

# An integrative proposal in addiction and health behaviors psychosocial research: overview of new trends and future orientations

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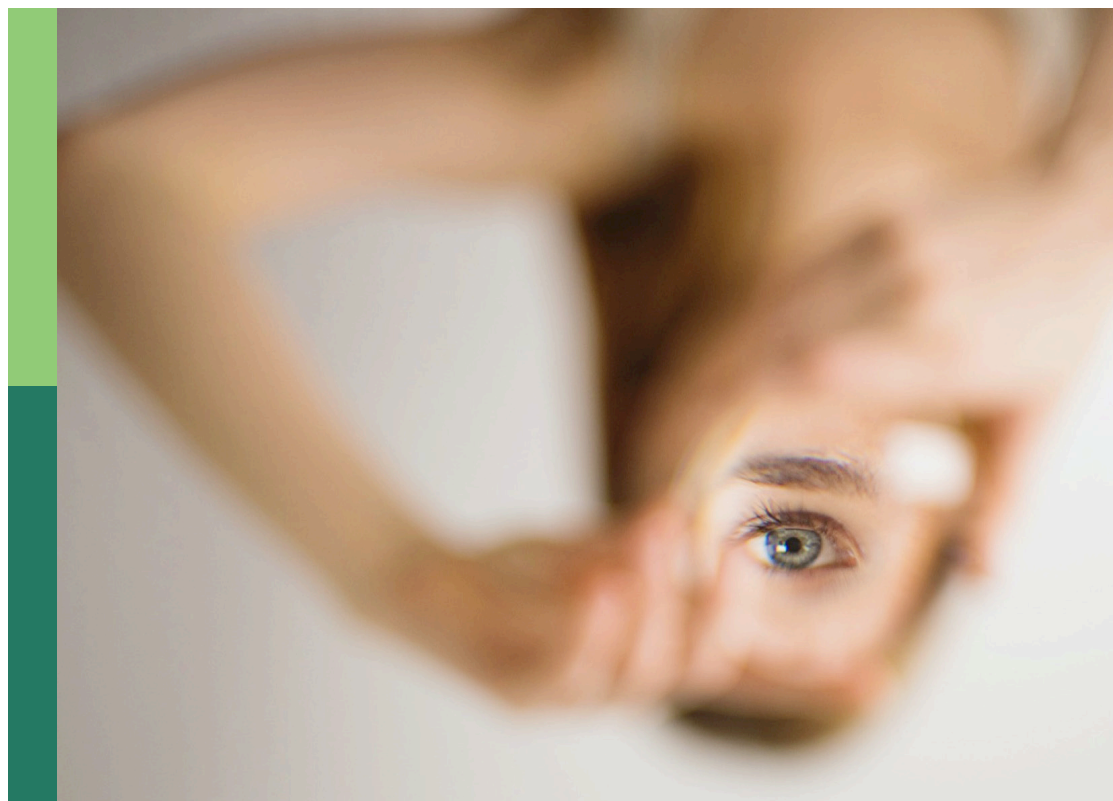
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# An integrative proposal in addiction and health behaviors psychosocial research: overview of new trends and future orientations

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# Editorial: An integrative proposal in addiction and health behaviors psychosocial research: overview of new trends and future orientations

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## KEYWORDS

addictions, health behaviors, psychosocial research, alcohol, smartphone abuse, KAT, gambling, public health

## Editorial on the Research Topic

An integrative proposal in addiction and health behaviors psychosocial research: Overview of new trends and future orientations

Addiction and health behavior research is a multifaceted field that integrates perspectives from psychology, public health, neuroscience, and the social sciences. This Research Topic aims to present a comprehensive overview of current trends and future directions by highlighting critical factors that influence addiction and its prevention, treatment, and management. We received multiple submissions addressing various aspects of addiction and health behaviors, resulting in the publication of 10 articles.

Wan et al. developed a decision tree model to predict online shopping addiction and identified key contributing factors, including academic procrastination, social anxiety, and a diminished sense of purpose in life. Their study provides valuable insights for the development of targeted interventions aimed at mitigating online shopping addiction. Their results indicate that academic procrastination—rooted in avoidance behaviors and ineffective time management—emerges as a predominant factor predisposing individuals to compulsive online shopping. Furthermore, social anxiety, characterized by fear of judgment and avoidance of face-to-face interactions, serves as a significant contributor, with individuals resorting to online shopping as a coping mechanism. In addition, a diminished sense of purpose in life was found to exacerbate compulsive shopping behavior, as individuals seek fulfillment and distraction through online purchases. These findings point to the need for targeted intervention strategies that address the key psychological factors and behavioral patterns that drive online shopping addiction.

Using the Theory of Planned Behavior (TPB) as a conceptual framework, Atsbaha et al. examined the intention to chew khat among adolescents in Raya-Azebo District, Ethiopia. Khat chewing, a common social and cultural practice in Ethiopia, poses significant physical, psychological, and socioeconomic challenges. Despite various interventions to curb its use, the behavior remains widespread, especially among young people. This study aims to assess the factors that influence the intention to chew khat and provide evidence-based recommendations for prevention efforts. The results of the study show

the importance of social influences and personal beliefs in shaping intentions to chew khat. To change positive attitudes toward khat chewing, the authors suggest strengthening social resistance skills and increasing self-efficacy. Educational programs, community engagement initiatives and policy implementation efforts are recommended to address the growing challenges associated with khat use in Ethiopia.

The relationship between cyberbullying and discrimination among students was explored in the work of Li Q. et al.. The authors examined the relationship between perceived discrimination and cyberbullying, identifying self-esteem as a mediator. Their findings suggest that students who experience discrimination are more likely to engage in cyberbullying behaviors, largely due to feelings of lowered self-esteem. In addition, the study identified self-compassion as a significant moderating factor that buffers the negative effects of perceived discrimination on self-esteem, thereby reducing the likelihood of engaging in cyberbullying. These findings suggest that interventions aimed at improving self-esteem and fostering self-compassion may be effective in reducing cyberbullying behavior. In addition, the study highlights the importance of creating inclusive and supportive environments within schools to reduce experiences of discrimination and promote psychological resilience among students.

Long et al. analyzed the influence of parental smartphone dependence on Internet addiction among elementary school students during the COVID-19 lock-in in China. Their study identified parent-child conflict as a mediating factor in this relationship, with parental roles moderating the observed effects. Specifically, fathers' dependence on smartphones was found to have a more significant influence on parent-child conflict than mothers' dependence. The results further suggest that parental smartphone overuse contributed to decreased parental involvement, weakened emotional bonds, and reduced overall family cohesion, all of which increased children's susceptibility to Internet addiction. In contrast, mothers, who were often the primary caregivers, were shown to mitigate some of these negative effects by providing emotional support and monitoring. These findings highlight the critical need for interventions aimed at reducing parental screen time, improving family communication, and promoting balanced use of technology in the home.

In an interesting focus on new modes of audiovisual consumption in social networks, Hu and Huang investigated the relationship between stress and short video addiction among Chinese users by extending the Compensatory Internet Use (CIU) model. The research introduces an extended CIU (E-CIU) framework that incorporates both compensatory motivations—such as the desire for social interaction and relaxing entertainment—and affective responses—like immersion and attitude—to better understand the mechanisms driving short video addiction. Key factors identified include emotional escapism, habit formation, and psychological dependence, with stress being the primary motivator that leads people to consume short videos as an emotional regulation mechanism. The findings suggest that the implementation of targeted interventions—such as digital detox initiatives and comprehensive stress management programs—can effectively reduce the risk of short video addiction and promote the adoption of healthier coping mechanisms.

Alcohol consumption remains a relevant global health problem. To analyze its incidence in the public sector, du Sart de Vigneulles et al. conducted a qualitative study to explore the context of alcohol consumption among French public service employees, with the aim of understanding the underlying behavioral factors and identifying effective prevention measures. Using a qualitative research approach, the study examines the social, occupational, and personal factors that contribute to alcohol use disorders (AUD) in this specific occupational sector. The findings show that work-related stress, organizational culture and prevailing social norms play a significant role in shaping the drinking behavior of employees. In addition, the study identifies factors such as accessibility to alcohol and peer influence as critical contributors to workplace drinking. The authors emphasize the need for a comprehensive prevention strategy that includes organizational interventions such as educational initiatives, stress management programs, and policies that restrict the availability of alcohol in the workplace. These measures are essential to achieving a healthier and more productive workplace.

Li H. et al. examined the influence of family socioeconomic status (SES) on digital addiction in young children, identifying parenting style as a crucial mediating factor in this relationship. Their findings indicate that lower SES is associated with reduced parental involvement, increased exposure to digital devices, and a heightened risk of developing digital addiction. The study further highlights that authoritative parenting styles serve as a protective factor, effectively mitigating these risks, while permissive and neglectful parenting approaches exacerbate excessive screen time and problematic digital usage behaviors. Based on these insights, the authors advocate for socioeconomic interventions that prioritize parental education, improve access to resources, and promote healthy digital habits within families as key strategies to prevent digital addiction in children.

Another current major challenge among young people is the growth of online gambling. In this context, Suriá-Martínez et al. conducted a comprehensive analysis of the risk profile associated with online gambling among university students, with particular attention to the differences between disabled and non-disabled participants. Their findings indicate that students with disabilities are at increased risk of developing gambling-related problems, indicating an urgent need for specific preventive actions. The study identified several factors that contribute to online gambling behavior, including psychological distress, economic difficulties, and social influences. In particular, students with disabilities face additional challenges, such as social isolation and limited access to alternative recreational activities, which make them more vulnerable to problem gambling. Based on these data, the authors advocate for the implementation of tailored intervention programs at the university level, including financial literacy initiatives, mental health support services, and opportunities for social engagement. These findings underscore the importance of implementing proactive strategies to minimize gambling-related harm and support the development of healthier coping mechanisms among the student population.

Liu et al. investigated the impact of negative urgency on implicit mobile phone addiction among college freshmen, particularly in the context of social exclusion. Using a modified GO/NO-GO

paradigm, the research examines how impulsivity driven by negative urgency influences students' susceptibility to compulsive mobile phone use and explores the moderating effects of social exclusion on this relationship. The findings of the study indicate that college freshmen with high levels of negative urgency exhibit a stronger tendency toward implicit mobile phone addiction compared to their low-negative urgency counterparts. Experiment 1 demonstrated a significant interaction between negative urgency levels and phone-related stimuli, revealing that individuals with high impulsivity struggle to inhibit responses to mobile phone-related content. Experiment 2 further established that social exclusion exacerbates this tendency, as students experiencing social isolation had even greater difficulty in controlling their engagement with phone-related stimuli. A three-way interaction effect was observed, highlighting the combined influence of negative urgency, social exclusion, and stimulus type in shaping mobile phone addiction tendencies. These findings underline the deterministic role of personality traits and environmental factors in the development of behavioral addictions among college students. By providing valuable insights into the interplay between psychological traits and social factors, this study contributes to the broader discourse on mobile phone addiction and highlights the need for holistic prevention strategies that address the unique challenges faced by college freshmen.

In this Research Topic, we have collected some of the most relevant trends in the current context of health and addiction research. Based on the included studies, the need for interdisciplinary collaboration in the identification of health problems, the design of prevention strategies, and the development of intervention programs and policies is evident. As addictive behaviors continue to evolve in response to societal changes,

future research should prioritize the development of integrative frameworks that address the psychological, social, and biological determinants of addiction. In addition, advances in artificial intelligence and big data analytics offer promising opportunities to delve deeper into patterns of addiction, enabling the development of predictive models and personalized treatment strategies.

## Author contributions

ÁG: Writing – original draft, Writing – review & editing.

## Conflict of interest

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# The impact of negative urgency on implicit mobile phone addiction tendency among college freshmen in the context of social exclusion

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**Purpose:** The purpose of this study is to investigate the impact of negative urgency on implicit mobile phone addiction tendency among college freshmen, and to observe whether social exclusion situations affect the relationship between negative urgency and implicit mobile phone addiction tendency.

**Methods:** The UPPS-P Impulsive Behavior Scale was used to screen 575 freshmen from a certain university. The experiment utilized a GO/NO-GO paradigm. Experiment 1 employed a 2 (negative urgency group: high negative urgency group, low negative urgency group) × 2 (word type: phone related words, phone non-related words) two-factor mixed experimental design. Experiment 2 employed a 2 (negative urgency group: high negative urgency group, low negative urgency group) × 2 (social exclusion type: priming group, non-priming group) × 2 (word type: phone related words, phone non-related words) three-factor mixed experimental design.

**Results:** Experiment 1 results showed a significant main effect of negative urgency group and a significant interaction effect between negative urgency group and word type. Experiment 2 results demonstrated a significant main effect of negative urgency group and a significant main effect of social exclusion type. There was a significant interaction effect between word type and social exclusion type, as well as between word type and negative urgency group. The three-way interaction effect among negative urgency group, word type, and social exclusion type was significant.

**Conclusion:** College freshmen with high negative urgency exhibit a higher tendency toward implicit mobile phone addiction. In social exclusion situations, college freshmen show a higher tendency toward implicit smartphone addiction. Social exclusion situations and negative urgency jointly influence the implicit mobile phone addiction tendency of college freshmen.

## KEYWORDS

negative urgency, social exclusion, implicit attitude, mobile phone addiction tendency, college freshmen

## Introduction

In the contemporary information era, mobile phones have become the most widely used internet access tool due to their convenience and accessibility. As of June 2021, the scale of mobile internet users in China reached 1.07 billion, which means that 99.6% of internet users utilize mobile phones to go online (China Internet Network Information Center, 2021). However, while mobile phones bring convenience to people's lives, they also pose the risk of addiction (He et al., 2012; Barnes et al., 2019). Mobile Phone Addiction (MPA), also known as Problematic Mobile Phone Use (PMPU), refers to a behavioral addiction in which individuals experience significant impairment in their psychological and social functioning due to excessive and uncontrollable mobile phone use (Liu et al., 2017). Research findings indicate that mobile phone addiction can have adverse effects on university students' academic performance and quality of life (Tian et al., 2021; Yang et al., 2022), and is also closely associated with individuals' experiences of negative emotions such as anxiety and depression (Mahsa et al., 2023; Niu, 2023).

## Mobile phone addiction tendency of college freshmen

College students are a high-risk and susceptible group for mobile phone addiction, which has shown a continuous upward trend in recent years (Peng et al., 2022). College students are at a critical stage of identity formation, role adjustment, and psychological maturation (Janet et al., 2018), and through the interaction of internal and external factors, students of different grade levels may develop distinct identity formations (Zhu and Qi, 2018). Under the influence of these varying identities, individuals exhibit diverse adaptive social behaviors (Oyserman, 2009). Freshmen university students face numerous challenges, such as changes in the learning environment and the increased complexity of interpersonal relationships. If these students have poor adaptive abilities and cannot actively cope with these challenges, some may turn to mobile phone use as a means of seeking a sense of belonging and emotional refuge, potentially leading to the development of mobile phone addiction (Tian and Wang, 2023). For instance, Zhao et al. (2023) examined the grade-level differences in the formation of smartphone addiction among female university students, finding that for lower-grade students, their school adaptation ability can predict the development of mobile phone addiction, compared to their higher-grade counterparts.

## Implicit mobile phone addiction tendency

Greenwald and Banaji (1995) proposed the concept of implicit social cognition, revealing the involvement of unconscious components in conscious social cognition processes. The Dual Attitude Model (DAM) (Wilson et al., 2000) posits that individuals may concurrently hold both explicit and implicit attitudes toward the same attitude object. Implicit attitudes are typically automatically activated, while explicit attitudes require more psychological energy and motivation to retrieve from the memory system. When individuals access their explicit attitudes and their intensity surpasses and suppresses the implicit attitudes, they report and exhibit the

explicit attitudes, concealing the implicit attitudes. Conversely, when individuals lack cognitive energy and motivation to retrieve their explicit attitudes, they can only report their implicit attitudes. Importantly, research indicates that self-report methods are insensitive to implicit thoughts or those occurring beyond consciousness (Derbyshire and Keay, 2023). The paradigm of implicit cognition does not necessitate participants to directly report their feelings, thereby mitigating to some extent the impact of social desirability bias (where participants may be influenced to provide socially acceptable responses). This approach can offer more authentic implicit attitude information, aiding researchers in gaining deeper insights into individuals' unconscious biases and emotional predispositions.

Research into implicit cognition can aid our comprehension of why individuals persistently engage in addictive behaviors despite being aware of the adverse consequences (Stacy and Wiers, 2010). Implicit cognition refers to the automatic thoughts that are not easily perceived or controlled by an individual. When exposed to cues related to addiction, whether through personal recollection or visual stimuli, an individual's attention is invariably drawn to the addictive object or behavior. During the development of addiction, a person's attitudes are subconsciously influenced, guiding them to select addictive behaviors as a means of coping with an inhospitable environment (Nock et al., 2010). This often results in the formation of a positive preference for addictive stimuli (Rudman, 2004), which may not be consciously desired or recognized by the individual. Such cognitive biases can exacerbate the development and persistence of addictive behaviors. In essence, implicit associative cognition is a significant cognitive bias that leads to addictive behaviors (Turel and Serenko, 2020).

This study employed a modified GO/NO-GO paradigm to assess individuals' implicit mobile phone addiction tendency. The "NO-GO" condition was used to instruct participants to inhibit their response to a specific stimulus, with participants' accuracy reflecting their inhibitory control over the stimulus. A higher accuracy rate indicates stronger inhibitory control (Wang et al., 2024). In other words, when assessing individuals' implicit attitudes toward mobile phone addiction, a higher error rate in responding to mobile phone-related words under the "NO-GO" condition indicates an inevitable response to the phone-related stimuli, an inability to control the processing of phone-related information, and thus an implicit mobile phone addiction tendency.

## Negative urgency and mobile phone addiction

Based on the biopsychosocial model of behavioral addiction, Wang et al. (2013) have posited that psychological factors are significant contributors to the susceptibility and maintenance of behavioral addictions, with personality traits being one of the primary pathological factors leading to such addictions. Impulsive personality has been identified as a robust predictor of mobile phone addiction (Mei et al., 2017; Sullivan et al., 2021; Ji et al., 2023). Impulsivity is a multidimensional concept, with negative urgency being a pivotal dimension, which can be construed as the intense and urgent desire to seek immediate gratification when faced with stress, discomfort, or the desire to avoid pain. This sense of urgency often compels individuals to engage in irrational and reckless behaviors, despite the

potential for long-term adverse consequences (Anestis et al., 2009). Negative urgency is closely associated with addictive behaviors (Kyoung and Hyejeon, 2019), as such behaviors are frequently employed to escape or alleviate negative emotions. There is research to prove that negative urgency is the best predictor of substance abuse behavior (Littlefield et al., 2015). Consequently, it is hypothesized that negative urgency may be a risk factor influencing the propensity for mobile phone addiction.

## Social exclusion, negative urgency, and mobile phone addiction

Social exclusion refers to the phenomenon where an individual is ignored, ostracized, and rejected by a social group or other individuals, thereby hindering their need for belonging and relationships (Roz, 2007). Negative emotions are often the direct consequence of social exclusion (Randy et al., 2024; Shuai et al., 2024). When faced with exclusionary situations, individuals may experience intense and urgent impulses to take immediate action to resolve or avoid the issue, thereby triggering or intensifying a sense of negative urgency (Horváth et al., 2022). Furthermore, previous studies have indicated a correlation between social exclusion and internet addiction (Douglas et al., 2008). The social compensation theory of addiction suggests that when individuals feel socially excluded and lack recognition and a sense of belonging, their social needs are unmet. The internet provides an environment suitable for compensation, leading to an increase in internet usage and the emergence of addictive behaviors (Kraut et al., 2002). For college freshmen, transitioning from the intense study environment and relatively simple interpersonal relationships of high school to the more frequent and extensive social interactions of college increases their social needs. When individuals struggle to adapt to their new environment, they may experience social exclusion, which could lead them to compensate through increased mobile phone usage.

In summary, utilizing a modified GO/NO-GO paradigm, experiment 1 investigates the impact of negative urgency on the implicit mobile phone addiction tendency among college freshmen. Experiment 2 explores whether the inclusion of environmental factors, specifically social exclusion scenarios, alters the relationship between negative urgency and implicit mobile phone addiction tendency. The study aims to elucidate the role of negative urgency in implicit mobile phone addiction tendency and the influence of social exclusion contexts on this relationship. From this, we propose the following hypotheses: H1: Individuals with high negative urgency, compared to those with low negative urgency, exhibit a greater implicit mobile phone addiction tendency, which is reflected in a lower accuracy rate on NO-GO tasks involving phone related words; H2: Compared to situations without social exclusion, individuals with high negative urgency exhibit a greater implicit mobile phone addiction tendency in situations of social exclusion, which is indicated by a lower accuracy rate in NO-GO tasks for phone related words under situations of social exclusion. By experimentally examining the connection between negative urgency and implicit mobile phone addiction tendency, we can gain a deeper understanding of the interplay between personality traits and environmental factors in the genesis of mobile phone addiction. This not only contributes to a more profound comprehension of the mechanisms underlying mobile phone addictive

behaviors but also provides significant guidance for future intervention and prevention efforts.

## Participants and methods

### Participants

#### Experiment 1

A convenience sampling method was employed to select 575 freshmen from a certain university and distribute the UPPS-P Impulsive Behavior Scale. A total of 560 valid questionnaires were returned, yielding a response rate of 97.4%. The average age of the participants was  $18.62 \pm 0.82$  years (ranging from 17 to 22 years old). Using the extreme groups approach, the scores of the negative urgency scale were sorted in descending order. Referring to previous research (Duan et al., 2020), participants whose scores fell within the top and bottom 27% were selected. A total of 80 participants were randomly chosen, with 40 in the high negative urgency group (16 males, 24 females, age  $18.64 \pm 0.81$ ) and 40 in the low negative urgency group (25 males, 15 females, age  $18.62 \pm 0.79$ ). An independent samples *t*-test was conducted. The results indicated a significant difference in negative urgency scores between the high and low groups ( $p < 0.001$ ). Four participants did not attend or withdrew from the experiment midway, resulting in final group sizes of 39 for the high negative urgency group and 37 for the low negative urgency group.

#### Experiment 2

The selection of participants was identical to that of Experiment 1. A total of 80 individuals were selected for the high negative urgency group and another 80 for the low negative urgency group. Subsequently, participants were grouped according to the ABBA balanced method based on their scores, with 80 individuals undergoing social exclusion priming and another 80 receiving non-social exclusion priming. Participants for whom the social exclusion priming was ineffective were excluded from the study. Ultimately, the number of participants in each group was determined as follows: 34 in the high negative urgency-priming Group, 34 in the high negative urgency-non-priming group; 33 in the low negative urgency-priming group, and 36 in the low negative urgency-non-priming group.

Before the formal experiment, an interview was conducted with all subjects to ensure that they had normal vision or corrected vision, no visual or auditory impairment, and to ensure that the subjects had not participated in similar experiments in the past month. The subjects were also made to understand that the purpose of this study was the measurement of keystroke response time, after which the principle of voluntariness was completely followed and the subjects willing to participate in the experiment were asked to sign an informed consent form.

### Measures

#### The simplified UPPS-P impulsive behavior scale

It was revised in Chinese by Xue et al. (2017) and consists of 20 items across five dimensions: Negative Urgency, Positive Urgency, Lack of Perseverance, Sensation Seeking, and Lack of Premeditation.

The scoring system for this scale ranges from “Very Inconsistent” to “Very Consistent,” with four points. In this study, only the four items pertaining to the negative urgency dimension were utilized. The Cronbach’s alpha coefficients for this scale in this study were above 0.67.

## GO/NO-GO task materials

The stimuli were divided into two categories: one unrelated to mobile phones and the other related to mobile phones. The unrelated stimuli included words such as “hat,” “kitten,” “table,” and “chair.” The mobile phone-related stimuli were selected by five graduate students majoring in psychology from BaiduWenku, resulting in a list of 150 words. Subsequently, four graduate students with over 3 years of mobile phone usage experience in psychology rated the relevance of these words on a five-point scale. A score of 1 indicated very irrelevant, 2 somewhat irrelevant, 3 neutral, 4 somewhat relevant, and 5 very relevant. Ultimately, 100 words with an average score above 4 were chosen as mobile phone-related stimuli.

## The social exclusion induction tool

This study employs the Cyberball paradigm by Williams et al. (2000) to elicit a sense of social exclusion in individuals. Prior to the experiment, participants are informed that they will engage in a ball-tossing game with two other individuals, and they are instructed to imagine the scenario as vividly as possible, including the appearance and expressions of their peers, as well as the ambient conditions. The two other players are fictitious, and their participation is pre-programmed to control the frequency with which the actual participant receives the ball. Over the course of 30 tosses in the game, the priming group receives the ball only during the initial two rounds and is subsequently excluded from further play; the non-priming group, however, receives the ball more than 10 times, exceeding a third of the total tosses.

## Procedures

This study draws upon the variant of the classic GO/NO-GO task as referenced by Kreusch et al. (2014), utilizing phone related words and phone non-related words as stimuli to explore participants’ inhibitory control abilities regarding phone related words, thereby further predicting their implicit mobile phone addiction tendency.

### Experiment 1

The GO/NO-GO task is scripted using E-prime 2.0 psychological software on a Hewlett-Packard computer with a resolution of 1,920 × 1,080 to present stimulus materials. The task is divided into two main sections: practice and the formal experiment, with stimuli consisting of the letter’s “O”/“E” and mobile-related/unrelated vocabulary. During the practice phase, participants are instructed to press the spacebar as quickly and accurately as possible when the letter “E” appears and to refrain from pressing the key when the letter “O” appears, with feedback provided. This phase includes 20 trials, with the letter “E” appearing five times, ensuring that participants fully understand the experimental process and can operate correctly before proceeding to the formal experiment. The results of the practice phase are not included in the final score. The formal experiment comprises two

parts: one part requires participants to respond to phone related words and not to unrelated words; the second part is the inverse, requiring participants to respond to unrelated words and not to related words. The experiment was conducted with inter-subject balance.

### Experiment 2

Conducted in a tranquil and well-lit psychology laboratory, the experimenter thoroughly explained the procedures prior to the commencement of the study to ensure that participants fully understood the experimental protocol. After participants were grouped, they engaged in the classic ball-tossing paradigm from the social exclusion scenario. Initially, instructions for the Cyberball task (CP) were presented on a white screen, stating that the game was designed to exercise participants’ imaginative abilities in preparation for subsequent experiments. Participants were instructed not to overly concern themselves with their performance but to focus on visualizing the game scenario, including the appearance and emotions of the other players, with as much realism as possible.

Upon the conclusion of the game, participants were asked to complete two questions: “Did you feel excluded during the game?” and “Did you feel ignored during the game?” These were rated on a scale from 0 (no feeling at all) to 10 (very profound feeling), following the method established by Xu et al. (2017). These questions served as a measure of the effectiveness of the social exclusion priming, with higher average scores indicating a greater sense of social exclusion. According to the criteria, the top 27% (a score of 7) is considered effective for social exclusion priming, while the bottom 27% (a score of 3) is deemed effective for non-social exclusion priming set (Gonsalkorale and Williams, 2007). In this study, the correlation coefficient between the two questions was  $r=0.94$  ( $p<0.001$ ). After responding to these questions, participants proceeded with the smartphone-related GO/NO-GO task identical to that in Experiment 1.

## Statistical methods

### Experiment 1

A two-factor mixed experimental design was employed, consisting of 2 (negative urgency group: high negative urgency group, low negative urgency group) × 2 (word type: phone related words, phone non-related words). The negative urgency group served as the between-subjects variable, while word type acted as the within-subjects variable, with the NO-GO accuracy rate as the dependent variable. Experiment 2: A three-factor mixed experimental design was utilized, with 2 (negative urgency group: high negative urgency group, low negative urgency group) × 2 (social exclusion type: priming group, non-priming group) × 2 (word type: phone related words, phone non-related words). Here, the negative urgency group and social exclusion were the between-subjects variables, and word type was the within-subjects variable, with the NO-GO accuracy rate again serving as the dependent variable.

The lower the accuracy rate on phone related words in the NO-GO task, the weaker the individual’s inhibitory capacity toward phone-related stimuli, indicating a higher tendency for addiction. The final data were subjected to descriptive statistical analysis and repeated measures ANOVA, with statistical significance determined by a  $p$  value of less than 0.05.

## Results

### Experiment 1: analysis of NO-GO correct rates

A repeated measures ANOVA was conducted on the dependent variable, the NO-GO accuracy rate. The results indicated a significant main effect of the negative urgency group [ $F(1, 74) = 6.701, p = 0.012, \eta^2 = 0.083$ ], with the high negative urgency group exhibiting a significantly lower NO-GO accuracy rate compared to the low negative urgency group. The main effect of word type was not significant ( $p > 0.05$ ). However, a significant interaction effect was observed between the negative urgency group and word type [ $F(1, 74) = 4.164, p = 0.045, \eta^2 = 0.053$ ]. Further simple effect analysis revealed that the high negative urgency group showed a significant difference in word type ( $F = 6.970, p = 0.010, \eta^2 = 0.086$ ), specifically, the high urgency group's NO-GO accuracy rate for phone related words was significantly lower than that of the low negative urgency group. For detailed information, refer to Table 1 and Figure 1.

### Experiment 2: analysis of NO-GO correct rates

A repeated measures ANOVA was conducted on the dependent variable, the NO-GO accuracy rate. The findings revealed a significant main effect for the negative urgency group [ $F(1, 133) = 4.060, p = 0.046, \eta^2 = 0.013$ ], with participants in the high negative urgency group demonstrating a significantly lower NO-GO accuracy rate compared to those in the low negative urgency group. Additionally, a significant main effect was observed for the social exclusion type [ $F(1, 133) = 30.693, p < 0.001, \eta^2 = 0.188$ ], indicating that participants in the priming group had a significantly lower NO-GO accuracy rate than those in the non-priming group. The main effect of word type was not significant ( $p > 0.05$ ). The interaction between the negative urgency group and word type was significant [ $F(1, 133) = 7.798, p = 0.006, \eta^2 = 0.055$ ]. Simple effects analysis indicated that the high negative urgency group was a significant difference based on word type ( $F = 7.840, p = 0.006, \eta^2 = 0.055$ ), with the high negative urgency group showing a notably lower NO-GO accuracy rate for phone related words than phone non-related words. This difference was not significant for the low negative urgency group ( $p > 0.05$ ). The interaction between social exclusion type and word type was also significant [ $F(1, 133) = 5.003, p = 0.027, \eta^2 = 0.036$ ]. Simple effects

analysis showed that the priming group was a significant difference based on word type [ $F(1, 133) = 5.961, p = 0.016, \eta^2 = 0.042$ ], with the priming group having a lower NO-GO accuracy rate for phone related words compared to phone non-related words. This difference was not significant for the non-priming group ( $p > 0.05$ ). Furthermore, a significant three-way interaction among negative urgency group, social exclusion type, and word type was found [ $F(1, 133) = 8.304, p = 0.005, \eta^2 = 0.059$ ]. Simple effects analysis within this interaction showed that participants in the high negative urgency-priming group had a significantly lower NO-GO accuracy rate for phone-related words than for phone non-related words. Within the priming group, the high negative urgency group had a significantly lower NO-GO accuracy rate for phone-related words compared to the low negative urgency group ( $p = 0.004$ ), while the high negative urgency group had a significantly higher NO-GO accuracy rate for phone non-related words compared to the low negative urgency group ( $p = 0.014$ ) (Figure 2; Tables 2, 3).

## Discussion

The implicit mobile phone addiction tendency is primarily assessed by comparing the accuracy of individuals in the NO-GO condition with phone-related and non-related words. The lower the accuracy of phone-related words, the weaker the individual's inhibitory control over them (Wang et al., 2024), indicating a higher implicit mobile phone addiction tendency. The dual-process model of addictive behavior posits that addictive behaviors are influenced by the interaction of impulsive precursors (implicit cognition), reflective precursors (explicit cognition), and limitations (Hofmann et al., 2008). Previous studies have predominantly focused on explicit attitudes toward addiction; hence, this study delves into the implicit mobile phone addiction of college freshmen from the perspectives of personality traits and environmental factors. Experiment 1 explores the impact of negative urgency on the implicit mobile phone addiction tendency of college freshmen from a personality standpoint, while Experiment 2 further investigates whether social exclusion scenarios can alter the influence of negative urgency on this addiction. The findings reveal that college freshmen with higher levels of negative urgency exhibit a greater implicit mobile phone addiction tendency compared to those with lower levels; under social exclusion scenarios, the implicit addiction tendency is heightened; and both social exclusion and negative urgency jointly affect the implicit mobile phone addiction tendency of college freshmen.

The results of Experiment 1 indicate that the main effect of negative urgency group is significant, and the interaction between negative urgency group and word type is also significant. Freshmen with high negative urgency exhibit a higher error rate in the NO-GO response to phone related words, suggesting a greater implicit toward mobile phone addiction tendency, which is consistent with previous findings (Kyoung and Hyejeen, 2019). The transition from high school to university requires freshmen to adapt to new social circles, academic pressures, independent living, and the challenges of making autonomous decisions. Compared to individuals with low levels of negative urgency, those with high negative urgency seem to be more prone to emotional and impulsive reactions, responding more intensely to negative emotions and stress. They may be more likely to fall into a cycle of negative emotions, struggling to effectively cope with stress and setbacks (Guo

TABLE 1 ANOVA on the accuracy of NO-GO for word types with different negative urgency group ( $\bar{x} \pm s$ ).

Negative urgency group	Word type	Accuracy rate	F	p
High negative urgency group	Phone related words	0.951 $\pm$ 0.007	6.970	0.010
	Phone non-related words	0.973 $\pm$ 0.004		
Low negative urgency group	Phone related words	0.979 $\pm$ 0.008	0.077	0.782
	Phone non-related words	0.976 $\pm$ 0.004		

NUG, Negative urgency group; HNUG, High negative urgency group; LNUG, Low negative urgency group; WT, Word type; PRW, Phone related words; PNRW, Phone non-related words.

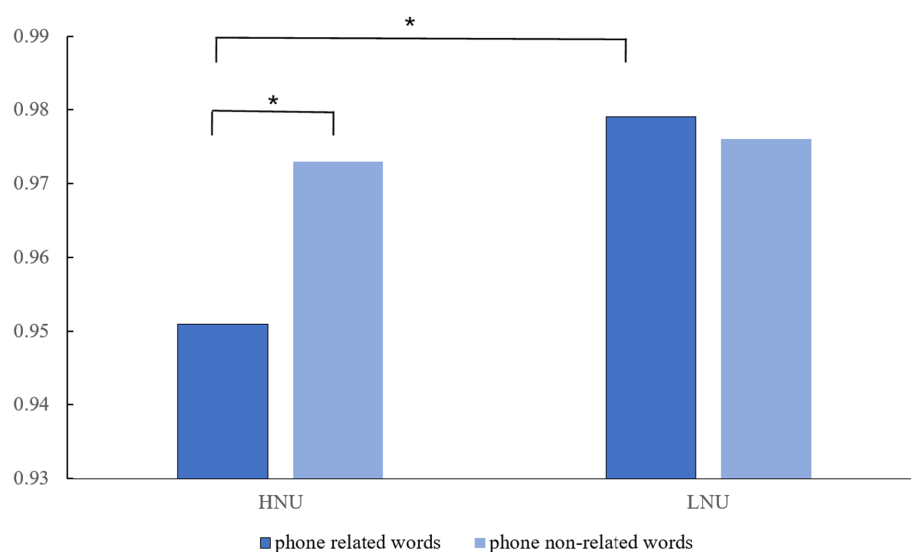


FIGURE 1

NO-GO accuracy rate of high and low negative urgency groups on phone-related words and phone non-related words. HNU, High negative urgency group; LNU, Low negative urgency group.

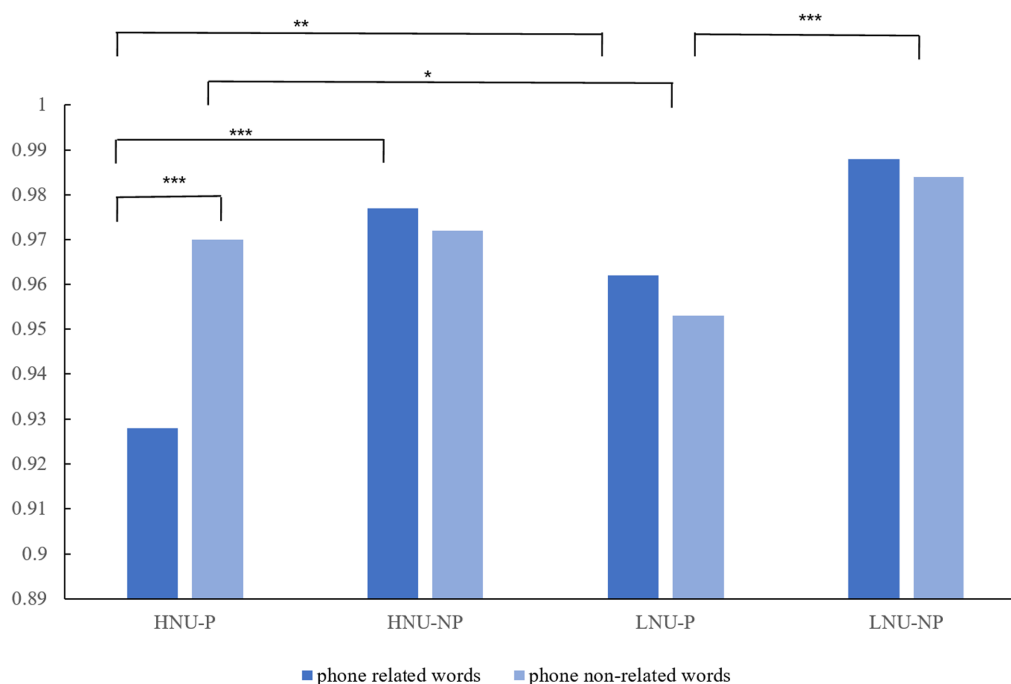


FIGURE 2

The NO-GO accuracy rate of different negative urgency and social exclusion in phone related words and phone non-related words. HNU-P, High Negative urgency-priming group; HNU-NP, High negative urgency-non-priming group; LNU-P, Low negative urgency-priming group; LNU-NP, Low negative urgency-non-priming group.

et al., 2024), and may seek an escape from reality and a way to alleviate stress, such as using smartphones, to ease their emotional discomfort. Over time, this leads to a subconscious focus and an inability to suppress the processing of phone related words, making them more susceptible to mobile phone addiction. Conversely, individuals with low negative urgency can maintain calm and composure, better equipping them to

handle the pressures of a new environment through positive means, and thus are less likely to fall into the trap of excessive smartphone use, with less processing of smartphone-related words.

The findings of Experiment 2 demonstrate a significant main effect of the negative urgency group, while the main effect of word type was not significant, consistent with the results of Experiment 1,

**TABLE 2 Results of NO-GO accuracy for negative urgency group under different social exclusion conditions ( $\bar{x} \pm s$ ).**

WT	SET	HNUG	LNUG
PRW	PG	0.928 $\pm$ 0.086	0.962 $\pm$ 0.027
	NPG	0.977 $\pm$ 0.026	0.988 $\pm$ 0.014
PNRW	PG	0.970 $\pm$ 0.025	0.953 $\pm$ 0.038
	NPG	0.972 $\pm$ 0.028	0.984 $\pm$ 0.017

HNUG, High negative urgency group; LNUG, Low negative urgency group; SET, Social exclusion type; WT, Word type; PRW, Phone related words; PNRW, Phone non-related words; PG, Priming group; and NPG, Non-priming group.

**TABLE 3 ANOVA in response to word types in the negative urgency group and the social exclusion type.**

Source of variation	MS	F	P	$\eta^2$
NUG	0.007	4.06017	0.046	0.030
SET	0.050	30.693	<0.001	0.188
WT	0.002	1.800	0.182	0.013
NUG $\times$ WT	0.011	7.798	0.006	0.055
SET $\times$ WT	0.007	5.003	0.027	0.036
NUG $\times$ SET	<0.001	0.076	0.783	0.001
NUG $\times$ WT $\times$ SET	0.011	8.304	0.005	0.059

NUG, Negative urgency group; SET, Social exclusion type; WT, Word type.

indicating the stability and reproducibility of the impact of negative urgency on smartphone addiction. The main effect of social exclusion type is significant, and the interaction between social exclusion type and word type is also significant. In other words, under conditions of social exclusion, freshmen exhibit a higher error rate in the NO-GO response to phone related words, indicating a greater implicit mobile phone addiction tendency, which aligns with previous research (Huang and Liu, 2021; Yue et al., 2022). Lutz et al. (2023) posits that social exclusion can trigger negative emotional experiences such as anxiety, depression, loneliness, and envy in individuals, with media (mobile phone) serving as their best emotional crutch and outlet. Individuals who feel excluded can experience a sense of belonging and have their needs for control and achievement met through smartphone use, elements they may lack in real life. In essence, smartphones exert a powerful allure for those who feel excluded, an attraction they find irresistible (Leary, 1990). In such contexts, Individuals may unconsciously process mobile phone related information, as these devices offer a means of escaping reality and achieving self-worth. They may become addicted to the interaction of social media, the achievements of online games, or the sense of identity in virtual communities, which invisibly satisfy their inner needs, even if they may not be fully aware of it.

Additionally, the results revealed that there is no interaction effect between the social exclusion type and the negative urgency group. However, a significant interaction effect was found among the negative urgency group, word type, and social exclusion type. This indicates that college freshmen with varying levels of negative urgency exhibit different reactions to phone-related words and non-related words

under different social exclusion scenarios, reflecting varying degrees of implicit smartphone addiction tendency. Compared to other groups, the high negative urgency-priming group displayed the highest level of implicit mobile phone addiction tendency. According to self-determination theory, an individual's behavior is influenced by intrinsic and extrinsic motivations (Ryan and Deci, 2000). Internally, students with high negative urgency are prone to emotional instability and tension, and they may overreact to negative emotions. In such an emotional state, these students are more likely to be driven by impulses to seek immediate gratification and distraction. Externally, university freshmen often face new social environments and challenges, especially when they first adapt to college life, feeling lonely and socially excluded. Mobile phone may serve as a means of escaping reality and fulfilling social needs, leading them to engage more in virtual social interactions while neglecting real-life social opportunities. Such behavior could be perceived as implicit addiction, hindering the freshmen's true integration into the new social environment and potentially leading to excessive dependence on smartphones. This suggests that there may be a complex interplay between negative urgency, social exclusion, and implicit mobile phone addiction tendency.

The combined effect of personality traits and the environment can influence individual behavior. This finding is significant for understanding the mental health and smartphone usage behavior of college freshmen. Further research could explore how college freshmen with different levels of negative urgency cope with social exclusion situations to reduce the mobile phone addiction tendency. This would aid in developing psychological health intervention measures tailored to university freshmen with different psychological characteristics, as well as in better understanding and preventing smartphone addiction behaviors. The study also has its limitations. Currently, there is no independent questionnaire for measuring negative urgency, and future research could develop more effective measurement tools. Extreme groups approach can compromise the statistical power and the estimation of effect sizes, thereby diminishing reliability. Future studies may employ more rigorous approaches to grouping, such as latent profile analysis, to enhance the robustness of the findings (Preacher et al., 2005). Additionally, this study only examined freshmen, and the sample lacks representativeness, which limits the further generalization of the research findings. Future studies should investigate other grades, regions, and non-university student populations to obtain more comprehensive results and conduct comparative studies.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by North China University of Science and Technology. The studies were conducted in accordance with the local legislation and institutional requirements.

The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## Author contributions

WL: Writing – review & editing, Data curation, Writing – original draft. MZ: Data curation, Writing – original draft, Investigation. RW: Writing – review & editing. MY: Writing – review & editing, Investigation. ZZ: Investigation, Writing – review & editing. SS: Writing – review & editing. LL: Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Negative impact of online gambling problematic in disabled and non-disabled university students: exploring the risk profile

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**Introduction:** The rise of online gambling has brought about significant concerns, particularly regarding its impact on university students. This issue becomes even more complex when considering students with disabilities.

**Objectives:** This research examines the gambling profile and beliefs of university students based on whether they have a disability. In turn, it seeks to identify if there is a typology of at-risk gamblers according to the disability variable. Finally, it aims to find out the prevalence of gambling among students depending on whether they have a disability and the typology of at-risk gambler.

**Method:** A total of 704 university students (135 with disabilities and 569 without disabilities) completed the NODS Belief Questionnaire to assess problems associated with gambling and to generate a typological grouping of risk gamblers, as well as a questionnaire designed specifically for the gambler profile.

**Results:** It was found that a small percentage of participants engage in gambling on a daily basis, with a higher frequency among students with disabilities. In addition, it was observed that the behavior and concern about financial expenditure on gambling interferes with their daily activities and is a cause for concern, with higher risk being observed to a greater extent in students with disabilities.

**Discussion:** These data suggest the importance for universities and relevant authorities to address these problems comprehensively, providing adequate resources for students with disabilities and promoting a culture of wellbeing that discourages problematic gambling activities and encourages healthy alternatives for entertainment and stress management.

## KEYWORDS

online gambling problematic, university students, disability, intervention, program

## 1 Introduction

In today's digital age, online entertainment has become an integral aspect of young people's lives. From the rise of social media to the explosion of online video games, today's young people are immersed in a virtual world that offers a wide range of entertainment activities.

In reference to leisure preferences, empirical evidence reveals that online games, and especially new forms of gambling, such as online poker, online casino games (blackjack, roulette, and online slots) and sports betting (games legalized by Law 13/2011 on the

regulation of gambling by the [Ministry of Finance and Public Administrations of Spain \(2011\)](#), are the most attractive and in demand by the youth population ([Labrador et al., 2021](#)).

However, despite the demand and availability of games, like any technological tool, their excessive misuse can lead to various personal and social problems ([Beranuy Fargues et al., 2009](#); [Zboralski et al., 2009](#); [Echeburúa and de Corral, 2010](#); [Esparza-Reig et al., 2023](#); [Jitoku et al., 2024](#)).

Thus, it is not new news that the number of young people whose activities and social life are solely web-based is increasing every day, and that the number of hours they spend in front of the computer is growing at the same rate, taking time away from other activities they used to do ([Krishnamurthy and Chetlapalli, 2015](#); [González-Bueso et al., 2018](#); [Aydin and Kuş, 2023](#)).

In reviewing the literature on this topic, most authors have focused on socio-demographic variables such as age ([Beranuy et al., 2009](#); [Labrador and Villadongos, 2010](#); [Auer and Griffiths, 2023](#)) or gender ([Muñoz-Rivas et al., 2003](#); [Sánchez-Martínez and Otero, 2009](#); [Esparza-Reig et al., 2023](#)) as possible risk factors for the problematice of gambling and betting offered over the Internet.

In terms of age and the problematice use of games available on the Internet, it has become a challenge for health professionals, being more and more frequent among young people ([Liu and Potenza, 2007](#); [Greer et al., 2023](#)). In fact, it is increasingly prevalent among the university population, as this group has the highest percentage of problematic and problematice Internet users ([Krishnamurthy and Chetlapalli, 2015](#); [Osuna et al., 2021](#)). University students become potential users because the internet is one of the main tools in academic activities, which enables and justifies online time; in addition, their study schedules and academic tasks are very flexible, and there is little adult supervision over their online activities. Add to this the fact that youth is a time of increased vulnerability for the development of addictions, because cognitive control and risk perception are not fully developed and therefore ineffective ([Casey et al., 2005](#)), and because of difficulties in setting limits ([Liu and Potenza, 2007](#); [Greer et al., 2023](#)), and a high vulnerability to Internet use and, possibly, to gambling and betting will be favored ([Kuss et al., 2013](#)). These data are evidenced by different prevalence studies conducted with this population, which indicate that a significant number of university students present internet addiction in some form, with percentages ranging from 3.2% ([Kuss et al., 2013](#)) to 11% ([Shao et al., 2018](#)).

With regard to gender and the risk of online gambling problematice, current prevalence figures according to the study by [Tristán et al. \(2020\)](#) indicate that 63.5% of men and 56.9% of women aged 15–64 years gamble with money on the internet. With special mention of the particularly worrying fact that the prevalence of the disorder among them has decreased by 1% for men and increased by 0.2% for women in 2020.

Other related variables that empirical evidence has highlighted and that may influence a person's greater vulnerability to excessive or problematice use of the Internet and, in particular, online gambling and betting, are certain personality characteristics. These include introversion, low self-esteem, high level of sensation seeking, impulsivity, inadequate coping with problems, etc. ([Widyanto and Griffiths, 2006](#); [Mehroof and Griffiths, 2010](#); [Duplaga and Szulc, 2019](#)). Deficits in interpersonal relationships

also increase psychological vulnerability to addictive gaming behavior ([Muñoz-Rivas et al., 2003](#); [Echeburúa and de Corral, 2010](#); [Balanzá-Martínez et al., 2020](#); [Blasco et al., 2021](#)).

Similarly, certain physical conditions such as stigmatizing illnesses ([Høybye et al., 2005](#)) and disability ([Finn, 1999](#)) could influence the problematice use of the internet ([Finn, 1999](#); [Høybye et al., 2005](#); [Bringué and Sádaba-Chalezquer, 2008](#); [Krishnamurthy and Chetlapalli, 2015](#); [Osuna et al., 2021](#)), as well as the gambling platforms available online.

In the disability context, the ease of access to a myriad of sites and resources without the constraints of having to travel, and thus being able to share their interests, concerns or needs, allows people with physical limitations to make changes in their lives that might otherwise be difficult or even impossible ([Finn, 1999](#)). This, as different researchers indicate, has been evidenced in different areas of life such as the academic ([Alcantud et al., 2000](#)), the social ([Suriá, 2015](#)), or the work context ([Cuervo and Menéndez, 2005](#)), and of course, in recreation ([Suriá, 2015](#)), and leisure and gambling through the internet ([García-Ruiz and Bonilla-del-Río, 2020](#)).

Although most often in individuals with a diagnosis of mental illness (schizophrenia, bipolar disorder, personality disorder, etc.), pathological gambling has also been detected in those with physical, sensory and intellectual disabilities. However, based on the published literature on the population of youth with disabilities and online gambling, very few studies have been published on the use of these sites and the problematic effects of problematice associated with gambling among people living with this disability ([Solish et al., 2010](#); [McCormack et al., 2013](#); [Pallesen et al., 2021](#); [Pitt et al., 2021](#)). Moreover, no studies have been conducted in our country.

Regarding online gambling and students with disabilities, the subject of this paper, access to online content logically facilitates access to online gambling platforms and has brought gambling into the privacy of our pockets; a place where gambling behavior is nourished until recreational gambling becomes a disorder. It is at this point that the biopsychosocial damage to the individual can no longer be hidden ([Balanzá-Martínez et al., 2020](#); [Fazeli et al., 2020](#); [Blasco et al., 2021](#)).

Despite the repercussions of overuse in virtual sites, it is easily verifiable that we are bombarded by online gambling and betting agencies across different media platforms. It is unlikely that any internet user will not stumble across several banners or eye-catching links inviting them to gamble, regardless of their status or age. This is especially true for people, as well as for those affected by limiting conditions such as having a disability ([Solish et al., 2010](#); [Mateu-Mateu and Navarro-Gómez, 2015](#); [Suriá, 2015](#); [Osuna et al., 2021](#); [Pitt et al., 2021](#)).

Notwithstanding the existence of a gap in the literature on the problematice or addiction of people with disabilities to online gambling and betting, this research is based on the need to focus on the population of students with disabilities and the use of online gambling for two fundamental reasons. First, given the vulnerability of university students to excessive use of these games, we believe that it may be very relevant to focus attention on the group of students who participate in this type of online leisure. Second the availability and access that people with disabilities find online provides them with an open window to the world, making

these virtual spaces more attractive. Hence, it is plausible to think that the students with the handicap of living with disabilities are particularly likely to spend more time online, and therefore to engage in addictive behavior on the Internet, and possibly online gambling and betting.

In this university context, it should be borne in mind that it is a context of training, development and biopsychosocial integration. In order to achieve the comprehensive achievement of young people, it becomes the task of universities to generate an environment that contributes to the wellbeing and personal development of their students (García-Ruiz and Escoda, 2021). Accordingly, the transition to the university stage demands a higher level of autonomy, responsibility, and achievement, which is why this educational cycle can become a strengthening scenario for the growth of personal and psychosocial health or a problematic space that generates risk behaviors.

On the basis of these considerations, the objectives of this research are 4-fold:

1. First, to examine the gambling profile, i.e., gambling type preference, as well as the frequency of participation in online gambling and betting among university students according to whether they have a disability.
2. The second objective aims to explore whether there are differences in beliefs and concerns between disabled and non-disabled university students who gamble and/or bet on the Internet.
3. The third objective is to identify whether there is a typology of at-risk gamblers based on the disability variable.
4. Finally, the fourth objective aims to find out the prevalence of gambling among these students depending on whether they have a disability and the type of at-risk gamblers.

## 2 Method

### 2.1 Participants

The analyses in the present study are based on data from a sample of university students ( $N = 704$ ) from 25 public and private universities in Spain, recruited through convenience sampling and an open online questionnaire between January and March 2024. Females represent 24.9% ( $n = 175$ ) of the sample and males 75.1% ( $n = 529$ ); ages range from 18 to 44 years with 14.1% between 18 and 22 years, 38.2% between 23 and 27 years, 26% between 28 and 33 years, 21.7% between 34 and 38 years, and 10.5% 39 from 44 years; 93.5% of the sample are undergraduate students: 31.1% of year 1, 14.3% of year 2, 12.6% of year 3, 35.4% of year 4, and 6.5% postgraduate and/or masters students and 18.5% ( $n = 130$ ) of the sample indicate having some kind of recognized disability: 8.7% motor, 3.7% mental, 3.0% hearing, 1.7% cognitive, and 1.4% visual (Table 1).

### 2.2 Instruments

*Student's socio-demographic data collection form (gender, age, and if disabled or not).*

TABLE 1 Sociodemographic profile.

Sociodemographic profile		N	%
Age	18–22	99	14.1
	23–27	269	38.2
	28–33	183	26.0
	34–38	81	11.5
	39–44	72	10.2
Sex	Male	529	75.1
	Female	175	24.9
Disability	Non-disability	569	80.8
	Disability	135	19.2
Undergraduate	1°	219	31.1
	2°	101	14.3
	3°	89	12.6
	4°	249	35.4
	Máster o Doctorado	46	6.5
	Total	704	100.0

*Questionnaire aimed at the profile of use, preferences, and money spent on gambling and betting* (typology of gambling preferences, frequency, and expenditure on gambling participation).

*NODS Belief Questionnaire*, DSM-IV Screen for Gambling Problems (Gerstein et al., 1999), as adapted from Becoña (2004). To assess the problems associated with gambling and to generate a typological grouping of at-risk gamblers (third objective), an adaptation of five variables called “beliefs and concerns” from the NODS (Gerstein et al., 1999) was used. The NODS has been developed with the aim of providing a reliable assessment instrument for pathological gambling that meets DSM-IV criteria. It consists of 17 items covering the 10 DSM-IV criteria for pathological gambling. The cut-off point is 5 or more criteria for probable pathological gambling. It is currently, together with the SOGS, the most widely used instrument in studies of pathological gambling. The 5-item subscale was used to assess beliefs and concerns about gambling and betting participation. Cut-off point  $> 1$ . Scores are distributed into four profiles according to risk: no risk (0); at risk (1 or 2); problem (3 or 4); pathological (5). To obtain the diagnostic criteria for gambling disorder based on the DSM-5, the sample is classified into four categories according to their level of problem gambling: non-risk gambler, at-risk gambler, problem gambler and pathological gambler.

For testing whether the adaptation of the questionnaire had adequate psychometric properties, the five variables included in the “beliefs” dimension were measured on a four-grade scale: 1 = never, 2 = sometimes, 3 = most of the time, and 4 = always. The reliability analysis of the scales measuring the variables by means of Cronbach's alpha is adequate (Cronbach's  $\alpha = 0.783$ ). To ascertain and validate the factorial structure of the scale, an Exploratory Factor Analysis was carried out using the Principal Component Analysis and by means of Varimax rotation, obtaining acceptable results: Kaiser-Meyer-Olkin (KMO) Index = 0.817;

Bartlett's Test of Sphericity = 1.021 ( $df = 10$ ) ( $p < 0.01$ ). Finally, a single factor explains 54.8% of the variance in the data.

## 2.3 Procedure

The data collection procedure consisted of applying the questionnaire to the sample of students. The sample was selected between January and February 2024, with the prior informed consent of the participants in the study. Access was relatively straightforward; the sample came from university degrees at the University of Alicante. The questionnaire was hosted on Google and through the collaboration of the Vice-Rectorate for Research was advertised on campus for dissemination. The estimated application time was  $\sim 10$  min.

## 2.4 Data analysis

Non-parametric tests were used to examine statistically significant differences between the groups (with and without disability). Thus, for the first objective, to analyse the differences between the students in the variable type of game, frequency, and type of at-risk gambler, the chi-square homogeneity test was used. For the second objective, to examine whether there are statistically significant differences in the "beliefs" dimension, depending on whether the students have a disability, the Mann-Whitney  $U$  test was employed. For the achievement of the third objective, to identify whether there is a typology of at-risk gambler according to the disability variable, the chi-square test ( $X^2$ ) was applied. Finally, the Kruskal-Wallis  $H$ -test was used to determine the prevalence of gambling and expenditure (fourth objective). Subsequently, *post-hoc* comparisons were performed using the Games-Howell *Post-Hoc* Test for median gambling expenditure by gambler type and disability.

## 2.5 Design

In selecting university students grouped according to the presence or absence of disability, a cross-sectional design was used, with a purposive and non-probabilistic approach. This type of design can be useful for studying specific groups in particular contexts, such as universities.

## 3 Results

In reference to the preference in the type of games, 74.1% of the students surveyed indicated that they usually play offline gambling and board games, while the remaining 25.9% prefer online gambling and betting. When looking at gambling preferences according to disability and non-disability (Figure 1), the results showed statistically significant differences between students with and without disabilities, albeit with a small effect, only in online games: students with disabilities ( $X^2_{13} = 12.198$ ,  $p < 0.005$ ,  $\Phi = 0.191$ ) show a higher prevalence for online gambling (18.8%) and online betting ( $X^2_{13} = 8.146$ ,  $p < 0.005$ ,  $\Phi = 0.162$ ) than those

without disability (5.3%), while students without disability ( $X^2_{13} = 4.898$ ,  $p < 0.005$ ,  $\Phi = 0.096$ ) show a higher prevalence for parlor betting (29.7%) compared to participants with disability (4.8%).

In terms of frequency of participation, 23.9% of the sample of students usually gamble once a year, compared to 76.1% who have a prevalence of gambling in the last 30 days. When examining the higher or lower frequency among gamblers (Table 2), it was observed that 49.7% of the players have low prevalence (once a month), 16.2% moderate prevalence (once a week), 4.7% moderate-high prevalence (several times a week), and 2.6% high prevalence (every day, several times a day).

Focusing the results on the prevalences of preoccupying gambling based on having or not having a disability, the analyses showed that at moderate-high (3.0%), and high (2.6%) frequency, statistically significant differences were observed. Students with a disability ( $X^2_4 = 14.06$ ,  $p < 0.005$ ,  $\Phi = 1.41$ ) indicated higher moderate-high (5.2%) and high (5.9%) prevalence for gambling than their non-disabled peers at both moderately high (2.5%) and high (1.8%) prevalence (Table 2).

Regarding the second objective (Table 3), and after exploring the scores of the five variables of the "beliefs or concerns" dimension included in the NODS questionnaire, which form a 4-point Likert-type scale (1 = never, 2 = sometimes, 3 = most of the time, and 4 = always), the analysis of the median<sup>1</sup> ( $Mdn$ ) of the five variables is around "Sometimes" ( $Mdn = 2$ ; Range = 3) and the analysis of the percentage distribution of the most extreme responses of the scale (3 = most of the time and 4 = always) reveals that 39.9% of the sample of students indicated items 3 and/or 4 as a minimum on any of the five variables: *gambled to win back what they lost* (10.5%), *felt bad about spending money gambling* (15.2%,  $d = 0.40$ ), *gambled more than they intended to* (21.1%), *borrowed or stole money to gamble or pay back debts* (7.8%,  $d = 0.30$ ), and *missed class or family/personal plans to gamble or bet* (15.4%). When examining disability and non-disability scores, the results showed that, in two of them, statistically significant differences with a small-medium effect size were observed, reflecting that students with disabilities tend to a higher degree to *feel bad about spending money gambling* ( $PR = 407.4$ ;  $\sum \% i3/i4 = 32.3\%$ ), than non-disabled participants ( $PR = 340.1$ ;  $\sum \% i3/i4 = 11.3\%$ ), although they tend to *ask for or steal money to gamble or pay back debts* to a lesser extent ( $PR = 310.8$ ;  $\sum \% i3/i4 = 0.8\%$ ) than non-disabled students ( $PR = 361.9$ ;  $\sum \% i3/i4 = 9.4\%$ ).

As far as the identification of the typology of at-risk gamblers is concerned, a high percentage are at risk of developing gambling problems,  $\sim 4.7\%$  already have problems and 5.6% have an existing addiction (Table 4). Thus, with regard to the typology of at-risk gamblers according to whether they have a disability, the analyses indicated the existence of statistically significant differences, although in all analyses the effect is medium ( $\Phi \leq 0.20$ ), showing a higher percentage of students with disabilities in the problematic profiles. In this way, a profile of pathological (11.1%) and at-risk gamblers (5.9%) was observed ( $X^2_{17} = 14.035$ ,  $p < 0.05$ ,  $\Phi = 1.141$ ).

<sup>1</sup> The Kolmogorov-Smirnov test corroborates the alternative hypothesis of non-normality for all five variables.

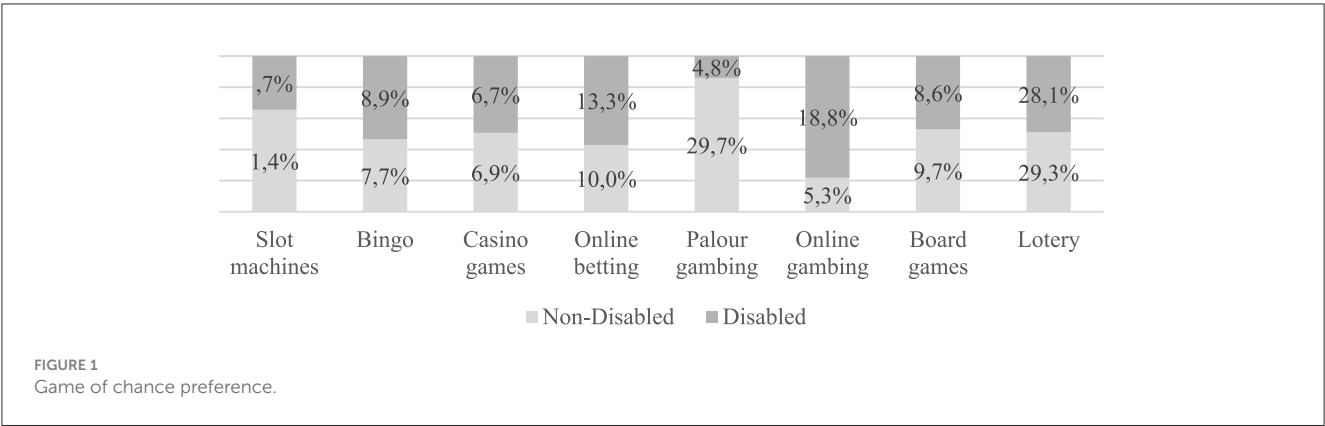


TABLE 2 Frequency of participation based on having or not having a disability.

Frequency		Non-disabled	Disabled	Total
No freq.	Once a year	142 (25.0%)	26 (19.3%)	168 (23.9%)
Low freq.	Once a month	290 (51.0%)	60 (44.4%)	350 (49.7%)
Moderate freq.	Once a week	88 (15.5%)	26 (19.3%)	114 (16.2%)
Moderate high freq.	Several times a week	25 (4.4%)	8 (5.9%)	33 (4.7%)
Moderate/high freq.	Every day	14 (2.5%)	7 (5.2%)	21 (3.0%)
High freq.	Several times a day	10 (1.8%)	8 (5.9%)	18 (2.6%)
	Total	569 (100%)	135 (100%)	704 (100%)
	X <sup>2</sup>	14.065	p < 0.05	
	Phi	1.41	p < 0.05	

\*\*p ≤ 0.01, \*p ≤ 0.05.

TABLE 3 Analysis of the items “beliefs and concerns” and disability.

Sometimes	Mdn/range	Disability	
		U	d
Gambled to win back what they lost	2.0 (3)	36,679	-
Felt bad about spending money gambling	2.0 (3)	30,165*	0.40
Gambled more than they intended to	2.0 (3)	35,863	-
Asked for/stole money to gamble or pay back your debts	2.0 (3)	31,892*	0.30
Missed school/family/personal plans due to gambling or betting	2.0 (3)	37,061	-

Effect size (d): 0.2 small, 0.5 medium, 0.8 large; (f): 0.1 small, 0.25 medium, 0.4 large.

\*\*p ≤ 0.01.

\*p ≤ 0.05.

Regarding the gambling prevalence and expenditure (Table 5), the median expenditure<sup>2</sup> (*Mdn* = 18 €; Range = 120) by students who gamble on the different online games is <20 € and as the level of risk increases the expenditure increases, reaching 67.5 € among

students with problems or 45 € among pathological gamblers. The Kruskal-Wallis H-test determines that there are statistically significant differences between the types of gamblers with and without disabilities with respect to expenditure ( $H = 81.655$ ,  $df = 7$ ,  $p = 0.001$ ). *Post-hoc* analyses using the Games-Howell statistic revealed that, in most significant pairwise combinations, students with disabilities spend more than students without disabilities and increase this expenditure as their level of risk increases: students with disability and not at risk had higher expenditure (*Mdn* = 45 €) than students without disability and not at risk (*Mdn* = 18 €,  $p = 0.025$ ) 95% CI (2.21, 55.79), students with disability and at risk had higher expenditure (*Mdn* = 73 €) than students without disability and at risk (*Mdn* = 18 €,  $p = 0.001$ ) 95% CI (15.97, 55.58) and disabled and at-risk students, the stratum with the highest observed expenditure, spent more (*Mdn* = 105.5 €) than students without disability and with problems (*Mdn* = 45 €,  $p = 0.050$ ) 95% CI (−1.73, 74.17).

4 Discussion

Nowadays, the increasing prevalence of online gambling among university students has raised serious concerns about the potential risks involved. This phenomenon is rooted in the context of a generation that has witnessed an explosion in the availability and accessibility of gambling, facilitated by the legalization of gambling activities and technological advances that have resulted

2 The Kolmogorov-Smirnov test (Stat. = 0.280;  $df = 704$ ;  $p = 0.001$ ) corroborates the alternative hypothesis of non-normality of the variable “Game expenditure.”

TABLE 4 Test of homogeneity ( $\chi^2$ ), at-risk gambler type based on having or not having disability.

	Non-disabled		Disabled		Total	
No risk	432	75.1	86	63.7	518	76.3
At risk	88	15.5	26	19.3	114	23.9
With problems	25	4.4	8	5.9	33	4.7
Pathological	24	4.3	15	11.1	39	5.6
Total	569		135		704	
$\chi^2$	14.035*		$p < 0.05$			
Phi	1.41*		$p < 0.05$			

\*\* $p \leq 0.01$ , \* $p \leq 0.05$ .

TABLE 5 Games-Howell *post-hoc* test for median expenditure on games by gamblers typology and disability.

1/ <i>n</i>	2/ <i>n</i>	Mdn €/Av. range (1)	Mdn €/Av. range (2)	Error deviation	<i>p</i>	95% CI	
						Lower limit	Upper limit
With dis., no risk/ <i>n</i> = 43	No dis., no risk/ <i>n</i> = 322	45 (424.45)	18 (309.22)	8.457	0.025	2.21	55.79
With dis., at risk/ <i>n</i> = 73	No dis., at risk/ <i>n</i> = 207	90 (474.05)	18 (324.44)	6.409	0.001	15.97	55.58
With dis., with problems/ <i>n</i> = 12	No dis., with problems/ <i>n</i> = 207	105.5 (585.00)	45 (455.36)	11.757	0.050	−1.73	74.17
With dis., pathological/ <i>n</i> = 2	No dis., no risk/ <i>n</i> = 322	90 (553.50)	18 (309.22)	2.146	0.001	53.87	66.97
	With dis., no risk/ <i>n</i> = 43	90 (553.50)	45 (424.45)	8.180	0.009	5.34	57.50
	No dis., at risk/ <i>n</i> = 207	90 (553.50)	18 (324.44)	2.839	0.000	49.00	66.38
	With dis., at risk/ <i>n</i> = 73	90 (553.50)	90 (474.05)	5.746	0.007	3.98	39.86
	No dis., with problems/ <i>n</i> = 207	90 (553.50)	45 (455.36)	8.347	0.034	1.34	55.11

\*\* $p \leq 0.01$ , \* $p \leq 0.05$ .

in a wide range of gambling options via the internet and mobile devices. Thus, the increased supply of legalized gambling and the proliferation of online platforms have created an environment conducive to young people’s participation in these activities. The extensive culture of gambling and online betting in Spain can be explained primarily by the fact that, in 2011, Spain passed legislation regulating online betting, creating a clear and secure legal framework for operators and players. Additionally, the high level of internet penetration and the widespread use of mobile devices in Spain have facilitated access to online betting platforms. This has made it easy and convenient for users to participate in gambling from anywhere and at any time. Furthermore, advertising campaigns, sports sponsorships, and promotional offers have contributed to increasing the visibility and social acceptance of online gambling. As a result, gambling and betting are often seen as a normalized and popular form of entertainment and leisure among much of the Spanish population. However, for certain groups, such as university students with disabilities, participation in gambling may be increased due to the inherent characteristics of the disability.

Therefore, the aim of this study is to test whether disability may be a risk factor for online gambling participation. To achieve

this goal, four specific objectives have been identified: first, to examine the type of games and frequency of participation in gambling among students with and without disabilities; second, to explore the beliefs and concerns related to gambling among students with disabilities; third, to research whether there is a profile of at-risk gamblers among students with disabilities; finally, to conduct a comparative analysis of the prevalence of gambling and associated expenditure among university students, based on their disability status.

Foremost, the results of the first objective indicate that, in general, university students tend to play offline games, although not very often. However, there are statistically significant differences in the type of gambling when the disability variable is taken into account, with disabled students preferring online gambling, while non-disabled students prefer gaming in arcades.

As some authors indicate, participation in online gambling among students with disabilities may be due to a variety of reasons. Aspects such as accessibility to connect with friends and engage in leisure activities without the physical limitations they might face in other social settings may be a justifiable reason for participation in this type of entertainment (Gómez Hernández, 2000; Pallesen et al., 2021). In this sense, this group may see their degree of

autonomy and independence reduced, limiting their attendance at leisure and recreational venues, which, in some way, may be conditioned by architectural barriers. The same applies to certain mass events such as concerts or festivals that involve crowds, or the need to depend on other companions for transport (Pitt et al., 2021). Finally, possible mobility, visual or hearing impairments may reduce autonomy and condition travel, sports or outdoor activities (Emerson et al., 2021).

Likewise, disability can reduce face-to-face interpersonal interaction and lead to problems of loneliness, especially in the juvenile stage, which is characterized by the need for personal affirmation through peer recognition (Luque-Parra et al., 2014). These circumstances can lead to demotivation or a tendency to engage in more passive leisure practices, in which direct or face-to-face participation is not necessary as in other types of gambling (Solish et al., 2010; Pitt et al., 2021).

In terms of time spent, ~25% of students showed a moderate, moderately high and high frequency of participation. Thus, when looking at the disability variable, comparisons reveal that students with disabilities showed a higher frequency of participation, with a moderately high and high frequency (16.9%), which are higher percentages than those observed in the data for students without disabilities (8.7%).

In relation to these findings, different studies have shown that internet gambling can be particularly attractive to many vulnerable groups, such as those who spend long periods of time at home. This may be the case of students with disabilities who, due to their circumstances, may spend more time alone at home and therefore have more opportunities to go online and opt for recreational opportunities such as these (Corney and Davis, 2010; Suriá, 2012; McCormack et al., 2013; Osuna et al., 2021).

In this regard, several authors note that online games have emerged among people as a form of entertainment and socialization, and can provide students with disabilities a way to connect with friends and engage in playful activities without the physical limitations they may encounter in other social settings (Pallesen et al., 2021; Martínez et al., 2024; Suriá et al., 2024). At the same time, online platforms can level the playing field for people with disabilities, providing opportunities for participation in recreational activities that might be more challenging in physical settings. Finally, online gambling can serve as a way to escape the realities of their disability and the limitations they are confronted with in everyday life, providing a temporary distraction from their physical or emotional challenges. This can lead to an ideal leisure context that can be accessed for recreational activities that do not involve added effort, such as the leisure-oriented spaces available on a multitude of websites (Morahan-Martin and Schumacher, 2000; McCormack et al., 2013; Duplaga and Szulc, 2019).

In reference to their beliefs about gambling and betting (second objective), the results reflect that, to some extent, they have spent more than they intended to, felt bad about gambling, or missed school or family appointments because of gambling. This, as indicated by the DSM-V, denotes a certain danger or risk of addiction, since their behavior and preoccupation with the financial cost of gambling begins to interfere with their daily activities and becomes a cause for concern, with more discomfort being observed to a greater extent in students with disabilities.

Possibly, if most students have not yet emancipated themselves from their families, those with disabilities are less likely to do so. Similarly, if labor market integration is difficult for people, it is much more difficult for people with disabilities to access the labor market (Suriá and Ortigosa Quiles, 2022; García et al., 2023). Therefore, in most of the cases of these students, the way of earning an income depends on their family members, so they do not have a high income. This and the fact that they tend to gamble at home (in which family members and/or carers live together very often) may generate more worries or concerns than in students without disabilities.

In this respect, and after reviewing the scarce literature on Internet addiction in the population of students with disabilities, the results of the study coincide with other authors. For example, Suriá (2015) focused on the comparative analysis of Internet problematic in a sample of university students with and without disabilities. The results reflected the existence of a certain inclination among disabled people to use this resource for online social and recreational leisure, as well as its access as an entertainment and leisure strategy. Moreover, although no apparent changes were obtained that affected the daily lives of these young people in their day-to-day activities, the findings did show that it generated some kind of discomfort or dependence if they did not go online. The results concluded that people with disabilities, who are regular users of the net as a form of leisure, recognized some negative consequences in their lives.

This hypothesis is strengthened when examining the last objective that analyses the profile of the at-risk gambler and the money invested in the games, and the results show that as the level of at-risk gambler increases, so does the amount spent. And as mentioned above, this is more pronounced in the case of students with disabilities, who spend more than non-disabled students.

Although the published literature on disabled gamblers and online gambling is sparse, some exceptions have focused on the relationship between the two variables. For example, Pitt et al. (2021) studied the benefits and negative effects of gambling and other risky behaviors in a group of young Australians with disabilities. The results showed that, although participants were cautious about alcohol consumption, most had gambled, and some of them indicated that they had had problems with online gambling.

Another international study conducted by McCormack et al. (2013) examined the characteristics and predictors of online gambling for problem vs. non-problem gamblers. Their results showed that the most addicted gamblers were more likely to be young, male, smokers, engage in these activities alone and have a disability.

Finally, in another European study by Pallesen et al. (2021), they analyzed changes over time and identified predictors of online gambling among three representative Norwegian samples over a 6-year period (2013–2019). Consistent predictors of online gambling were students, male gender, being unemployed and having a disability.

In summary, online gambling addiction is a serious problem that can affect people of all ages and backgrounds, including students with disabilities. People with disabilities may face unique challenges that can increase their vulnerability to such addictions.

For example, they may turn to online gambling and betting as a way of escaping the difficulties they experience in everyday life, or they may be attracted by the accessibility and ease of access offered by online platforms.

Despite the relevance of the present work, the study on online gambling and betting problematic among students, both with and without disabilities, may encounter several limitations that could affect the validity and generalizability of the results of a study with this population and methodology. First, the sample size. A study with only 704 participants may not be representative of the general university student population. The sample may be too small to detect small effects or significant differences. Also, generalizability. Since the study is limited to university students with and without disabilities, the findings may not be generalizable to other age groups, educational levels or cultural backgrounds. Regarding the questionnaire and response bias, the results of the questionnaire may be biased by participants' tendency to respond in a socially desirable way or to exaggerate or minimize their online gambling addiction problems. The self-selection of the sample should also not be overlooked. Students who agree to participate in the study may have different characteristics than those who choose not to participate, which could bias the results. Finally, there is the lack of diversity. The sample may lack diversity in terms of types of disability, severity of disability, gender, ethnicity, or other important factors that could influence online gambling addiction.

To address these limitations, it would be useful to conduct a study with a larger and more diverse sample. It would also be helpful to use multiple data collection methods (e.g., qualitative interviews in addition to questionnaires) and ensure that measurement instruments are adapted to address the specific needs of people with disabilities. By proactively addressing these issues and providing the necessary support, it is possible to help prevent problem gambling and promote the wellbeing of all students, including those with disabilities. It is important to consider the additional risk factors associated with disability when designing prevention and treatment strategies for gambling addiction in this population group. Students with disabilities may require specialized access to resources and support to address needs related to gambling addiction, highlighting the importance of including mental health and wellness services specifically tailored to their needs. This would allow for the establishment of policies that promote responsible gambling and the creation of prevention tools for vulnerable students.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by Comité de Ética de la Universidad de Alicante. The studies were

conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

## Author contributions

RS-M: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. FG-C: Investigation, Supervision, Visualization, Writing – original draft, Writing – review & editing. EV-C: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing. CL-S: Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. CC-B: Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Family socioeconomic status and young children digital addiction: a moderated mediation model

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**Background:** Presently, the problem of digital addiction in young children is becoming more and more prominent, and digital addiction can cause significant harm to the healthy physical and mental development of young children. A growing body of research suggests that family socioeconomic status and parenting styles are associated with digital addiction. However, little is known about the mediating and moderating mechanisms behind this relationship, and few studies have explored whether this relationship holds in young children populations. Therefore, the present study aimed to investigate whether parenting styles mediate the relationship between family socioeconomic status and young children's digital addiction and whether young children's gender moderates this mediation process.

**Methods:** A cross-sectional study design was used. 403 parents of young children were asked to complete online questionnaires, including the Internet Addiction Test-10 (IAT-10) the Chinese version of the Parenting Style Questionnaire (C-EMBU). The mediation model with moderation was tested using the PROCESS plug-in for SPSS.

**Results:** (1) Family socioeconomic status is significantly and negatively associated with digital addiction in young children. (2) Parenting styles (emotional warmth and understanding, punishment and harshness) mediate the relationship between family socioeconomic status and young children's digital addiction. (3) Young children's gender moderates the relationship between family socioeconomic status and punishment and severity parenting styles, emotional warmth and understanding parenting styles and young children's digital addiction.

**Conclusion:** The results indicate that family socioeconomic status can prevent digital addiction in young children through the path of improving parenting styles. However, there is still an overall negative effect of family socioeconomic status on young children's digital addiction.

## KEYWORDS

family socioeconomic status, parenting styles, digital addiction, young children digital addiction, gender

# 1 Introduction

With the rapid advancement of China's informatization work, the "Internet + education" model is developing rapidly, and the Internet penetration rate of underage Internet users has also been further enhanced. By June 2020, the Internet penetration rate for minors exceeded 94 percent, the number of children accessing the Internet reached 183 million, and more than 33 percent of primary schoolchildren used the Internet for the first time before school age (China Communist Youth League, 2021). Over 70% of young children are exposed to and use online media. Among them, 34.53% were 3-year-olds, and 21.13% were 4-year-olds (Tang, 2023). The trend of "under-aging" of Internet use cannot be ignored. Although many studies have pointed to the positive effects of Internet use on the development of cognitive functioning and well-being (Heo et al., 2015; Chopik, 2016; Zhou et al., 2022), inappropriate or excessive use of the Internet can lead to digital addiction, which may result in neurological complications, psychological disorders, and social problems (Cash et al., 2012). Digital addiction is a severe psychological disorder that manifests itself as an individual's inability to effectively control their use of the Internet and digital media, resulting in an impaired psychological state or functioning (Young, 1996; Young and Rogers, 1998). It has been shown that digital addiction hurts the healthy development of young children, such as reduced visual acuity, delayed physical development, weakened social interaction, slowed cognitive and language development, and reduced family intimacy (Liu et al., 2020). At present, several scholars have conducted in-depth studies on the influencing factors and mechanisms of digital addiction among Chinese adolescents, college students, and older people (Yang et al., 2022; Zhang et al., 2022; Gao et al., 2023; Xie et al., 2023; Wang et al., 2024; Yang et al., 2024). However, no scholars have focused on young children in this area. Therefore, this study takes young children as the research object and explores the mechanisms behind the influencing factors of digital addiction to provide a theoretical basis and practical support for the prevention of young children's digital addiction and the maintenance of young children's physical and mental health.

At present, many scholars have explored the influencing factors of digital addiction, among which the factor of family socioeconomic status has attracted much attention. Family socioeconomic status refers to a hierarchical ranking based on the degree of social capital, such as rights and status, available to or controlled by the family, reflecting differences in an individual's access to actual or potential resources, and the social capital involved generally includes factors such as family members' educational attainment, income level, and occupational reputation. (Zhang et al., 2007) One study showed a significant positive correlation between family socioeconomic status and digital addiction, as evidenced by the correlation between higher family socioeconomic status and a higher propensity to become addicted to the Internet (Mann, 2006). Another study also showed that students from high family socioeconomic status scored significantly higher on the tendency to digital addiction than students from low family socioeconomic status (Zou et al., 2014). However, some studies pointed to the opposite conclusion that family socioeconomic status has a significant negative correlation with digital addiction (Urbanova et al., 2019). This result may be because an individual is in a high socioeconomic status household, which will reduce their reliance on online social activities. In contrast, households with low socioeconomic status can increase their dependencies on

online social activities (Jin et al., 2017). It can be seen that the socioeconomic status of the family is a prominent influence on digital addiction. However, regarding the relationship between family socioeconomic status and digital addiction, Scholars have not yet reached an agreement.

In addition to family socioeconomic status, the relationship between parenting styles and digital addiction has also attracted the attention of scholars. Parenting style is a relatively stable conceptual, behavioral, and emotional expression of parents' treatment of their children, reflecting the nature of the interaction between parents and children. Its dimensional structure includes emotional warmth and understanding, punishment and harshness, over-interference, favoring subject, denial, and over-protection (Perris et al., 1980). It has been shown that parenting behaviors directly affect the behavioral development of young children (Kanan et al., 2018). Parents who tend to adopt negative parenting styles are more likely to cause their children to develop more psychological and behavioral problems, increasing their risk of digital addiction (Fu et al., 2004). A previous study found significant differences in parenting styles between individuals with and without digital addiction tendencies, such as over-interference, punishment and harshness, and denial (Li and Zhang, 2004). Based on this, another study conducted an in-depth exploration of the relationship between parental parenting styles and digital addiction and found a significant positive correlation between denial and over-interference parenting styles and digital addiction (Yu, 2015). In addition to the parenting styles mentioned above, recent research suggests that over-protection parenting styles are also a significant positive predictor of digital addiction (Guo et al., 2023).

It is worth noting that there is also a significant correlation between family socioeconomic status and parental parenting styles. Research has shown that parents raising their children stems from their expectations of their children, and this behavior varies with changes in the family's socioeconomic status (Hoff et al., 2002). It is reflected in the fact that parents of lower socioeconomic family status are more likely to use harsh, more authoritarian parenting styles, such as corporal punishment and lack of communication, and parents in families of higher socioeconomic status tend to adopt a caring and understanding parenting style and have more interaction and communication with their children (Shonkoff, 2000). Additionally, it has been pointed out that compared to high-income families, low-income families usually associate media time with family time. Parents of low-income families may feel stressed or overworked, resulting in a poorer response to their children's needs (Clark, 2013; Livingstone et al., 2015).

Many scholars have focused on the moderating role of gender in the relationship between family socioeconomic status and parenting style, and parenting style and digital addiction. Regarding the relationship between family socioeconomic status and parenting styles, one study found that boys in high family socioeconomic status families were likely to experience less parental rejection and more emotional warmth. At the same time, this association was not significant among girls (Cheng and Wu, 2021). A subsequent study noted that when inequality in family socioeconomic status increases, parents have higher expectations of boys compared to girls and are more inclined to adopt intensive parenting styles, such as authoritative and authoritarian parenting, to increase boys' expected future earnings in the labor market (Li and Zhu, 2022). In addition, another study shows that the lower the household's socioeconomic status, the greater

the gender inequality in access to resources (Wu, 2012). Specifically, in families of lower socioeconomic status, parents are inclined to satisfy boys' interests at the expense of girls and tend to use overprotective and spoiled parenting styles for boys. In contrast, girls are more likely to be criticized, harsh, and punished (Zhang and Ma, 2019). Regarding the relationship between parenting styles and digital addiction, previous studies have pointed out that when boys do not receive emotional support from their parents, they develop a psychological sense of "abandonment," a feeling that is stronger in boys than in girls (Wang, 2008). In order to give vent to their bad moods and relieve their depressed moods, boys choose online games more often to vent and release their repressed moods and anxieties through online games. A subsequent study indicated that parenting styles of monitoring significantly and negatively predicted digital addiction in both boys and girls, constraints significantly and positively predicted digital addiction in boys, and neglect and material rewards significantly predicted digital addiction in girls (Li and Zhou, 2009). In addition, recent research has shown that in adolescent populations, positive parenting styles are significantly more negatively predictive of digital addiction among male parents than among female students (Niu et al., 2023). Other scholars exploring the relationship between negative parenting styles and digital addiction among college students found that gender moderated the relationship between parental rejection and digital addiction, whereas gender did not significantly moderate the relationship between parental overprotection and digital addiction (Guo et al., 2023).

To summarize, first, previous studies have found that family socioeconomic status and parenting style are essential factors in digital addiction, which provides many references for this study. However, the specific relationship between family socioeconomic status and digital addiction and parenting style and digital addiction is still controversial. Second, many scholars have focused on the moderating role of gender in the relationship between family socioeconomic status and parenting styles, and parenting styles and digital addiction but have not reached uniform conclusions. Third, numerous studies in recent years have pointed out that parenting styles, parent-child relationships, and children's digital addictions are a dynamic process that changes over time and that there is significant heterogeneity

among different groups (Cao and Liu, 2023; Liu et al., 2023; Xie et al., 2023). But most of the existing studies have been conducted on young children, college students, and the elderly population, and there is a lack of attention to digital addiction in the early childhood population. Therefore, in exploring the relationship between family socioeconomic status and young children's digital addiction, the present study used parenting style as an essential mediating variable and considered the moderating role of gender in the mediating process. Based on that, this study constructs a moderated mediation model to explore the relationship between family socioeconomic status and young children's digital addiction (see Figure 1). The following four hypotheses were formulated in this study:

*H1:* Young children's family socioeconomic status is a significant negative predictor of their digital addiction.

*H2:* Parenting style mediates the relationship between family socioeconomic status and young children's digital addiction.

*H3:* Young children's gender moderates the relationship between family socioeconomic status and parenting style.

*H4:* Young children's gender moderates the relationship between parenting style and digital addiction.

## 2 Materials and methods

### 2.1 Participants

The sample of this study using a random sampling approach comprised 415 parents of young children recruited from Urumqi, Xinjiang. After eliminating samples with incomplete information, regular responses, apparently garbled responses, and primary caregivers who were not parents, the actual valid sample size entering the analysis was 403. There were 304 females (75.43%) and 99 males (24.57%), 7 were of them 16–25 years old (1.74%), 206 were of them

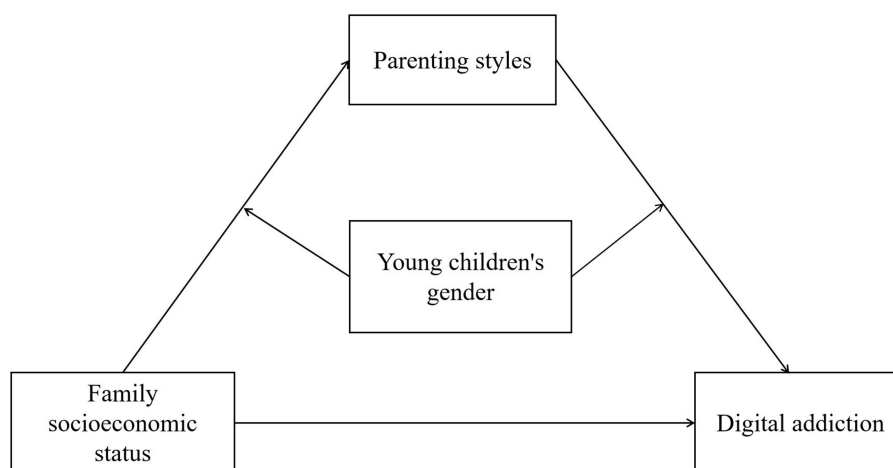


FIGURE 1  
Research hypothesis model.

26–34 years old (51.12%), 167 were of them 35–45 years old (41.44%), 22 were of them 46–55 years old (5.46%) and one was of them 56–65 years old (0.25%). The gender of the parents' children was 208 (51.61%) boys and 195 (48.39%) girls, and the age of the children was 3–4 years 147 (36.48%), 4–5 years 94 (23.33%), 5–6 years 133 (33%), 6–7 years 26 (6.45%) and others 3 (0.74%). 140 parents reported their work as general managers, general professional and technical staff, and clerical staff (34.74%). 110 parents were casual workers, unemployed, unemployable, unskilled, and agricultural workers (27.3%). 89 parents' occupations were manual labor workers (commercial service workers), self-employed workers, skilled workers, and workers of the same grade (22.08%), and 45 parents were engaged in middle managers, middle-level professional and technical staff, and assistant professionals (11.17%). The remaining 19 parents had the occupation of career senior managers (managers), senior professional and technical staff, and professional supervisors (party leaders) (4.71%). The literacy levels of parents represented in the study sample include the following: 1 (0.25%) below the elementary school, 5 (1.24%) in elementary school, 67 (16.63%) in middle school, 90 (22.33%) in high school or junior college, 231 (57.32%) in college (college or bachelor's degree), and 9 (2.23%) in graduate school and above.

## 2.2 Measures

### 2.2.1 Digital addiction scale

This study referred to the *Internet Addiction Test* (IAT-10) developed by Young (1996) at the University of Pittsburgh, United States, based on the digital addiction Screening Scale. It mainly deals with the length of time the child uses electronic products, emotions, outcomes, and behavioral manifestations. The questionnaire consists of 10 “yes” or “no” questions and young children who answered “yes” to five or more questions were diagnosed with digital addiction. The Cronbach's alpha coefficient for this scale in this study was 0.842.

### 2.2.2 Parenting style scale

Parenting styles were measured using the *Chinese version of the Parenting Styles Questionnaire* (C-EMBU). The questionnaire was developed by Perris et al. (1980) scale and revised by our scholars Yue et al. (1993). Following China's national conditions, the C-EMBU contained 66 items, of which 58 items used to evaluate the father's parenting style, consisting of six factors: emotional warmth and understanding, punishment and harshness, over-interference, favoring subject, denial, and over-protection; and 56 items used to evaluate the mother's parenting style, consisting of five factors: emotional warmth and understanding, over-interference, denial, punishment and severity, and favoring subject. The reliability of the dimensional scales was 0.7 or higher.

## 2.3 Statistical analysis

First, Harman's one-factor approach has been used to detect systematic errors due to the homogeneity of the environment and the psychology of evaluating the overall expectations of the sample. Second, means, standard deviations and correlations of variables of the present study were reported through SPSS 26.0. Finally, the mediating role of parenting style was tested using the macro program

PROCESS v4.1.1. The moderating role of young children's gender in the first half of the model path and the second half of the model path was analytically tested.

## 3 Results

### 3.1 Common method bias test

Harman's one-factor approach has been used to detect systematic errors due to the homogeneity of the environment and the psychology of evaluating the overall expectations of the sample. The results showed that of the 14 characteristic root factors extracted, the first common factor accounted for 22.233% of all explanatory variables, less than the 40% determination criterion proposed by Podsakoff et al. Therefore, there is no serious problem of common method bias in the data of this study.

### 3.2 Descriptive statistics and correlation analysis

The means, standard deviations, and correlation coefficients of the variables are shown in Table 1. As can be seen, family socioeconomic status was significantly and negatively associated with digital addiction in young children ( $p < 0.01$ ), emotional warmth and understanding parenting style was significantly and positively related to digital addiction in young children ( $p < 0.01$ ), rejection and denial was negatively associated with digital addiction in young children ( $p < 0.001$ ), and punishment and harshness parenting style was significantly and negatively related to digital addiction in young children ( $p < 0.05$ ), family socioeconomic status was significantly positively correlated with emotional warmth and understanding parenting style with digital addiction in young children ( $p < 0.001$ ), family socioeconomic status was significantly negatively correlated with punishment and harshness parenting style ( $p < 0.01$ ).

### 3.3 Testing for the mediation model

The Bootstrap method provided bias-corrected confidence estimates of the mediating role of parenting styles and young children's digital addiction and the statistics analyzed by the SPSS macro program PROCESS (Preacher and Hayes, 2004). As shown in Table 2. Family socioeconomic status significantly negatively predicted young children's digital addiction ( $\beta = -0.160$ ,  $p < 0.01$ ). After the introduction of mediator variables, family socioeconomic status negatively predicted young children's digital addiction through emotional warmth and understanding parenting style ( $\beta = -0.019$ ,  $p < 0.001$ ), and family socioeconomic status negatively predicted children's digital addiction through punishment and harshness parenting style ( $\beta = -0.184$ ,  $p < 0.001$ ). Meanwhile, emotional warmth and understanding parenting styles significantly positively predicted young children's digital addiction ( $\beta = 0.173$ ,  $p < 0.001$ ), and punishment and harshness parenting styles significantly negatively predicted young children's digital addiction ( $\beta = -0.150$ ,  $p < 0.01$ ).

A mediation model was used to test whether the effect of family socioeconomic status on young children's digital addiction was

TABLE 1 Results of descriptive statistics and correlation analysis for each variable.

Item	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7
Young children's digital addiction	1.627	0.284	–						
Emotional warmth and understanding	2.942	0.465	0.143**	–					
Over-intervention and over-protection	2.176	0.503	–0.058	0.327***	–				
Rejection and denial	1.508	0.517	–0.181***	0.135**	0.669***	–			
Punishment and harshness	1.756	0.463	–0.121*	0.176***	0.643***	0.838***	–		
Favoring subject	2.623	0.449	0.056	0.592***	0.451***	0.336***	0.386***	–	
Family socioeconomic status	9.75	2.836	–0.160**	0.155**	–0.059	–0.057	–0.157**	0.049	–

*N* = 403; \**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001.

produced through parenting styles. As shown in Table 3, mediation analysis showed that the mediating effect of parenting style on the relationship between family socioeconomic status and young children's digital addiction was 0.006, 95% CI [0.003, 0.011]. The ratio of the indirect effect to the total impact was –37.5%. Thus, the association between family socioeconomic status and young children's digital addiction can be partially explained by parenting styles.

### 3.4 Testing for moderated mediation models

The moderating role of young children's gender in the first and second half paths of the model was analyzed through the PROCESS macro program. First, the moderating role of young children's gender in the first half path was examined, and the results are shown in Table 4. Family socioeconomic status was a non-significant predictor of punishment and harshness parenting style ( $\beta = -0.042$ ,  $t = -3.716$ ,  $p > 0.05$ ), young children's gender was a significant predictor of punishment and harshness parenting style ( $\beta = -0.377$ ,  $t = -2.316$ ,  $p < 0.05$ ), and the interaction term between family socioeconomic status and young children's gender was a significant positive predictor of punishment and harshness parenting styles ( $\beta = 0.033$ ,  $t = 2.040$ ,  $p < 0.05$ ), with 95% confidence intervals of [0.001, 0.064] and excluding 0, suggesting that young children's gender moderates the relationship between family socioeconomic status and punishment and harshness parenting styles. Specifically, as shown in Figure 2, in the girls' group, family socioeconomic status was a significant predictor of punishment and harshness parenting styles ( $\beta = -0.042$ ,  $p < 0.001$ , 95% confidence interval [–0.064, –0.020]). In the boys' group, family socioeconomic status was a non-significant predictor of punishment and harshness parenting styles ( $\beta = -0.009$ ,  $p > 0.05$ , 95% confidence interval [–0.032, 0.013]).

Second, the moderating role of young children's gender in the second half of the pathway was tested. As shown in Table 5. Emotional warmth and understanding parenting styles were significant predictors of digital addiction in young children ( $\beta = 0.165$ ,  $t = 4.012$ ,  $p < 0.001$ ), gender of young children was an essential predictor of digital addiction ( $\beta = 0.497$ ,  $t = -2.783$ ,  $p < 0.01$ ), and the interaction term between emotional warmth and understanding parenting styles and young children's gender significantly and negatively predicted young children's digital addiction ( $\beta = -0.166$ ,  $t = -2.769$ ,  $p < 0.01$ ), with a 95% confidence interval of [–0.284, –0.048] and excluding 0, suggesting that young children's gender moderates the relationship

between emotional warmth and understanding parenting styles, and young children's digital addiction. Specifically, as shown in Figure 3, in the group of girls, emotional warmth and understanding parenting styles were significant predictors of digital addiction ( $\beta = 0.165$ ,  $p < 0.001$ , 95% confidence interval of [0.084, 0.246]). However, in the boys' group, emotional warmth and understanding parenting style were not significant predictors of digital addiction ( $\beta = -0.001$ ,  $p > 0.05$ , 95% confidence interval [–0.087, 0.085]).

## 4 Discussion

This study found that family socioeconomic status significantly and negatively predicted digital addiction in young children, and the results validated research hypothesis 1. This conclusion is similar to the results of existing studies (Andreou and Svoli, 2013; Islam and Hossin, 2016; Malak et al., 2017). Ecosystem theory states that individuals live in interacting and interconnected environmental systems and that physiological and environmental factors can influence children's psychological and behavioral development (Bronfenbrenner and Morris, 1998). The family's socioeconomic status, as one of the essential components of the family environment system, is closely related to the development of good psychological quality and behavioral habits in young children. As mentioned in the theoretical model constructed by Urbanova et al. (2019), people with low socioeconomic status in the family tend to carry relatively more difficulties and less happiness. This state of life may expose them to more significant psychological stress and social barriers. As a result, individuals with low family socioeconomic status are more likely to seek comfort and escape from reality online. Some other researchers have pointed out that individuals with low socioeconomic status have a lower sense of self-worth (Twenge and Campbell, 2002), are more psychologically stressed (Kraus et al., 2011), have higher tendencies to anxiety and depression (Chen and Miller, 2013), higher impulsivity and lower inhibitory control (He and Yin, 2016), and are more prone to psychological problems and behavioral deviations than individuals in families with high socioeconomic status (Lynam et al., 2000; He and Yin, 2016). At the same time, previous studies have also found that individuals of low household socioeconomic status with lower inhibitory control, higher impulsivity, and higher stress are more inclined to overuse online social media (He et al., 2021). This may be because individuals with low inhibitory control have more difficulty controlling their impulses when confronted with online temptations. Thus, they are more likely to fall into a state of overuse. However, it is

TABLE 2 Results of inter-mediation analysis.

Regression equation		Fitness index			Significance of regression coefficients			
Implicit variable	Independent variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>F</i>	$\beta$	<i>t</i>	LLCI	ULCI
Young children's digital addiction	Family socioeconomic status	0.160	0.026	10.603**	−0.160	−3.256**	−0.026	−0.006
Emotional warmth and understanding	Family socioeconomic status	0.155	0.024	9.814**	0.155	3.133**	0.351	1.533
Young children's digital addiction	Family socioeconomic status	0.234	0.055	11.546***	−0.187	−3.801***	−0.028	−0.009
	Emotional warmth and understanding				0.172	3.492***	0.046	0.164
Over-intervention and over-protection	Family socioeconomic status	0.059	0.004	1.421	−0.059	−1.192	−0.888	0.218
Young children's digital addiction	Family socioeconomic status	0.174	0.030	6.247**	−0.165	−3.335***	−0.026	−0.007
	Over-intervention and over-protection				−0.067	−1.367	−0.093	0.017
Rejection and denial	Family socioeconomic status	0.057	0.003	1.304	−0.057	−1.142	−0.850	0.225
Young children's digital addiction	Family socioeconomic status	0.249	0.062	13.226***	−0.171	−3.533	−0.027	−0.008
	Rejection and denial				−0.191	−3.933	−0.157	−0.052
Punishment and harshness	Family socioeconomic status	0.157	0.025	10.166**	−0.157	−3.188**	−1.556	−0.369
Young children's digital addiction	Family socioeconomic status	0.218	0.048	9.986***	−0.184	−3.724***	−0.028	−0.009
	Punishment and harshness				−0.150	−3.026**	−0.151	−0.032
Favoring subject	Family socioeconomic status	0.049	0.002	0.981	0.049	0.990	−0.308	0.932
Young children's digital addiction	Family socioeconomic status	0.173	0.030	6.164**	−0.164	−3.320**	−0.026	−0.007
	Favoring subject				0.064	1.306	−0.021	0.102

\**p* < 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001.

essential to emphasize that the relationship between self-regulation skills and digital addiction is not simply inverse. Moderate digital media use may also promote the development of self-regulation in individuals (Frost et al., 2019; Toh et al., 2023). For example, through online learning platforms or educational games, young children can learn how to control their behavior, make plans, and reach goals playfully, experiences that help them develop inhibitory control and other self-regulation skills. Thus, in further exploring the relationship between SES and digital addiction in the future, we cannot ignore the mediating role of self-regulatory capacity. Still, neither can we equate low inhibitory control with a high risk of digital addiction. Instead, we should focus on how education and interventions can enhance young children's self-regulating ability in different family socioeconomic contexts, thereby reducing their risk of digital addiction.

The mediation analysis results indicated that parenting styles (emotional warmth and understanding, punishment and harshness) mediated the relationship between family socioeconomic status and young children's digital addiction, and the results validated research hypothesis 2. This conclusion supports previous research findings. According to the ecosystem theory, family socioeconomic status belongs to the outer system, parenting style belongs to the microsystem, and family socioeconomic status needs to be passed through parenting style to act on the young children themselves (Bronfenbrenner, 1986). Some studies have found that parents of lower family socioeconomic status are more likely to use harsh, more authoritarian parenting styles, such as punishment and harshness and lack of communication (Hoffman, 2003). This parenting style may make young children more likely to exhibit poor self-control and disobedient behavior, leading to digital addiction (Zhang, 2016). It has also been found that parents in low-income families experience more stress and fatigue, are less responsive to their young children's needs, and allocate less time management and energy to their young

TABLE 3 Total effect, direct effect, and total indirect effect.

Effect	Effect Value	SE	LLCI	ULCI
Total effect	−0.016	0.005	−0.026	−0.006
Direct effect	−0.022	0.005	−0.032	−0.013
Total Indirect effect	0.006	0.002	0.003	0.011

children's use of media, resulting in higher rates of digital addiction among their children, compared to higher-income families (Livingstone et al., 2015). This research conclusion supports the family investment theory, in which parents whose families have a higher socioeconomic status are more likely to invest in early childhood education, which includes resources such as time, participation in activities, and parenting styles, in addition to financial resources (Schofield et al., 2011; Layte, 2017). Specifically, parents whose families have higher socioeconomic status are more willing to participate in their children's daily life and academic activities and are more inclined to use discussion to solve problems with their children. Conversely, parents from lower socioeconomic status families have to work longer hours for economic reasons and spend less time with their young children, leading to increased problematic behaviors (Gennetian and Rodrigues, 2021). This finding also supports the family stress theory that parents with lower socioeconomic status in the family are more prone to financial stress and psychological problems due to lack of insufficient financial income, which makes them tend to display harsh and punitive parenting styles that negatively affect the physical and mental development of young children and increase their tendency to become addicted to the Internet (Conger and Conger, 2002). In addition, parents of low family socioeconomic status may be unduly influenced by adverse media reports on the impact of Internet use on children's behavior. Due to their low level of education and lack of

experience with the Internet, they may strictly control or prohibit Internet use (Álvarez et al., 2013). This approach may foster children's aversion and rejection of their parents, exacerbate excessive Internet use, and generate digital addiction (Li et al., 2016). This will create a vicious circle. However, in families with high family socioeconomic status, most parents are well-educated, have extensive online skills, understand the positive and negative impacts of the Internet, and consciously teach their children how to use the Internet (Álvarez et al., 2013), which can increase the breadth and depth of parent-child communication and improve parent-child relationships. At the same time, it can avoid some of the risks of Internet use and reduce the probability of digital addiction (Lee and Chae, 2007; Dong et al., 2021).

The results of the moderation analysis indicated that family socioeconomic status and punishment and harshness parenting styles were moderated by gender, and the results supported hypothesis 3. This conclusion is similar to the results of previous studies. The different expectations placed on different genders under traditional attitudes result in a "Son preference" mentality (Wu et al., 2013) that parents are more inclined to satisfy boys at the expense of girls when resources are scarce (Hannum et al., 2009). Currently, this phenomenon still exists among families of lower socioeconomic status (Yang et al., 2016), with parents striving to satisfy boys' interests and over-protection and spoiled upbringing with adequate resources for the child. In contrast, girls are more likely to be taught in a critical, punishment, and severity manner (Zhang and Ma, 2019). The present study found no significant difference in digital addiction in young children by gender. Although studies have shown that boys have significantly higher levels of digital addiction than girls, some studies point to a narrowing of this gap (Weiser, 2000). It is worth exploring that the present study found a significant gender difference in the relationship between caring and understanding parenting style and young children's digital addiction, and girls' parents' caring and understanding were more predictive of young children's digital addiction compared to boys'. This result supports hypothesis 4. However, the conclusions of this study differ from the views of previous scholars, namely Niu et al. (2023) noted that in the adolescent population, the use of positive parenting styles by parents of boys was a more significant negative predictor of digital addiction compared to girls. This difference may be due to differences in the characteristics of the subject sample, with young children aged 3–6 years being more curious but less self-controlled compared to adolescents. Emotional warmth and understanding parents may be overly tolerant and understanding and lack supervision and control over their children's activities and behaviors (Anandari, 2016), which may lead to overindulgence in the online world of digital addiction and lead to digital addiction. In addition, scholars have noted that girls are more susceptible to parenting styles to parenting styles because girls feel more lonely than boys and are more likely to use the Internet in search of socialization and recognition, which leads to a rise in their risk of digital addiction (Akhter et al., 2020; Guo et al., 2023).

## 5 Implications and limitations

### 5.1 Theoretical and practical implications

This study explores the influencing factors and internal mechanisms of digital addiction for the first time for a group of young children, filling the gap in the field of digital addiction research for this

age group and expanding the scope of the target group of digital addiction research. Second, the study clarified the negative correlation between family socioeconomic status and young children's digital addiction and explored the moderating role of parenting styles as well as the moderating role of gender. These findings emphasize the critical role of the family environment in young children's development and provide a theoretical rationale for early intervention, as well as directing policy and legislative attention to young children's digital health. Third, the study reveals the influence of factors such as family socioeconomic status, parenting style, and the gender of young children on young children's digital addiction, which provides new perspectives and a theoretical basis for understanding the formation mechanism of young children's digital addiction. In addition, the research results not only help to improve the existing theoretical model of young children's digital addiction but also provide a reference for future research on young children's digital addiction and related fields.

The study found that family socioeconomic status and parenting styles are influential factors in young children's digital addiction and that young children's gender plays an essential moderating role in this influential mechanism. Given this, the study recommends the following practices to prevent and intervene in digital addiction among young children. First, the Government and social organizations should strengthen special funds and educational subsidies to enhance family socioeconomic support and educational resources. AI technology can accurately identify the needs of families with low socioeconomic status and provide personalized economic assistance and education programs. At the same time, community support networks should be established to promote sharing of parental experience and optimize the environment for family growth. Second, the education and health sectors should jointly organize lectures and workshops to popularize caring and understanding parenting styles, reduce punitive education, and enhance parents' communication and emotion management abilities. AI home education assistants can be introduced to provide customized parenting advice and enhance parents' understanding of their children's emotions through emotion recognition technology. Encourage non-screen time parent-child activities, such as outdoor adventure and parent-child reading, to improve parent-child relationships. Finally, analyze the different manifestations of gender in young children's use of numbers and design gender-appropriate non-numeric activities to reduce number dependence. Strengthen gender-sensitive education for parents and guide them to respond to their children's specific digital behaviors effectively. In addition, personalized analysis using AI technology can accurately identify and intervene in young children's risk of digital addiction, ensuring that interventions are more targeted and effective.

### 5.2 Limitations and future research

This study has many contributions and implications but is not without shortcomings. First, the study used a cross-sectional research design, which could not show the dynamic relationship between family socioeconomic status, parenting styles, and young children's digital addiction. In the future, we will observe the changes in family socioeconomic status, parenting styles, and young children's digital addiction behaviors at different points in time through a long-term follow-up survey to reveal the dynamic relationship between them. Second, the variables of young children's digital addiction and parenting styles in the study were reported by parents. Although it has

TABLE 4 Moderating effect test for the first half of the path.

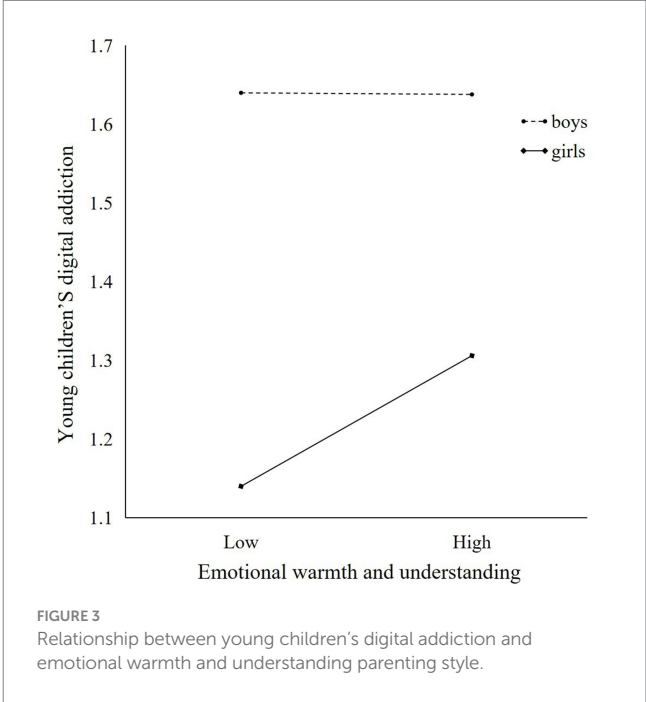
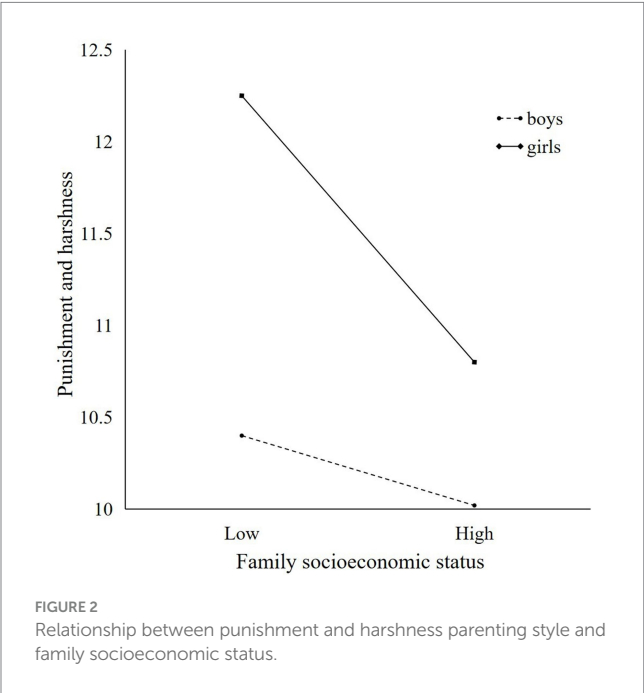
Variant	Punishment and harshness			
	$\beta$	SE	t	95%CI
Family socioeconomic status	−0.042***	0.011	−3.716	[−0.0641, −0.0198]
Young children’s gender	−0.377*	0.163	−2.316	[−0.697, −0.057]
Family socioeconomic status*Young children’s gender	0.033*	0.016	−2.04	[0.001, 0.064]
R <sup>2</sup>	0.039			
F	5.353**			

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

TABLE 5 Moderating effects test for the second half of the path.

Variant	Young children’s digital addiction			
	$\beta$	SE	t	95%CI
Emotional warmth and understanding	0.165	0.0041	4.012	[0.084, 0.246]
Young children’s gender	0.497**	0.179	−2.783	[0.146, 0.848]
Caring and understanding *Young children’s gender	−0.166**	0.06	−2.769	[−0.284, −0.048]
R <sup>2</sup>	0.039			
F	5.414**			

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .



been found through testing that there is no serious issue of common method bias in the data of this study, multiple ways of collecting data should be considered in future research to enhance the objectivity of conclusions. Second, this study only examined the relationship between family socioeconomic status, parenting styles, and young children’s digital addiction. However, other studies have shown that factors such as self-regulation, inhibitory control, parental digital addiction, parental mental health status, and parent–child relationships also affect young children’s digital addiction (Frost et al., 2019; Lam, 2020; Li et al., 2022; Toh et al., 2023). In addition, it has been noted that digital addiction can, in turn, affect parenting styles

(Dong et al., 2021). Therefore, in future studies, we can consider adding variables such as parental digital addiction, parental mental health status, and parent–child relationship and exploring bidirectional influence pathways to more accurately reflect the intrinsic mechanisms of the factors affecting young children’s digital addiction.

## 6 Conclusion

This study explored the factors influencing digital addiction in young children and the internal mechanisms between them and

found that family socioeconomic status was significantly negatively correlated with digital addiction in young children. Parenting styles (caring and understanding and punishment and severity) mediate the relationship between family socioeconomic status and young children's digital addiction. Early childhood gender moderates the relationship between family socioeconomic status, punishment, severity parenting styles, caring and understanding parenting styles, and early childhood digital addiction. This finding contributes to further understanding and knowledge of the relationship between family socioeconomic status, parenting styles, gender of young children, and young children's digital addictions, which is of great significance to the prevention of young children's digital addiction and the promotion of young children's healthy physical and mental development.

## Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical requirements. Requests to access these datasets should be directed to HL, [huanhuanli@xjnu.edu.cn](mailto:huanhuanli@xjnu.edu.cn).

## Ethics statement

The studies involving humans were approved by the study was approved by University Committee on Human Research Protection of Shanghai Normal University with approval number "2023035" in advance of data collection. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

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– review & editing. MS: Validation, Writing – review & editing. HD: Supervision, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Work context and drinking behavior in the French public service: a qualitative study

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**Introduction:** Alcohol use disorders (AUD) are a major public health problem. Among the working population, alcohol is the most frequently used psychoactive substance, as well as the most inappropriately used. Alcohol consumption reduces the worker's psychophysical integrity, leads to an increase in inappropriate behavior, accidents and injuries, and affects the safety and health of other workers. Thus, the workplace must play an essential role in prevention. Particularly in France, in the civil service, a specific professional sector made up of many professionals exposed to stress, the prevention of AUD must play an essential role. The objective of this study was to describe the framework of alcohol consumption in the French public service in order to understand the sources of alcohol consumption behaviors and to identify the prevention measures to be implemented, in order to reduce the risk of transition to an alcohol use disorder.

**Methods:** This descriptive qualitative study was based on focus groups. Sampling was purposive and data saturation was verified. Coding was "in vivo," descriptive and pattern-oriented. Analysis was inductive thematic, and the COREQ guidelines were followed.

**Results:** Firstly, the presence of alcohol in the workplace has been characterized by a before-and-after a prohibition law, and by the revelation of mechanisms for avoiding the ban. Then, the three main determinants for alcohol use disorders were: society, work and personal factors. Lastly, the prevention initiatives identified must be based on both collective and individual approaches. They must be encouraged by the hierarchy, include screening, accompaniment to care, and take into account both work in the workplace and work at home. The fight against work-related alcohol use disorders must be part of the corporate culture.

**Discussion:** Preventing alcohol-related disorders among civil servants will help fight the burden of non-communicable diseases.

## KEYWORDS

alcohol, addiction, prevention, workplace, behavior, health promotion, public service

# 1 Introduction

Alcohol use disorders (AUD) are a major public health problem responsible for 3 million deaths every year (1). The consumption of alcohol, a psychoactive substance with addictive and toxic properties, is associated with increased risk of non-communicable diseases, infectious diseases and injuries (1, 2). It accounts for 5.1% of the global burden of morbidity and mortality (1). Mortality associated with alcohol consumption is greater than for diseases such as HIV/AIDS, tuberculosis, and diabetes (1). Among people aged 20 to 39, 13.5% of deaths are attributable to alcohol (1). Despite a 5% reduction in the number of drinkers worldwide, alcohol is still consumed by more than half the population in three WHO regions – the Americas, Europe and Western Pacific (1). In Europe, alcohol is responsible for around 800 deaths a day [cancer (29%), cirrhosis of the liver (20%), cardiovascular disease (19%) and injuries (18%)]. Alcohol impacts not only consumers, but also their families and the community, through the degradation of personal and professional relationships, criminal behavior, decreased productivity and healthcare costs (2, 3). In France, alcohol-related disorders affect around 7% of adults (3.5 million people) and were responsible for 41,000 deaths in 2015 (4). Among people with alcohol use disorders (AUD), less than half have sought mental health care in the past 12 months and approximately 10% have received related medical care (5).

A relationship between alcohol and work has been underlined in several studies (6–8). In addition to the negative influence on productivity and performance at work, the consumption of alcohol is associated with increased unemployment, reduced employment, absenteeism and the risk of accidents (2, 6). Among the working population, alcohol is the most frequently used psychoactive substance, as well as the most inappropriately used (9). Out of every 10 employees, 1–3 can be considered at-risk drinkers needing attention (10, 11), i.e., whose drinking habits lead to increased risk of medical, domestic, social, legal, occupational and economic problems (10).

In Europe in 2019, 8.4% of the adult working-age population drank alcohol daily, 28.8% weekly, 22.8% monthly and 26.2% never or not at all in the last 12 months (12). In addition, alcohol consumption is responsible for serious problems in 5–20% of this working population (13). Alcohol consumption reduces the worker's psychophysical integrity, leads to an increase in inappropriate behavior, accidents and injuries, and affects the safety and health of other workers (2). To be more concise, in occupational sectors with a high risk of accidents (police forces, transport, etc.), workers who are under the effect of alcohol represent a danger to other workers (2, 14).

The workplace represents a living environment bringing together structural and social determinants of health (15) including alcohol consumption. Thus, the workplace influences workers via: (i) workplace alcohol beliefs (presence of alcohol, ease of drinking during breaks or work); (ii) descriptive norms (members of the worker's social network work under the influence of alcohol or while consuming alcohol); and (iii) injunctive norms (members of the worker's social network approve of working under the influence of alcohol or drinking while working) (16). The workplace can therefore be correlated with alcohol consumption and constitutes an opportunity to change risky behaviors according to personal motivation and individual abilities (17). Thus, the workplace must play an essential role in prevention (18).

In France, representations, beliefs and patterns of alcohol consumption make it difficult to implement effective prevention (19). Alcohol consumption represents a social and cultural norm from adolescence (20) and alcohol consumption is an element of daily social interactions (19). For example, wine in France or rum in the French West Indies, due to the history of their production and the tradition of their consumption, retains a positive image and leads to minimizing the damage that its consumption causes (21, 22). Furthermore, alcohol is consumed throughout the week unlike in certain other European countries where alcohol is mainly consumed on weekends (23). Additionally, as a large number of people work in the alcohol industry in France, the French government finds it difficult to completely discredit this drug (24). Unlike other countries like in the United Kingdom, for example, there are currently no plans to increase taxes on alcohol (19).

However, several occupational health and safety measures have been implemented to address the risks associated with alcohol consumption in the workplace. These measures are regulated under the Labor Code, which includes specific provisions such as articles R4228-20 (25) and R4228-21 (26) that limit the consumption of alcohol in professional settings. These regulations prohibit the presence of alcoholic beverage, except for wine, cider, beer or perry, in company restaurants or during special events like farewell evening or end-of-year party. Additionally, employers are encouraged to implement workplace health programs focusing on psychoactive substance use, including alcohol. Recently, initiatives such as “Dry January,” a public health campaign encouraging alcohol abstinence throughout the month of January (27), has been implemented in France since 2020 (28). As AUD represents a health burden, the French government has initiated political reflection on the use of psychoactive substances, including in the workplace (29, 30).

Despite these initiatives, comprehensive prevention strategies in the workplace, especially in the public service, remain underdeveloped. While some policies such as the National Health and Safety at Work Strategy (2016–2020) offer general guidelines on preventing alcohol-related harm, public service employees have historically lacked targeted prevention measures (31). The first national occupational health plan for the civil service, introduced in 2022, aims to address mental health and substance use disorders, encouraging the implementation of preventive measures such as employee assistance programs, stress management workshops, and stricter alcohol screening policies (32). However, the shortage of occupational health physicians and the lack of routine prevention programs tailored specifically for public service employees continue to pose significant barriers to effective prevention efforts.

Thus, the study of alcohol consumption in the specific socio-professional context of the French public service is interesting for several reasons. First, these public agents operate in a specific work context, with a job guarantee and relatively strong stability in their professional environment. Second, several socio-professional categories are represented (33). Third, several public service professions can be related to stress and psychological suffering, such as police officers (34), prison guards (35), or custom officers (36). Finally, this population works in a particular context with little prevention, since the first national occupational health plan for the civil service is recent (32) and there are few occupational health doctors in post.

The objective of this study was to describe the framework of alcohol consumption in the French public service in order to understand the sources of alcohol consumption behaviors and to identify the prevention measures to be implemented, in order to reduce the risk of transition to an alcohol use disorder.

## 2 Methods

This qualitative study followed the research protocol previously published (37) and was carried out in the public service workplace in France. The choice to conduct qualitative studies is based on the potential that this type of research can contribute to understanding a problem in various dimensions or to study phenomena not yet detected (38). It focused on a descriptive design based on the framework of alcohol use in the public service workplace.

This research was performed in accordance with the Consolidated criteria for reporting qualitative research (COREQ) guidelines (39) (Supplementary File 1).

### 2.1 Sample recruitment

The sampling method was purposive (40). Participants received an email containing the recruitment announcement, the study information sheet (with ethics approval references), and the consent document. Participants gave written informed consent for the focus groups to be recorded, full verbatim transcribed and the data being published anonymously.

### 2.2 Inclusion and exclusion criteria

Inclusion criteria were: (i) over 18 years old, (ii) active or retired civil servants, (iii) mutualist activists and, (iv) representatives of the Local Health Insurance Section (SLAM, Section Locale d'Assurance Maladie) responsible for implementing preventive actions in public administrations on behalf of the Union of Health Prevention for the Obligatory System (*Union prévention santé pour la Fonction publique, Urops*).

Exclusion criteria were: (i) lack of consent form; (ii) inability to participate in the focus group; and (iii) early departure during the focus group.

### 2.3 Interview guide

The interview guide was composed of three parts (37). The first part (nine open-ended questions) focused on the topic of alcohol and work to analyze the link between alcohol consumption and the professional social framework, typologies of alcohol consumption at workplace, perceived risks, and specificities in the public service. The second part (three open-ended questions) focused on the topic of alcohol and psychological suffering to explore the link between alcohol consumption and mental health, the mental state of civil servants and its impact on alcohol consumption. The third part (one question) focused on solutions.

The interview guide was subsequently presented to two SLAM representatives, out of focus groups, to confirm its relevance to the target audience. The same interview guide structure was used for both studies.

The form and content of the interview guide were validated by a PhD health professional, specialized in the addiction research field (CM). The same guide was used for all focus groups.

### 2.4 Data collection

Data collection was carried out through five focus groups held in France between November 2022 and January 2023.

To conduct the focus group, two men acted as animators. CM has a PhD and is a physician specializing in addictology. BD has a MSc and is a doctoral student in public health. BD was the main animator who steered the discussions according to the interview guide, and CM acted as an observer who ensured that the research ran as planned, and could intervene if necessary. These two researchers were trained in qualitative studies and had no prior relationship with participants. Participants were informed that the goal of this research was to determine the preventive measures against AUD.

The framework in which the collection took place was explained to each group of participants, ensuring their freedom of speech, data protection, anonymisation, and policy of non-reporting to their hierarchy.

The focus group took place in meeting rooms outside the participants' place of work and in the absence of non-participants. Each participant realized one focus group interview which was recorded without taking notes. Discussions were transcribed in verbatim form by a qualified researcher. The moderators checked the accuracy of the transcripts. Feedback regarding focus groups was asked to the participants.

### 2.5 Qualitative data analysis

The five steps methodology framework proposed by Braun and Clarke to conduct the thematic analysis were applied (41). Nvivo 14 software (QSR International) was used to perform the analyses.

- 1 Familiarization with the data. This phase involves reading and rereading the data, to become immersed and intimately familiar with its content (BD, PhDc; FC, PhD and GR, PhDc).
- 2 Generating initial Codes: this phase involves generating succinct codes that identify important features of the data that might be relevant to answering our research question. It involves coding the entire dataset, and after that, collating all the codes and all relevant data extracts, together for later stages of analysis (BD, PhDc; FC, PhD and GR, PhDc).
- 3 Searching for themes: the collection of codes was worked on by the three researchers (BD, PhDc; FC, PhD and GR, PhDc) to validate a comprehensive interpretation and a grouping of code elements into themes.
- 4 The resulting themes were then compared and discussed between the researchers.
- 5 Finally, a more refined coding was used for each part of the verbatim used to illustrate the themes.

## 2.6 Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Research Ethics Committee of the University of Lyon (n°2022-09-15-004 on 18 October 2022). All participants were given written and oral information about the study and gave informed consent to participate.

## 3 Results

### 3.1 Characteristics of focus group participants

Among the 75 SLAM representatives who received the email presenting the study, 30 accepted to participate (40%) and were divided into five focus groups. The participants represented a wide variety of ages, seniority and experience as described in Table 1. Group size ranged from four to eight with an average of six participants. Sixty percent of participants ( $n=18$ ) were male, 53.33% ( $n=16$ ) were retired and 70.00% were over 60 years old. Regarding the public service categories, 30.00% ( $n=9$ ) was from

category A (conceptual, managerial and supervisory grades and positions, as well as teaching positions), 40.00% ( $n=12$ ) from category B (middle management, application and editorial positions) and 30.00% ( $n=9$ ) was from category C (executive positions). In terms of length of service in the public sector, 93.33% ( $n=28$ ) had more than 10 years' seniority.

Debriefing session followed each focus group discussion. All participants were enthusiastic about speaking out on the subject of alcohol and its uses in their professional environment.

The average duration of each focus group was 1 h46 (min 1 h35–max 2 h03). They were grouped by topic. A total of 48 topics were discussed in the first focus group. Seven other topics were discussed in the second focus group. Then, again, seven other topics were discussed in the third focus group. The fourth and fifth focus groups did not reveal any additional topics, confirming data saturation and the analysis reliability. Thus, 62 topics were covered.

### 3.2 Major themes and sub themes emerging

The qualitative analysis revealed three main themes, each associated with three sub-themes. Table 2 provides an overview of the categorization:

- i The presence of alcohol consumption in the public service
- ii The sources of alcohol consumption behaviors
- iii The appropriate prevention actions

#### 3.2.1 The presence of alcohol consumption in the public service

The first content theme (illustrated by 459 verbatims) to emerge was the presence of alcohol consumption in the public service. Three sub-themes were developed (Table 2): (i) in the past, excess of alcohol, (ii) nowadays, the ban in the workplace and its consequences, (iii) deviations from today's ban.

- In the past, excess of alcohol:

In the past, alcohol consumption at work in the public service was habitual, frequent and high. The opportunities for drinking were many and varied. The alcohol consumption was considered as necessary:

“Every day, another reason to drink something” ( $n^{\circ}12$ ).

Access to alcohol in the workplace was easy. The possession of alcohol by civil servants in their offices was commonplace and was facilitated by the structure itself:

“I’ve known departments where there were people who had their drawer, and their bottle right in the drawer, and from time to time, there you go” ( $n^{\circ}42$ ).

Alcohol-related disorders could affect everyone, and all socio-professional categories. It is in this sense that it has been observed that social position is waning in the face of alcohol. People in positions of authority (chiefs, directors) could also be alcoholized at work:

“Managers like any of us and even outside the public service are people, so they have problems and have different reactions, some like

TABLE 1 Characteristics of the 30 participants.

Variables	N (%)
Gender	
Man	18 (60.00)
Woman	12 (40.00)
Profession status	
Active	16 (53.33)
Retired	14 (46.67)
Age groups	
30–44 years	2 (6.67)
45–59 years	7 (23.22)
≥ 60 years	21 (70.00)
Public service category <sup>1</sup>	
A	9 (30.00)
B	12 (40.00)
C	9 (30.00)
Public service seniority	
5–10 years	2 (6.67)
> 10 years	28 (93.33)
Seniority as SLAM representative	
< 5 years	14 (46.67)
5–10 years	9 (30.00)
> 10 years	7 (23.33)

<sup>1</sup>The French public service distinguishes three main categories of workers: Category A covers hierarchically superior conceptual, managerial and supervisory grades and positions, as well as teaching positions, Category B concerns middle management, application and editorial positions, Category C includes executive positions. The conditions of access to these categories vary according to the level of qualification and graduation. The basic remuneration is different between these categories. There is also the category of “contractual” or “non-permanent”.

TABLE 2 Overview of major themes and subthemes associated.

Major theme	Presence of alcohol consumption in the public service	Sources of alcohol consumption behaviors in the public service	Appropriate prevention actions
Sub theme	<ul style="list-style-type: none"><li>• In the past, excess of alcohol</li><li>• Nowadays, the ban in the workplace and its consequences</li><li>• Deviations from today's ban</li></ul>	<ul style="list-style-type: none"><li>• In society</li><li>• The work</li><li>• The personal factors</li></ul>	<ul style="list-style-type: none"><li>• Collectives approaches</li><li>• Individual approaches</li><li>• Doing nothing</li></ul>

<p><i>the rest of the population being the use of alcohol as an escape or as a way of forgetting</i> (n°26).</p> <p>In addition, alcohol could be perceived as a symbol of performance or shared culture:</p> <p><i>“we had to have the strength, the ability, to overtake those who could overtake us, by the product itself [implied alcohol], and show that we were able to endure”</i> (n°51).</p> <p>Furthermore, alcohol was associated with moments of conviviality, and seen as a facilitator of working relationships:</p> <p><i>“Alcohol was the aperitif that allowed us to better discuss”</i> (n°53).</p> <p>It seems that professional traditions could have been conducive to unlimited alcohol consumption.</p> <p><i>“There are traditions every day. In the Army, there are lots of traditions. Before I came [here to the focus group], there was Sainte Barbe, there was Saint Eloi, there’s always... and now I’m back on Wednesday, Friday there will be the Colonial breakfast”</i> (n°24).</p> <p>Accident associated with alcohol consumption was not considered by the professional structure:</p> <p><i>“There’s one thing that’s been really important. It’s the responsibility of agents, particularly in terms of driving. That is to say, in the old days, before the 85/90s perhaps, a civil servant who had a serious car accident, etc., due to alcoholism, posed no problem for the administration. I remember some memos from around 2000, which said: “Now, agents are responsible, and all the more so if it’s a company vehicle”</i> (n°51).</p> <ul style="list-style-type: none"><li>• Nowadays, the ban in the workplace and its consequences:</li></ul> <p>Nowadays, it appears that the reduction in alcohol consumption in the workplace is due to the introduction of a law that has led to material and practical changes, such as alcohol-free social events or even their disappearance.</p> <p><i>“And now, it is true that for a few years, for quite a few years now, with the regulations, it is true that there are almost, there are no more convivial drink moments”</i> (n°42).</p> <p>These changes can have psychosocial impacts and consequences on mentalities and behaviors:</p>	<p><i>“And this frustration [of not having alcohol at work, and going somewhere else] bothers me”</i> (n°27).</p> <p>We can also notice that alcohol has become a taboo subject:</p> <p><i>“No, but what I meant was that alcohol at work is not talked about”</i> (n°24).</p> <p>Indeed, compliance with the ban on alcohol in the workplace is verified, offices can be inspected, and breaches can be sanctioned:</p> <p><i>“there’s the inspector who comes in, checking the offices to make sure we do not have cupboards with bottles or things like that”</i> (n°55).</p> <p>The prevalence of alcohol consumption and the agents concerned by alcohol use disorders in the workplace may appear to be declining:</p> <p><i>“So over the last few years, it’s calmed down a little bit everywhere”</i> (n°12).</p> <p>This decline in prevalence seems to be accompanied by a reduction in social pressure to drink alcohol:</p> <p><i>“Now, it’s not heard anymore. If you do not feel like drinking alcohol, even cider, you drink orange juice, and that’s fine. There’s no longer that stigma”</i> (n°42).</p> <p>However, the ban on alcohol in the workplace can be circumvented by implementing avoidance strategies. People drink outside the workplace, for example, lunch outside is an opportunity to consume alcohol:</p> <p><i>“And the alternative, cheating, that’s done [alcohol consumption] elsewhere”</i> (n°26).</p> <ul style="list-style-type: none"><li>• Deviations from today’s ban</li></ul> <p>However, there seems to be a persistent presence of alcohol in the workplace that can indirect or direct:</p> <p><i>“People who go out for lunch, who have a punch [drink with rum], who have wine, who have beer off the work site, but who come back with alcohol in their blood, they are drunk”</i> (n°24).</p> <p>The ban can be differentially interpreted and the presence of alcohol in the workplace remains tolerated:</p> <p><i>“it’s just... then everyone interprets it the way they want”</i> (n°24).</p>
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It turns out that cases of drunkenness persist in the workplace:

*"Now, we have both, we can have... we can experience two situations: people who are addicted to alcohol, and then others who are hyper athletes and rarely have a drink" (n°14).*

The relevance of alcohol prohibition in the workplace is questioned in cases where work is not affected:

*"as long as it does not affect his work, if it does not affect the department's activity, it's hard to see why he should be sanctioned" (n°34).*

Also, there may be a shift to private space, with the development of teleworking, work from home:

*"Now, that makes me wonder. It raises the issue of working from home and alcohol. Because the law regulates alcohol at work, but what is it when you work from home?" (n°44).*

### 3.2.2 The sources of alcohol consumption behaviors in the public service

The second content theme (illustrated by 239 verbatims) to emerge was the sources of alcohol consumption behaviors in the public service. Three different content codes were developed: (i) in society, (ii) the work, (iii) personal factors (Table 2).

- In society:

Alcohol consumption is omnipresent, and can be found in all sectors of professional activity and at all socio-professional levels. And the disorders that can be associated with it have multiple origins.

*"There are people who have major problems with alcohol in all the... I do not think it's specific to one public administration or another [...] The origin can be multiple" (n°35).*

Alcohol is a cultural product, a form of heritage, liable to bring pride:

*"Everyone wanted me to bring back X [name of a brand of local alcohol], even though it is a product that is everywhere. That's the proof that it's cultural" (n°56).*

Alcohol can be seen as an element of conviviality and sharing, of cohesion and socialization:

*"it was alcohol socialization. In other words, we socialize through alcohol" (n°56).*

But these social relationships organized around alcohol can lead to higher levels of consumption that can initiate the addiction phenomenon.

*"But then, when we are several? well, there's someone who buys his round of booze, the second, the third and then it's a chain after that" (n°31).*

And then there are specific social circumstances that can encourage alcohol consumption:

*"There was Covid too, we must not forget that. It's not just telecommuting, it's Covid too, which has generated additional stress. In fact, as we have seen, mental health problems have increased significantly" (n°53).*

- The work:

Work can be seen as an emotional destabilizer, and the nature of the work can be a determining factor in alcohol consumption:

*"But I know some too, it's still... it's work what, it's work that makes them drink" (n°13).*

Pressure to perform professional tasks, the pace of work and difficult working conditions are seen as factors that can encourage alcohol consumption. Work can lead to psychological fatigue of employees, a feeling of ill-being or even a burn-out:

*"But the guy, because he has an ill-being at work, drinks because of it" (n°13).*

Working conditions can also have an impact on ancillary sources of emotional stability, such as family separation for professional reasons, as in the police force for example:

*"the difficult context of [professional] travels and the social situation that is not easy for colleagues to live with, leads to decompression by alcohol" (n°14).*

But also, absence of work can be a cause of alcohol consumption. For civil servants, retirement is the main cause of absence of work. And this state is seen as a possible source of alcohol consumption:

*"About retirement, I knew an officer who worked, he was a police officer, I'm not going to name him. And he came in every morning - I met him at the end of his career - and he came with fear in his stomach [...], then he started drinking [in retirement] and in fact, he ended up with... he committed suicide [...] All his frustrations, well, they came out" (n°33).*

Periods of confinement during the COVID health crisis or the loss of a job are also situations that can lead to increased alcohol consumption:

*"Because someone who does not have a reason to keep busy, well that's catastrophic [regarding alcohol consumption]" (n°34).*

- Personal factors:

Two endogenous characteristics are mainly invoked in relation to alcohol consumption and use disorders. Firstly, individual genetic characteristics:

*"Sometimes, there's already something genetic, and then that triggers it as well. But in my opinion, there is something. Well, I'm not a scientist, but I think that genetics... from generation to generation, sometimes it comes out" (n°12).*

Second, individual psychic characteristics, related to a weakness of character or personality:

*"I find that we encourage weak people to drink [social pressure to drink alcohol during social occasions at work], rather than protecting them" (n°31).*

Early exposure to alcohol, or even education in alcohol consumption, is cited as a source of personal factors that may explain the transition to a substance use disorder:

*"since we were little, we had this pattern of alcohol. So afterwards, you take your punch..." (n°23).*

Vulnerability factors in personal life, family problems and financial problems can also be a source of behavior leading to drinking disorders:

*"And many civil servants, when there are personal worries, turn to alcohol" (n°33).*

Alcohol can be seen as a marker of fragility in social integration:

*"And we can see, without it being pejorative, but the 'social cases' [people in precarious situations], without it being pejorative, I repeat, all the people who have really had a lot of problems with alcohol in particular" (n°56).*

Lastly, it results that alcohol can then be considered as a help in the face of ill-being, stress, pressure, annoyance, fatigue, worries, mental or physical pain:

*"we could say that workloads are changing, and that this is causing more stress, perhaps for agents, and that they are trying to find reasons, ultimately, to decompensate by consuming alcohol" (n°53).*

*"mental health problems have increased significantly because of Covid, and that may also explain the increase in consumption" (n°53).*

*"Also, when you are very tired, a little shot of alcohol, it... (gesture mimicking tonus) A little one" (n°58).*

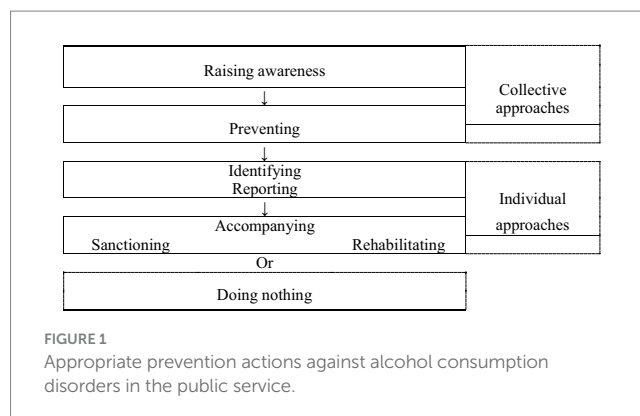
*"Some people think that by drinking alcohol, it can at least relieve some pains" (n°25).*

### 3.2.3 The appropriate prevention actions

The third content theme (illustrated by 708 verbatims) to emerge was about prevention actions to reduce the risk of transition to an alcohol use disorder. Three different content codes were developed: (i) collective approaches, (ii) individual approaches, or (iii) doing nothing (Figure 1).

#### • Collective approaches

Raising awareness of AUD must be done in the context of addictions in general in order to attract as many people as possible because this topic is different from others dealing with health risk factors:



*"because if we'd only done alcohol addiction, I cannot even imagine, we'd have had even fewer people [...] Do a prevention campaign just by saying 'addictions,' no one comes" (n°42).*

Some participants felt that prevention actions should be voluntary and open to everyone:

*"After that, it is true that the population we touched with the Addictoquiz (name of a serious game), it was not necessarily people who were addicted to something. Everyone signs up, no matter" (n°55).*

However, other participants indicated that it is necessary to gain access to people and that, therefore the obligation to participate in actions may have advantages:

*"They did three conferences, but you had an obligation to go [...] And in the mountains, it was the brigade director who forced the officers to go" (n°56).*

Preventive actions must include education, communication with clear messages, be entertaining and be long-term:

*"Yes [education], it's a minimum" (n°37).*

The alcohol use topic should be included in more general actions such as the promotion of well-being or health and be adapted to the individual:

*"It should perhaps be integrated [the alcohol topic] into a well-being action [...]. For example, if someone like me likes sport, we could say to them ~ 'listen, you like sport, but alcohol is not good for your performance'" (n°44).*

These preventive measures must also take the form of measures that can use prohibitions and/or obligations to standardize behavior:

*"It's a bit the same. If there was a breathalyzer at the entrance to buildings, and people had to blow out their breath systematically, just like badging. I think there would be some grumbling at first, but after that it would quickly become standard practice" (n°44).*

But also through participative actions, because the motivation to commit to changes in health behaviors can be strengthened by collective stimulation.

*"There is a group effect [in months without alcohol]. People need that" (n°43).*

The preventive approach must be part of a clear political structure with committed directions. And to encourage management commitment, financial remuneration is mentioned:

*"there would already be a common policy on the apprehension of alcohol in all departments, throughout the public service" (n°37).*

However, prevention requires human, financial and technical resources:

*"I think it's the resources. You need the resources" (n°33).*

- Individual approaches

The importance of the identification of persons suffering from AUD was underlined. For some, AUD are easily detectable:

*"everyone can see it" (n°13).*

But these disorders can also be seen in the application to the professional task and the quality of the work done, or in morale and the quality of relationships:

*"Because the person who is going to become dependent is going to be worse and worse, quality at work, quality of family life too" (n°11).*

Identification should take place during interviews carried out as part of a professional activity, such as a medical examination:

*"I think it's during the professional interview [where alcohol can be discussed]" (n°56).*

Targeted actions such as the use of breathalyzers could be used to identify people with AUD. However, the problem of accreditation of such checks, acceptability by civil servants or syndicats, the risk of positive tests and the cost is put forward.

*"The idea is very good [a car that will not start if the driver is drunk], but I'm going to have to worry about the means of doing it" (n°37).*

Participants underlined the importance of reporting cases of AUD but this is countered by the notions of denunciation and responsibility:

*"that's it, you have to go and denounce" (no. 34).*

*"It's not denunciation, it's support" (n°32).*

Reporting also means delegating responsibility:

*"I report it to exonerate myself" (n°37).*

However, it appears that it is not easy to report a problem related to alcohol consumption, the error is possible, and it can sometimes be seen as a private matter:

*"So, I go there, I go to see my director, we knew each other well, she knew the guy very well and when I told her: 'oh there?! No, no, we must say nothing, we must do nothing, we will not bother him' — O right? What can I do after that?" (n°33).*

The participants mentioned the need of accompanying people identified as having an AUD and thus, the need of referral person:

*"that's why it's important to have someone within the... within the structure who is... trained for it" (n°14).*

The participants pointed out that sometimes resources (occupational physician, social services) exist but with limited power to act:

*"but the social worker, even if she knows of a case, well she cannot say anything, she does not have the right" (n°13).*

In some cases, the civil servants responsible for implementing health and safety rules are also prevention assistants or advisors, like

*"Sentinels" and "ACMO" (Agent Chargé de la Mise en Œuvre des règles d'hygiène et de sécurité, Health and Safety Officer) (n°44).*

Empathy in the workplace and solidarity are mentioned:

*"You have a colleague next to you who is obviously drunk, so you do what a human being would do, i.e., you suggest that they do not take their car" (n°35).*

Sanctions were not perceived as a solution, managers' views on the matter changed, and individual's rehabilitation seems to be sought through care:

*"And he [the colleague sanctioned for alcohol] is going to feel diminished [...] and we will not necessarily solve the problem of alcohol" (n°14).*

*But "in any case, these guys, if you put them in a treatment center because they have done something stupid, because they drink, and if you do not have any real psychological follow-up, it's useless" (n°56).*

- Doing nothing

But sometimes, nothing is done for the employee with alcohol consumption problems:

*"because that's what we were talking about too, people who feel bad. I think I've got three friends like that, they had problems at work, they did not get any help" (n°27).*

*"I do not feel that the space for intervention in public administration has been codified in such a way as to make it easy to correct problems" (n°57).*

*"They tell me: 'yes, we know, but we turn a blind eye' [...] I know for a fact that there will not be anything [...] The follow-up is a mess, it's disjointed" (n°37).*

*"because our leaders, all they want is for them to have numbers that are in their ways [...] I'm going to be even tougher, but our managers aren't interested. Our managers aren't interested" (n°24).*

*"But they avoid the problem" (n°12).*

It is however reminded that:

*"Hiding does not help, it only makes it worse and it's not doing anyone any favors" (n°43).*

## 4 Discussion

This study describes the framework of alcohol consumption in the French public service in order to understand the sources of alcohol consumption behaviors and to identify the prevention measures to be implemented, in order to reduce the risk of transition to an alcohol use disorder.

First, regarding alcohol consumption in the workplace, the study showed that it had been significantly reduced by the introduction of a law prohibiting alcohol consumption in the workplace even if the ban is not always respected. Indeed in 2008, article R4228-21 of the French Labor Code prohibited the entry or presence of intoxicated persons in the workplace (26). In 2014, article R4228-20 of the Labor Code prohibits alcoholic beverages other than wine, beer, cider and perry in the workplace [Citation]. These alcoholic beverages may be served in the company restaurant or at special events (e.g., farewell parties, end-of-year celebrations, etc.). Any company wishing to prohibit the presence of alcohol in the workplace can do so via its internal regulations. In 2022, article L4622-2 reinforces the role of the employer, who must organize the provision of services in such a way as to avoid any negative impact on workers' health (42). The employer must prevent the consumption of alcohol in the workplace. However, the Labor Code only authorizes systematic screening for alcohol consumption among employees performing dangerous tasks. Thus, France, like 18 European union member states (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic...), has adopted an approach where laws regulate the phenomenon and impose restrictions on alcohol consumption (2). Four other countries (Ireland, Luxembourg, Portugal and Sweden) have delegated the power to control alcohol consumption to the employer, while others (Greece, Malta, the Netherlands and Romania) have no specific rules.

Second, despite the fact that the law restricts alcohol consumption in the workplace, this study showed that alcohol is still present in the workplace in all sectors of professional activity and at all socio-professional levels. Alcohol may be associated not only with the workplace, but also with individual factors (genetic, psychological...), educational factors, stress factors (personal difficulties, financial problems, family problems...) and cultural factors. Thus, this study fits into the socio-ecological framework explaining influences on alcohol consumption described by Sudhinaraset et al. (43). According to this model, individual factors influencing alcohol consumption are linked to the microsystem (family, work and school environments), which in turn are linked to the wider community (community, cultural, gender norms...).

Macroeconomic factors, such as exposure to advertising, can influence the attitudes and norms of the family and peer network, which ultimately influence individual attitudes and behavior. Although, alcohol has been shown to be a risk factor for many chronic diseases and conditions (44), this study has demonstrated, as previously described in other contexts (8, 45, 46) that in the workplace, alcohol remains considered as an element of conviviality and sharing, of cohesion and socialization. The main problem is that the social anchoring of alcohol is one step of the addiction phenomenon. In addition, alcohol is described as a source of relief that can help to fight against the stress that represents the work. Some working conditions (shift or night work, long hours, remote working, physical danger and interface with a demanding or aggressive public, etc.) are associated with stress and alcohol consumption (47). In France, the state public service that represents 44% of public-sector employment with 2,52 million of agents in 2021, which comprises almost 10% of police officers, customs officers and prison guards (48), has the majority of its workers in occupations associated with stress. They are also more exposed to family instability (separation, divorce...) due to their profession and working conditions (working hours, transfers...). Alcohol is thus perceived as a help. This maladaptive coping mechanism of alcohol consumption was analyzed in several studies (49–51). Furthermore, in this study, participants pointed out that certain public service professions (military...) could be retired quite young (as early as 52 years) and that this change, this reduction in activity could be associated with an increase in alcohol consumption. As a result, many civil servants appear to be at risk of alcohol-related disorders, and preventive measures are essential.

Third, the workplace appears as an opportunity for implementing prevention programs because the main part of adults are employed, full-time employees spend an important proportion of their time at the workplace and work plays an important role in most people's lives (52–54). A key element of preventive programs is the identification of persons suffering from disorders. For this, the managers could use interviews carried out as part of a professional activity, but they need to be trained (53). Medical physicians could also be further educated in the detection of AUD. Each worker can also play a role in detection, but while some equate this with solidarity, others equate it with denunciation. In addition, other detection options, such as alcohol testing, have been proposed. However, current French legislation does not allow this, except for certain high-risk professions (2). After this step of detection, it is important to accompany the worker suffering from these disorders. Consideration of alcohol screening and brief interventions by the Capability, Opportunity, Motivation and Behaviour model (COM-B) (17) has shown several advantages (55) and may be needed for successfully implementing preventive actions and intervention functions to strengthen health behaviors 9/24/24 9:54:00 PM. Moreover, prevention campaigns can be adapted to the different levels of alcohol health literacy (56, 57) of employees and employers, and monitored by an alcohol use disorders test (58). However, significant improvement in employees' knowledge of alcohol does not necessarily translate into significant effects on alcohol consumption (59); maybe due to lack of risk perception (60) or denial of problem drinking (61). Thus, it would be important to regularly maintain motivation for appropriate health behavior over the long term. Work-related AUD

are a broader prevention target with the development of telework from home. In 2022, 23% of the state public servants teleworked at least one day a week (62). The implementation of participative collective actions, which can be carried out at any time or any place, such as “Dry January” (63, 64), can facilitate changes in health behavior. The support of people suffering from AUD in the professional context must also be able to go toward care, without stigma, and in the benevolence of professional staff. Moreover, managing this burden must involve a cultural approach: due to a link between the use of psychoactive substances and ill-being, prevention of AUD must also involve the prevention of psychological suffering linked to the professional task. This can particularly apply to the public service, a specific work context which is at the origin of the collective identity, based on solidarity. Indeed, with the development of new public management, essentially based on a budgetary pragmatism and austerity (65), some structural injustices at work were observed (66) and a lesser social consideration of this sector is sometimes denounced (67). In this study, alcohol is strongly associated with celebration, sharing, and socialization. Thus, the ban on alcohol in this workplace seems to be accompanied by a decline in professional conviviality and cooperation. This seems to reinforce the perception of a cultural shift toward an erosion of the sharing of values, which are the source of the signification of the activity and the motivation of the engagement (68). Interventions that involve in-depth cultural adaptation may be more likely to be effective (69). Health prevention must therefore become part of the corporate culture, with the commitment of the top management (53), and must be adapted to the specificities of the workplace (52). This highlights the necessity of designing prevention measures that are not only tailored to the workplace but are also planned for the medium and long term, ensuring sustained effectiveness. This is a major challenge, because preventing the health of civil servants involves issues that range from individual well-being to the general public interest.

This study has several limitations. First, the selection of participants may have led to a “confirmation bias,” as people tend to report information that is consistent with their beliefs and to interpret the information they do have in favor of their preferred hypotheses (70). Second, participants were mostly from the state public service. They did not cover the entire French public service: the national education sector and the hospital sector, for example, were not present. However, they covered a wide variety of professions. Finally, because of the qualitative approach used in this study, it is not possible to generalize these findings to a broader population. However, the sample size is compatible with reliable qualitative analysis (71).

## 5 Conclusion

Overall, this study allowed us to explore the perceptions and representations of representatives of the Local Health Insurance Section responsible for implementing preventive actions in public administrations on behalf of the Union of Health Prevention for the Obligatory System, about alcohol consumption in the French public service. Although they consider that the introduction of legislation regulating alcohol consumption in the workplace has been associated with a reduction in consumption in France even if alcohol is still

present in the public service. Thus, preventive measures to combat AUD need to be implemented. These actions must be part of general health initiatives, and should aim to prevent consumption, identify those suffering from alcohol or other use disorders and provide support.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by the Research Ethics Committee of the University of Lyon. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

BS: Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation, Conceptualization. FC: Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. GR: Writing – review & editing, Formal analysis, Data curation. ChM: Writing – review & editing, Investigation, Conceptualization. CaM: Writing – review & editing, Investigation, Conceptualization. GM: Writing – review & editing. EV: Writing – review & editing, Writing – original draft, Methodology, Data curation, Conceptualization. CD: Writing – review & editing, Project administration, Conceptualization.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2024.1432324/full#supplementary-material>

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# How stress influences short video addiction in China: an extended compensatory internet use model

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**Introduction:** The rise of short video applications has become a defining feature of modern digital media consumption, drawing increasing attention from researchers due to issues related to short video addiction. While earlier studies have examined the perceived stress as a cause of short video addiction, there is limited understanding of the potential mechanisms underlying the relationship between these two variables. Building on compensatory Internet use (CIU) theory, this study introduces an extended model (E-CIU) to explore how stress, compensatory motivations (i.e., social interaction and relaxing entertainment), and affective responses (i.e., immersion and attitude) relate to short video addiction. This study also examines differences between the age groups.

**Methods:** Data from 319 Chinese short video users were tested applying partial least squares structural equation modeling (PLS-SEM) and PLS-SEM multigroup analysis.

**Results:** Findings indicate that stress, immersion, and attitude each contribute positively to short video addiction. Stress is linked to both social interaction and relaxing entertainment. While both factors positively affect attitude toward short videos, only relaxing entertainment enhances immersion. Results confirmed the perceived stress indirectly influences short video addiction through a serial mediating pathway comprising motivations and affective responses. Moreover, the study shows that perceived stress influences social interaction, relaxing entertainment influences attitude and immersion, and social interaction influences immersion across all age groups. The study further identified variations in how different groups experience the relationship between stress and addiction, stress and relaxation, attitude and addiction, and immersion and addiction.

**Discussion:** Consequently, this study enriches the understanding of the E-CIU as a new theoretical model of short video addiction. These insights offer practical recommendations for short video applications to address user engagement and addiction more effectively.

## KEYWORDS

short video addiction, compensatory internet use (CIU) theory, PLS-SEM, immersion, motives, attitude, perceived stress

## 1 Introduction

In recent years, individuals have increasingly faced stress from various aspects of modern life, including personal, professional, academic, familial, and social domains. Stress is generally understood as a state where external demands exceed internal resources, triggering the neuroendocrine stress response, which can lead to anxiety, depression, and

other negative emotional states (Lazarus, 1993). To manage these pressures, individuals often turn to different coping strategies. Online media has become a popular and effective method for stress relief, encompassing video games, social network sites, and general internet (Cannito et al., 2022; Huang et al., 2021; Qin et al., 2022; Velezmoro et al., 2010; Zhang et al., 2019). Short videos, with their characteristics of mobility, interactivity, easy access, and diverse content, greatly satisfy the multiple needs of Chinese netizens and rapidly develop into a “new favorite” of online media for daily usage (Jiang and Yoo, 2024). The 53rd China Internet Network Information Center Statistical Report on Internet Development reveals that as of December 2023, there are 1,053 billion short video users in China, constituting 96.4% of the total number of internet users (China Internet Network Information Center, 2023). Moreover, the China Network Audio-Visual Development Research Report discloses that people spend approximately 151 min daily watching short videos (National Radio and Television Administration, 2024). In light of such excessive use, issues of short video addiction have surfaced (Zhang et al., 2019). Short video addiction can be described as “a condition in which individuals invest considerable time using short video apps, despite encountering adverse outcomes” (Qu et al., 2024, p.1), which precipitates a plethora of negative consequences for users, including increased depressive symptoms, reduced subjective wellbeing, and deteriorated parent–child relationships (Mu et al., 2022; Jiang and Yoo, 2024; Qu et al., 2024).

Existing research indicates a significant positive correlation between stress and short video addiction (Mu et al., 2022; Huang et al., 2021; Liu et al., 2021; Zhang et al., 2019). This addiction is seen both as a compulsive behavior resulting from loss of self-control (Chak and Leung, 2004; Kim et al., 2017) and a conscious self-compensation strategy to manage negative emotions (Kardefelt-Winther, 2014a; Shen and Williams, 2011). The former provides an approach for researching the relationship between self-control and addiction, while the latter allows an empirical examination of how negative emotion influences addictive behavior within a compensatory approach. This paper would prefer the latter approach. Meanwhile, researchers suggest that the stress-short video addiction link can be explained by metacognition and self-compensatory motives (i.e., escape and coping motives) (Huang et al., 2021; Liu et al., 2021; Sun et al., 2024). However, prior studies have not taken into account the associations of affective responses and their mediating roles between stress and short video addiction. The answer to this key question would help us further understand the mechanism underlying the influence of stress on short video addiction. Furthermore, individuals across different age groups exhibit varying cognitions and responses to stress and short video addiction. On the one hand, these differences arise from the distinct pressures faced by each age group, as well as their varying levels of pressure perception (Birditt et al., 2021). On the other hand, speculation of “addiction varies with age” by Lu et al. (2022) suggesting that the degree of addiction also differs among individuals at various life stages. Previous studies neglected the potential influence of age as a moderating role. Specifically, we would explore whether there were differences in the relationship between stress and short video addiction in age groups (i.e., adolescents, emerging adulthood, adulthood).

The compensatory internet use (CIU) theory provides a suitable framework for addressing the mechanisms between stress and addiction as a core research question. This model has gained wide acceptance in the addiction field (e.g., Gong et al., 2021; Stanković et al., 2021; Kardefelt-Winther, 2014a, b). Based on the conventional

CIU model, this study proposes an extended compensatory internet use model (E-CIU), introducing the key variables of affective responses (i.e., attitude and immersion) and further exploring their relationship with perceived stress, compensatory motivations, and short video addictive behavior. More specifically, the current research aims to address two main questions within the E-CIU framework: (1) examining the effects of stress, compensatory motivations and affective responses on short video addiction; (2) exploring how the age groups moderate the relationship between these variables above.

## 2 Theoretical background

### 2.1 The compensatory internet use theory (CIU)

Compensatory internet use theory focuses on explaining why individuals become addicted to the internet (Kardefelt-Winther, 2014a). The theory suggests that individuals may compensate in the online world for unmet needs in real life. When people's negative emotions cannot be effectively vented in real life, individuals may use the internet as an escape or coping strategy to reduce the impact of negative emotions, which may lead to internet addiction in the long run (Kardefelt-Winther, 2014a). According to the compensatory internet use theory, the degree of an individual's short video addiction is influenced by negative emotional states, particularly stress perception (Liu et al., 2021). Individuals could experience various forms of stress in daily life, including academic pressure, employment challenges, work-related stress, and familial obligations. To cope with these pressures, individuals tend to relieve themselves by using short video applications, which leads to excessive usage of short videos or short video addiction.

The compensatory internet use theory also holds the importance of self-compensatory motivations, and highlights the variations in different contexts. For instance, the compensatory purposes of video games include achievement, social interaction, and immersion (Kardefelt-Winther, 2014b), while the compensatory purposes of social network service include information search and entertainment (Luchman et al., 2014), as well as maladaptive mood regulation (LaRose et al., 2003; Caplan, 2005). Short video applications such as TikTok, Kwai, and Bilibili allow users to upload short videos of 10 of seconds or minutes from their daily lives, such as cooking, singing, dancing, traveling, and health, for other users to watch (Zhang et al., 2019). These UGC contents are interesting and have addictive hedonic value (Tian et al., 2023; Cui et al., 2022; Zhang et al., 2019). These applications also provide functions such as “like,” “comment,” or “forward” to meet users' social needs (Da-yong and Zhan, 2022). Therefore, this study classifies the compensatory motives of users who choose to use short video applications as relaxing entertainment and social interaction, and takes them as mediating factors to analyze the mechanisms between stress and short video addiction.

### 2.2 An extended model of CIU theory (E-CIU)

The compensatory internet use theory reveals the mediating role of compensatory motivations (e.g., social interaction and relaxing

entertainment) in the relationship between negative emotions (i.e., stress) and internet addiction behaviors (Kardefelt-Winther, 2014a, b), but overlooks the possibility of other factors related to affective responses. Prior studies have found that motives positively predict affective responses (Karagiannidis et al., 2015), suggesting that once users perceive the favorable value of using mobile service, they respond with certain positive experiences. For instance, Pang (2021) demonstrated that individuals' positive attitude and gratification toward social media usage was impacted by hedonic and utilitarian values. Simultaneously, affective responses have a significant positive impact on short video addiction, such as curiosity, and affinity (Dong et al., 2024). Therefore, we contend that it is necessary to integrate other affective factors into the original CIU model and construct an extended CIU model to improve the explanatory power of the short video addiction behavior.

Attitude is an important factor that effectively predicts online addictive behavior (Can and Kaya, 2016; Jeong and Kim, 2011; Tsai and Lin, 2001). Previous studies indicated that attitude should be conceptualized as a tripartite structure, primarily consisting of affective (e.g., emotion or feeling), cognitive (e.g., beliefs, judgments, or thoughts), and behavioral information domains (Edwards, 1990; Bizer and Krosnick, 2001). Nevertheless, scholars' definitions of attitude show their recognition of the affective component. For example, a handful of extant studies suggested that attitude refers to the positive and negative views held by an individual toward a specific object, such as an action, event, situation, issue, or people (Howarth, 2006; Marcinkowski and Reid, 2019). Ozel et al. (2013, p. 13) also indicated that attitude reflects "a general liking or disliking, or more specific affective reactions toward the object." Similarly, Petty and Briñol (2015, p. 2) have posited that "attitudes are not only based on thoughts and beliefs but also feelings and emotions." In addition, existing studies have also regarded attitude as a factor of affective response when constructing theoretical models (Henter, 2014; Pang, 2021; Zhang, 2013). Therefore, attitude is one of the affective factors considered in this study.

Generally, immersion has been recognized as one of the most significant conceptions for understanding users' affective experience in the field of media effect (Cheng and Tsai, 2020; Lin et al., 2020). Immersion refers to "a state of deep mental involvement in which their cognitive processes (with or without sensory stimulation) cause a shift in their attentional state such that one may experience dissociation from the awareness of the physical world" (Agrawal et al., 2020, p. 407). Jennett et al. (2008) analyzed the differences between immersion and relevant concepts such as flow, cognitive absorption, and presence in detail. They argued that the key to the construct of immersion lay in emphasizing the loss of awareness of time and the real world, involvement, and focused attention. Building upon this foundation, this study believes that when individuals watch short videos they like or prefer, they have a good viewing experience and a sense of being "lost to the world" (Seah and Cairns, 2008). At present, most studies on immersion and addictive behaviors focus on video games (Lee et al., 2021; Seah and Cairns, 2008), virtual reality services (Saneinia et al., 2022), and gambling (Rémond and Romo, 2019), the role of immersion in short video addiction also needs to be empirically tested. Thus, this study proposes attitude and immersion as the affective factors, we aim to empirically investigate how stress perception affects addictive outcomes through motivational and affective paths in the context of short video applications.

## 2.3 Hypothesis development

### 2.3.1 Perceived stress and short video addiction

Perceived stress, conceptualized by Cohen et al. (1983) as "the degree to which individuals appraise situations in their lives as stressful," has been shown to instigate a cascade of responses at the psychological, behavioral, and physiological levels (Schiffman and Nelson, 2008). This multifaceted impact extends to individuals' susceptibility to addiction, particularly in relation to the emerging phenomenon of short video addiction. Recent research by Liu et al. (2021) elucidates that perceived stress serves as a pivotal determinant directly influencing the addictive tendencies toward short video applications among Chinese users. Moreover, the literature highlights that the alleviation of stress and facilitation of relaxation serve as central incentives driving the consumption of mobile videos (McNally and Harrington, 2017). Given the established link between perceived stress and short video addiction, we hypothesize that:

*H1: Perceived stress is positively associated with short video addiction.*

### 2.3.2 Perceived stress, relaxing entertainment, and social interaction

Stress, as a negative emotional experience, drives individuals to seek relief. Short video applications provide a notable coping strategy for stress reduction (Sun et al., 2024). According to the compensatory internet use theory, internet addiction can arise from individuals seeking gratifications online to alleviate negative emotions. This paper will examine two key aspects of gratifications-seeking in relation to short videos: relaxing entertainment and social interaction. These elements align with the use and satisfaction theory. Meanwhile, Vaterlaus and Winter (2021) reviewed existing literature on short video user motivations and found significant overlap in the focus on relaxation entertainment and social interaction.

Previous studies demonstrate the influence of perceived stress on motives for media consumption. Pavić and Rijavec (2013) highlight the significant effect of perceived stress on instrumental motives and ritual motives toward a television viewing environment. A study by Sun et al. (2024) based on empirical data found that stress can stimulate people's escape motive for using short videos. This view indicates that if individuals have a higher level of experienced stress, they are more likely to generate the motivation to watch short videos to achieve escape. This study aimed to test whether a positive association between stress and relaxing entertainment motive and social interaction motive. Under significant pressure (e.g., work stress, academic stress, etc.), people often turn to short videos for relief, seeking both entertainment and social interaction. Consequently, we formulate hypotheses as following:

*H2: Perceived stress is positively associated with relaxing entertainment.*

*H3: Perceived stress is positively associated with social interaction.*

### 2.3.3 Relaxing entertainment, social interaction and attitude

Previous studies found that social interaction and relaxing entertainment are the two most important motivations for using short

video applications (Zhang et al., 2023; Shi et al., 2024; Deng et al., 2023). On the one hand, short videos have the function of relaxation and entertainment. Chen and Lin (2018) noted that the purpose of relaxing entertainment is to make users feel happy by providing a temporary escape from reality, allowing them to relieve stress by forgetting their worries. Dong and Xie (2024) report that users regard short video applications as relaxing entertainment to relieve stress. On the other hand, Dholakia et al. (2004, p. 244) defined social interaction as “the social benefits derived from establishing and maintaining contact with other people such as social support, friendship, and intimacy.” Vaterlaus and Winter (2021, p. 9) noted that TikTok, one typical short video application, by nature, is “a relational activity or a way to form new relationship.” Thus, users prefer to maintain online interpersonal relationships on the short video applications by adding friends, chatting with friends, sharing, liking, commenting, and other interactive activities. Past studies have found that both relaxing entertainment and social interaction positively impact attitude. For example, Curras-Perez et al. (2014) concluded that the motivations of interacting with friends, meeting new users, finding enjoyment, entertainment, and escapism are strong predictors of the attitude toward social network site usage. Therefore, this study proposes the following two hypotheses:

H4: Relaxing entertainment is positively associated with attitude.

H5: Social interaction is positively associated with attitude.

### 2.3.4 Relaxing entertainment, social interaction and immersion

Drawing on flow theory (Csikszentmihalyi, 1990), we believe that users are eager to seek a high level of interactive experience through short videos and positively influence their immersion. Empirical studies have shown that motivation is considered to be a proximal determinant of immersion, and the underlying mechanism of this effect is users' expectation of positive outcomes from internet use (Liu and Chang, 2016; Miranda et al., 2023). The primary goal of short video usage is to create entertainment and interaction through intrinsic motivation, which is closely related to flow and immersion (Yan et al., 2023). Tian et al. (2023) found that social interaction and entertainment are also positively correlated with immersion. In a study conducted by Lv et al. (2022), showed that entertainment and social interaction play significant roles in user immersive experience. In addition, Miranda et al. (2023) found in a study of short video addictive behaviors that avoidance motivation increased individual immersion. Therefore, we believe that entertainment and social interaction positively influence the formation of immersion because they enrich the viewing experience and produce high levels of concentration and cognitive absorption. Thus, we propose the following hypotheses:

H6: Relaxing entertainment is positively associated with immersion.

H7: Social interaction is positively associated with immersion.

### 2.3.5 Attitude and short video addiction

Attitude toward behavior delineates a user's endorsement of spending more time-consuming short videos. When users

perceive short videos as delivering values such as entertainment and relaxation, they develop a favorable attitude toward short videos, and then their behavior becomes proactive. Precious studies, such as Lai et al. (2016), explored the impact of favorable attitude on users' addiction to online gaming applications. Hence, we embrace Lai et al.'s (2016) viewpoint in the present study to understand how attitude influences individuals' short video addictive behavior. Hence, we postulate the following research hypothesis:

H8: Attitude is positively associated with short video addiction.

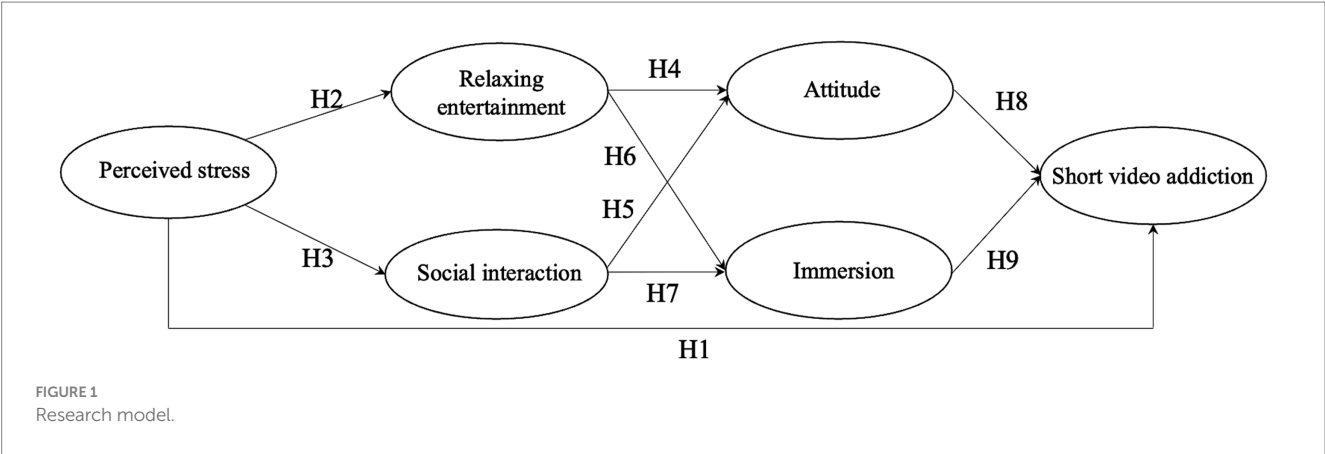
### 2.3.6 Immersion and short video addiction

Lee and Li (2023) suggested that immersion represents a sense of cognitive absorption, concentration, and forgetting about physical reality. In an empirical study, Lehenbauer-Baum et al. (2015) pointed out that immersion availability could enhance individuals' MMORPG addiction. In the present study, immersion refers to users becoming immersed in a video-centric world, such as diverse content, and interactive experiences like liking. Besides, with its streamlined algorithmic recommendations, short video applications can rapidly discern, comprehend, and assimilate user behavior. Sustained delivery of tailored content enhances user engagement with the viewing experience and may contribute to a propensity for excessive short video consumption. Ye et al. (2023) argued that the deeply immersive nature of short videos may lead to heightened difficulty for users in disengaging. Moreover, previous research demonstrated a positive correlation between immersion and short video addiction (Nong et al., 2023; Yang et al., 2021). Thus, this study proposes the following hypothesis:

H9: Immersion is positively associated with short video addiction.

### 2.3.7 Multigroup difference

Age has been widely used as an important moderating variable in internet addiction studies (Chatterjee, 2021; Ioannidis et al., 2018). Previous studies have shown that users of different ages show different levels of addiction. In the study of Heo et al. (2014), Korean high school students have a low addictive internet use score, which is related to high academic performance pressure. Devine et al. (2022) found that younger adults tended to have greater levels of internet addiction than older adults. Previous studies highlight the differences among different age groups. In addition, it has been found that age regulates the relationship between antecedents and addiction. Chatterjee (2021) found that, compared with young adults (18–35 years), middle-aged adults (36–55 years) had a stronger predictive effect on internet addiction, such as loneliness and anxiety. In our study, according to the age classification recommended by the National Bureau of Statistics of China, we divided young short video users into three categories and named them: adolescence (14–20 years old), emerging adults (21–25 years old), and adulthood (>25 years old), and the number of young short video users in these three categories is relatively high in China. In this article, we will discuss how individuals in these three age groups influence the associations of the six variables in the proposed model. Therefore, this paper proposes the following research questions:



RQ1: Does Age moderate the relationships among the stress, relaxing entertainment, social interaction, attitude, immersion and short video addiction

The conceptual model diagram is illustrated in [Figure 1](#).

3 Materials and methods

3.1 Measures

Following rigorous translation and back-translation, all English measurement items involved in this research were translated into Chinese by the authors. The questionnaire used in this survey mainly consists of two parts and two additional screening question. First, participants need to answer one screening questions, which asks whether they have the habit of watching short videos in the past 6 months. Participants who choose “Yes” are invited to fill in the remaining survey questions. In contrast, those who choose “No” are denied to participate. The first part measures the model variables, and the second part is descriptive statistical analysis, including variables such as gender, age, monthly income, education level, and average daily usage time ([Table 1](#)). Additionally, an attention-check question was inserted in the middle of a questionnaire that helps to screen out invalid questionnaires. In total, 30 questions of the questionnaire were encompassed in this paper.

To further enhance the validity of the questionnaire and ensure that each item could represent a specific construct, we invited four experienced researchers and four master students in the field to modify it and obtained their approval. Subsequently, we conducted a pre-survey with 82 participants to evaluate whether the reliability and validity of the six scales met the thresholds proposed by previous studies. We undertook additional modifications to the questionnaire scale in response to the confusion and feedback provided by participants following their completion of the survey. The results of the preliminary survey are satisfactory, and then we can proceed to distributing the formal version’s questionnaire. In the first part of the questionnaire, the measurement items were evaluated using a 5-point Likert scale, ranging from “1 = strongly disagree” to “5 = strongly agree.”

TABLE 1 Sample profile (N = 319).

Variables	Distribution	Frequency	Percent (%)
Gender	Male	148	46.4%
	Female	171	53.6%
Age	14–20	70	21.9%
	21–25	178	55.8%
	26–30	44	13.8%
	31–35	11	3.4%
	36 and more	16	5.0%
Education level	Middle school or lower	33	10.3%
	High school	66	20.7%
	Junior college	23	7.2%
	College	128	40.1%
	Master’s or higher	69	21.6%
Average daily usage time	<30 min	84	26.3%
	30–60 min	87	27.3%
	1–2 h	83	26.0%
	2–3 h	39	12.2%
	>3 h	26	8.2%
Monthly income (CNY)	3,000 or less	192	60.2%
	3,001–5,000	55	17.2%
	5,001–8,000	40	12.5%
	8,001–10,000	11	3.4%
	10,001 or more	21	6.6%

Specifically, attitude was measured in three items using [Ajzen’s \(2002\)](#) and [Eagly and Chaiken’s \(1993\)](#) scale. Following [Khan \(2017\)](#), relaxing entertainment was measured by using two items. The measurement of immersion was adopted from [Hamari et al. \(2016\)](#). Social interaction was measured in three items using [Zadeh et al. \(2023\)](#) scale. The measurement of perceived stress was based on [Cohen et al.’s \(1995\)](#) scale. Moreover, short video addiction was adopted from [Chen et al. \(2003\)](#). All measurement items are included in the [Table 2](#).

TABLE 2 Instrument of the variables.

Variables (sources)	Items
Perceived stress (Cohen et al., 1995)	I am unable to cope with life's challenges and feel overwhelmed or stressed.
	I cannot control important matters and worries in life and feel depressed.
	I lack confidence in dealing with significant changes happening in my life.
	I feel incapable of overcoming difficulties and making things progress smoothly.
Relaxing entertainment (Khan, 2017)	To relax.
	To pass the time when bored.
Social interaction (Zhang et al., 2023)	To meet new people
	To interact with people with the same interests
	To spend time with people I care about
Attitude (Ajzen, 2002; Eagly and Chaiken, 1993)	I enjoy watching short videos for a long time.
	I think watching short videos for a long time is normal behavior.
	I think watching short videos for a long time is beneficial.
Immersion (Hamari et al., 2016)	I find it easy to concentrate and immerse myself in watching short videos, often losing track of time.
	I often immerse myself in short videos recommended by short video apps.
	I often immerse myself in short videos I am interested in.
Short video addiction (Chen et al., 2003)	I watch short videos whenever I have free time.
	I open the short video application frequently.
	I feel that life without the short videos would be boring, empty and joyless.
	I feel that I watch short videos longer than before.
	I neglect the interaction with my family, friends, classmates and colleagues to spend more time watching short videos.
	On more than one occasion, I have delayed things that need to be completed on time because of watching short videos.
	I try to cut down the amount of time I spend online, but failed.

## 3.2 Sampling and data collection

The formal survey was conducted from June 3rd to July 5th, 2021, utilizing the Sojump<sup>1</sup> online platform, which boasts a user base of over 10 million. This study obtained approval from the institutional review board (IRB) of the author's affiliated institution. A total of 356 questionnaires were distributed, and after excluding invalid responses such as those from non-short video users and those with identical consecutive answers exceeding 10 instances, a total of 319 valid questionnaires were collected, resulting in a response rate of 89.60%. Table 1 presents the sample characteristics. Among all 319 participants, 46.4% ( $n = 148$ ) were males and 53.6% ( $n = 171$ ) were females. 68.9% of them had a bachelor's degree or higher and 46.4% of the participants engaged in daily consumption of short videos for over 1 h.

## 3.3 Statistical analysis

SPSS 24.0 and SmartPLS 4.0 were used to analyze the data. This study used SPSS 24.0 to conduct a descriptive analysis of respondent demographic characteristics analysis. Then, a two-step approach was used for PLS-SEM analysis. In the initial step, the reliability, content validity, and discriminant validity of the measurement model were

evaluated. In the second step, path analysis and multigroup analysis was applied to test the proposed research hypotheses in this study.

## 4 Results

### 4.1 Measurement model

The validity and reliability of the measurement were assessed through confirmatory factor analysis using SmartPLS 4.0. As shown in Table 3, the Cronbach's alpha values exceeded a marginal value of  $>0.7$ , and Composite Reliability (CR) for each construct was higher than 0.7, which is a widely accepted threshold in research, indicating good internal consistency reliability (Hair et al., 2017). The Average Variance Extracted (AVE) values for all constructs ranged from 0.685 to 0.880, surpassing the threshold of  $>0.5$ , and all Outer Loadings (OL) were greater than the suggested value of 0.7, leading to the conclusion that convergent validity is not a concern (Bagozzi and Yi, 1988). The findings, as presented in Table 4, confirmed the discriminant validity by showing that the square root of the AVE (highlighted in bold and displayed on the diagonal figure) surpassed its correlation coefficients with other factors. Hence, the present study has favorable discriminant validity (Fornell and Larcker, 1981).

In the analysis of the reflective measurement model, we employed the Heterotrait Monotrait Ratio (HTMT) criterion proposed by Henseler et al. (2015) to evaluate discriminant validity among six constructs (see Table 5). The scores of HTMT for all constructs are

<sup>1</sup> www.wjx.cn

TABLE 3 Instrument of the variables of the standardized factor loading value and scale reliability.

Indicators	Abb.	Items	Factor loading	Cronbach's $\alpha$	CR	AVE
Attitude	ATT	ATT1	0.847	0.803	0.810	0.716
		ATT2	0.855			
		ATT3	0.837			
Relaxing entertainment	RET	RET1	0.923	0.783	0.799	0.820
		RET2	0.889			
Immersion	IMM	IMM1	0.828	0.778	0.810	0.689
		IMM2	0.785			
		IMM3	0.875			
Social interaction	INT	INT1	0.896	0.783	0.799	0.820
		INT2	0.869			
		INT3	0.900			
Perceived stress	PSS	PS1	0.920	0.954	0.956	0.880
		PS2	0.953			
		PS3	0.946			
		PS4	0.933			
Short video addiction	SVA	SVA1	0.887	0.923	0.934	0.685
		SVA2	0.893			
		SVA3	0.866			
		SVA4	0.842			
		SVA5	0.751			
		SVA6	0.736			
		SVA7	0.806			

CR represents "Composite Reliability," AVE represents "Average Variance Extracted".

TABLE 4 Fornell-Larcker criterion.

	Mean	SD	1	2	3	4	5	6
1. ATT	2.82	0.997	<b>0.846</b>					
2. PSS	3.08	1.060	0.481	<b>0.938</b>				
3. SVA	2.86	0.950	0.575	0.680	<b>0.828</b>			
4. RET	3.79	0.855	0.496	0.497	0.464	<b>0.906</b>		
5. IMM	3.68	0.843	0.374	0.524	0.554	0.617	<b>0.830</b>	
6. INT	2.52	1.051	0.596	0.489	0.540	0.330	0.269	<b>0.888</b>

ATT, Attitude; RET, Relaxing entertainment; IMM, Immersion; INT, Social interaction; PSS, Perceived stress; SVA, Short video addiction. Numbers in parentheses are square roots of AVE.

below the threshold value of 0.85, confirming the discriminant validity of the model.

## 4.2 Structural model

The structural analysis represents the second step of PLS-SEM. To determine the significance of each path coefficient, bootstrapping with 5,000 samples was used. The result of the structural model is depicted in Figure 2, displaying path coefficients, significance levels of paths,  $VIF$ ,  $f^2$ ,  $R^2$  values, and  $Q^2$  values. The model explains 24.7% of the variance for relaxing entertainment, 23.9% of the variance for social interaction, 38.5% of the variance for immersion, 45.6% of the variance for attitude, and 57.9% of the variance for short video

addiction. This finding showed that the explanatory power of our model is acceptable (Chin, 1998). Furthermore, relaxing entertainment has 0.197, social interaction has 0.186, immersion has 0.254, attitude has 0.317, and short video addiction 0.384 as  $Q^2$  values, all  $Q^2$  values exceed zero and indicated that the predictive relevance of the structural model was satisfied (Geisser, 1975). In addition, we examined the model fit using the standardized root mean square residual (SRMR) measure. Our model had an SRMR value of 0.072, which is below the threshold of 0.08 (Henseler et al., 2016), and can be considered an acceptable value for a PLS-SEM-based model.

As shown in Figure 2 and Table 6, the findings from the SEM analysis revealed several key relationships. Perceived stress is positively related to the short video addiction ( $\beta = 0.424$ ,  $p < 0.001$ ), supporting H1. Perceived stress is positively associated with relaxing

entertainment and social interaction ( $\beta=0.497, p<0.001$ ;  $\beta=0.489, p<0.001$ ). Hence, H2 and H3 were confirmed. Relaxing entertainment displayed significant and positive associations with attitude and immersion ( $\beta=0.335, p<0.001$ ;  $\beta=0.593, p<0.001$ ). H4 and H6 were

supported. Social interaction exhibited noteworthy positive correlations with attitude ( $\beta=0.486, p<0.001$ ), but failed to be related to immersion ( $\beta=0.073, p>0.05$ ). Therefore, H5 was supported, but H7 was not supported. The effect of attitude on short video addiction is significantly positive ( $\beta=0.287, p<0.001$ ). H8 was supported. The results reveal a significant and positive correlation between immersion and short video addiction ( $\beta=0.226, p<0.001$ ). Hence, H9 was confirmed.

TABLE 5 Assessment of discriminant validity using the HTMT criterion (HTMT<0.85).

	1	2	3	4	5	6
1. ATT						
2. PSS	0.542					
3. SVA	0.646	0.715				
4. RET	0.611	0.569	0.527			
5. IMM	0.442	0.596	0.613	0.784		
6. INT	0.714	0.538	0.602	0.394	0.308	

ATT, Attitude; RET, Relaxing entertainment; IMM, Immersion; INT, Social interaction; PSS, Perceived stress; SVA, Short video addiction.

### 4.3 Mediating effect test

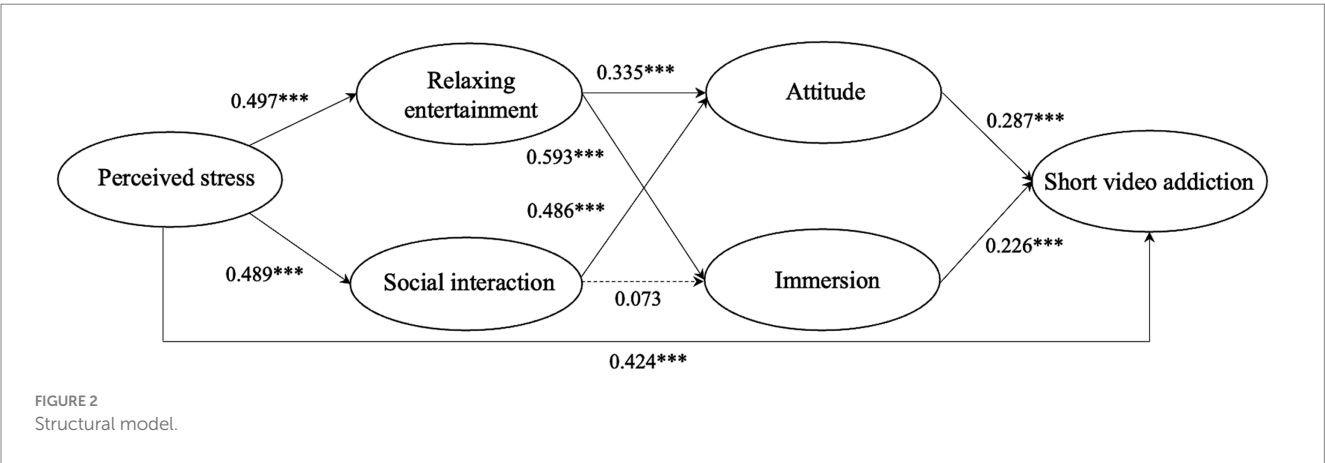
Following the preceding findings, it is evident that further analysis is warranted to investigate the mediating effects in the relationship between perceived pressure and short video addiction. Mediation analyses using bootstrapping were performed in SmartPLS 4.0 to examine two specific pathways as outlined in Table 7. Given that the positive correlation between social engagement and immersion

TABLE 6 Assessment of structural model with bootstrapping procedure.

Path relationship	Std beta	Std error	t-value	p-value	Confidence interval	VIF	f <sup>2</sup>
PSS → SVA	0.424***	0.059	7.223	0.000	[0.324, 0.520]	1.585	0.270
PSS → RET	0.497***	0.048	10.435	0.000	[0.417, 0.574]	1.000	0.328
PSS → INT	0.489***	0.052	9.319	0.000	[0.401, 0.573]	1.000	0.314
RET → ATT	0.335***	0.047	7.154	0.000	[0.257, 0.409]	1.122	0.184
RET → IMM	0.593***	0.046	12.904	0.000	[0.514, 0.666]	1.122	0.510
INT → ATT	0.486***	0.046	10.655	0.000	[0.411, 0.561]	1.122	0.387
INT → IMM	0.073	0.053	1.368	0.086	[−0.016, 0.159]	1.122	0.008
ATT → SVA	0.287***	0.052	5.505	0.000	[0.205, 0.378]	1.337	0.147
IMM → SVA	0.226***	0.047	4.785	0.000	[0.148, 0.304]	1.416	0.085

	Coefficient of determination, R <sup>2</sup>	Predictive relevance, Q <sup>2</sup> _predict
RET	0.247	0.197
INT	0.239	0.186
IMM	0.385	0.254
ATT	0.456	0.317
SVA	0.579	0.384

ATT, Attitude; RET, Relaxing entertainment; IMM, Immersion; INT, Social interaction; PSS, Perceived stress; SVA, Short video addiction. VIF, Variance Inflation Factor; f<sup>2</sup> (Effect Size). \*\* $p<0.010$ ; \*\*\* $p<0.001$ .



remains unverified, this study focuses on three specific paths. As indicated by the path analysis results presented in Table 7, perceived pressure influences short video addiction through a serial mediating pathway comprising relaxation entertainment, social interaction, immersion, and attitude.

4.4 Multigroup analysis (MGA)

We use the categorical variable “age group” as a moderator. More specifically, multigroup analysis has sample size requirements: (1) the sample size for each group must be almost equal; (2) no group can use less than 80% of the recommended sample size (Matthews, 2017). Our basic idea is to combine the descriptive statistics of 26–30, 31–35, and 36 and more into one group category “25 and more,” which further divide the sample into three groups: 14–20 ( $n=70$ ), 21–25 ( $n=178$ ), and 25 and more ( $n=71$ ). However, we found that the sample size in each group was not equal, which would lead to weakened statistical power and the underestimation of the moderating effect (Hair et al., 2017; Aguinis et al., 2017). According to the recommendations of Aguinis et al. (2017) and Matthews (2017), we chose almost equal sample sizes. The main method was to use the random sampling method in the Excel software from the 21–25 ( $n=178$ ) group and select 71 participants.

Following the procedure suggested by Cheah et al. (2020), we first used the measurement invariance of composite models (MICOM) to assess measurement equivalence, which can be effectively explained if the research data standards are acceptable. More precisely, this study aimed to ascertain whether construct measurements are understood similarly across the three age groups. MICOM consists of three steps, the first step is the configurational invariance assessment, the second is the establishment of compositional invariance assessment and the third is the assessment of equal means and variances. The results as shown in Table 8, the MGA’s group-specific differences in the PLS-SEM findings are feasible to compare and interpret (Henseler et al., 2016) and are acceptable to perform path analysis among three groups.

From Table 9, our results show a significant difference between Group 14–20, Group 21–25, and Group >25. First, the comparisons between Group 14–20 and Group >25 ( $|diff| = -0.574, p < 0.01$ ) and Group 21–25 and Group >25 ( $|diff| = -0.540, p < 0.001$ ) show a significant relationship between perceived stress and short video addiction. Second, Group >25 significantly differs from Group 14–20 ( $|diff| = -0.288, p < 0.01$ ) and Group 21–25 and Group >25 ( $|diff| = -0.334, p < 0.01$ ) for the relationship between perceived stress and relaxing entertainment. Third, the result shows a significant difference between Group 14–20 and Group >25, and Group 21–25 and Group >25 for the relationship between attitude and short video

addiction ( $|diff| = -0.288, p < 0.01, |diff| = -0.334, p < 0.01$ ). Last, the result of the relationship between immersion and short video addiction showed that the Group 14–20 sample differs significantly from the Group >25 sample ( $|diff| = -0.334, p < 0.05$ ).

5 Discussion

This study employed an extended CIU model to investigate short video addiction in China, highlighting stress as a key factor directly affecting user addiction. By utilizing this model, the research deepens our understanding of the factors driving short video addiction. It integrates self-compensatory motives, immersion, and attitude into the analysis, offering insights specific to the Chinese context. Furthermore, the study presents new opportunities to refine the conventional CIU model by exploring the complex relationships among these predictors.

Firstly, the results revealed a positive correlation between perceived stress and short video addiction, aligning with findings from Liu et al. (2021) and Sun et al. (2024), who reported that higher stress levels are associated with increased addiction to short videos. This relationship can be understood from a psychopathological perspective, stress serves as a mental predisposition and is accompanied by anxiety, which may drive individuals to use short videos more frequently, leading to addiction (Brand et al., 2016). Engaging with preferred short videos can trigger dopamine release, aiding emotional regulation and reducing tension and anxiety (Mouchabac et al., 2021). Consequently, individuals experiencing higher levels of perceived stress and anxiety may seek pleasure through short video consumption, resulting in addictive behaviors.

Secondly, our findings indicate that perceived stress is positively related to two primary motives: relaxing entertainment and social interaction. This finding supports the notion that these motives play a crucial role in compensating for negative emotions, such as stress, among users of short video applications. Specifically, stress has a significant impact on both the relaxing entertainment motive and the social interaction motive. This finding is consistent with previous research (Curras-Perez et al., 2014; Dong and Xie, 2024; Vaterlaus and Winter, 2021), which highlights the importance of relaxation and social interaction as crucial motives when engaging with short video applications. Individuals experiencing higher levels of perceived stress are more likely to watch short videos to fulfill their motives for relaxation and social interaction.

Thirdly, relaxing entertainment has a significant influence on both users’ attitude and immersion, while social interaction only exerts influence on attitude. This finding is consistent with a previous study, confirming a positive association between relaxing entertainment, social interaction, and attitude (Curras-Perez et al., 2014). When users perceive that the short videos consumption satisfies their needs, they

TABLE 7 Mediation calculation.

	Std beta	Std error	t-value	p-value	Confidence interval
PSS → RET → IMM → SVA	0.067***	0.016	4.117	0.000	[0.041, 0.094]
PSS → INT → ATT → SVA	0.068***	0.017	3.976	0.000	[0.043, 0.100]
PSS → RET → ATT → SVA	0.048***	0.012	3.997	0.000	[0.030, 0.069]
PSS → INT → IMM → SVA	0.008	0.006	1.236	0.108	[−0.002, 0.019]

ATT, Attitude; RET, Relaxing entertainment; IMM, Immersion; INT, Social interaction; PSS, Perceived stress; SVA, Short video addiction. \*\*\* $p < 0.001$ .

TABLE 8 Assessment of measurement invariance.

Comparison	Constructs	Configurational invariance (Step 1)	Compositional invariance (Step 2)		Partial measurement invariance	Equal mean assessment (Step 3a)		Equal mean assessment (Step 3b)		Full measurement invariance
			Original Correlation	5.0%		Original Differences	Confidence Interval	Original Differences	Confidence Interval	
Group 14–20 Vs. Group 21–25	ATT	Yes	0.999	0.985	Yes	0.119	[−0.323, 0.329]	−0.082	[−0.539, 0.474]	Yes/Yes
	PSS	Yes	1.000	1.000	Yes	0.021	[−0.348, 0.349]	−0.512	[−0.562, 0.446]	Yes/Yes
	SVA	Yes	0.999	0.998	Yes	0.264	[−0.330, 0.319]	−0.172	[−0.492, 0.471]	Yes/Yes
	RET	Yes	0.998	0.997	Yes	−0.333	[−0.321, 0.345]	−0.127	[−0.495, 0.476]	No/Yes
	IMM	Yes	0.992	0.991	Yes	−0.63	[−0.340, 0.001]	0.066	[−0.450, 0.402]	No/Yes
	INT	Yes	0.999	0.996	Yes	0.398	[−0.333, 0.017]	−0.166	[−0.536 0.426]	No/Yes
Group 14–20 Vs. Group >25	ATT	Yes	0.999	0.995	Yes	0.005	[−0.314, 0.318]	−0.641	[−0.484, 0.434]	Yes/No
	PSS	Yes	1.000	1.000	Yes	−0.175	[−0.304, 0.346]	−0.583	[−0.482, 0.431]	Yes/No
	SVA	Yes	0.997	0.997	Yes	−0.099	[−0.331, 0.326]	−0.327	[−0.469, 0.463]	Yes/Yes
	RET	Yes	0.999	0.997	Yes	−0.479	[−0.316, 0.328]	−0.210	[−0.477, 0.466]	No/Yes
	IMM	Yes	1.000	0.995	Yes	−0.454	[−0.309, 0.331]	−0.297	[−0.447, 0.408]	No/Yes
	INT	Yes	0.996	0.995	Yes	0.034	[−0.311, 0.328]	−0.387	[−0.478, 0.443]	Yes/Yes
Group 21–25 Vs. Group >25	ATT	Yes	1.000	0.991	Yes	−0.103	[−0.323, 0.310]	−0.561	[−0.447, 0.463]	Yes/No
	PSS	Yes	1.000	1.000	Yes	−0.178	[−0.321, 0.318]	−0.073	[−0.390, 0.413]	Yes/Yes
	SVA	Yes	0.999	0.995	Yes	−0.326	[−0.321, 0.297]	−0.152	[−0.431, 0.417]	No/Yes
	RET	Yes	1.000	0.995	Yes	−0.167	[−0.317, 0.336]	−0.074	[−0.474, 0.508]	Yes/Yes
	IMM	Yes	0.993	0.989	Yes	0.153	[−0.315, 0.319]	−0.370	[−0.492, 0.453]	Yes/Yes
	INT	Yes	0.999	0.997	Yes	−0.338	[−0.313, 0.314]	−0.243	[−0.454, 0.453]	No/Yes

AAT, Attitude; RET, Relaxing entertainment; IMM, Immersion; INT, Social interaction; PSS, Perceived stress; SVA, Short video addiction.

TABLE 9 Results of hypothesis testing of multigroup.

	Group 14–20				Group 21–25				Group >25				diff		
	Std beta	Std error	t-value	p-value	Std beta	Std error	t-value	p-value	Std beta	Std error	t-value	p-value	Group 14–20 vs. group >25	Group 14–20 vs. group 21–25	Group 21–25 vs. group >25
PSS → SVA	0.214	0.176	1.214	0.112	0.249*	0.118	1.214	0.017	0.788***	0.069	11.499	0.000	–0.574**	–0.035	–0.540***
PSS → RET	0.435***	0.116	3.736	0.000	0.389***	0.105	3.736	0.000	0.723***	0.049	14.64	0.000	–0.288**	0.046	–0.334**
PSS → INT	0.578***	0.138	4.199	0.000	0.441***	0.113	4.199	0.000	0.640***	0.077	8.337	0.000	–0.062	0.137	–0.198
RET → ATT	0.437***	0.102	4.296	0.000	0.341**	0.113	4.296	0.001	0.365***	0.097	3.758	0.000	0.072	0.096	–0.023
RET → IMM	0.638***	0.082	7.748	0.000	0.570**	0.101	7.748	0.000	0.723***	0.079	9.206	0.000	–0.085	0.068	–0.154
INT → ATT	0.462***	0.101	4.559	0.000	0.310**	0.132	4.559	0.009	0.466***	0.086	5.437	0.000	–0.004	0.152	–0.156
INT → IMM	0.164	0.127	1.292	0.098	0.043	0.119	1.292	0.358	0.049	0.087	0.555	0.289	0.116	0.121	–0.005
ATT → SVA	0.299**	0.106	2.828	0.002	0.390***	0.106	2.828	0.000	0.022	0.072	0.301	0.382	0.277*	–0.091	0.368**
IMM → SVA	0.439***	0.126	3.477	0.000	0.269**	0.086	3.477	0.001	0.126*	0.07	1.786	0.037	0.314*	0.170	0.143

ATT, Attitude; RET, Relaxing entertainment; IMM, Immersion; INT, Social interaction; PSS, Perceived stress; SVA, Short video addiction. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

are likely to develop a positive attitude toward the usage behavior. Specifically, the desire for relaxation and enjoyment is a crucial driver for using short video applications, which significantly enhances users' positive attitudes toward the continuous viewing behavior. Additionally, social interaction—such as communication, sharing, and building connections—reflects the social purposes for which users adopt these applications, further influencing their attitudes. Engaging in social interactions on these short video applications can provide a sense of community and belonging, which contributes to a more positive attitude toward the application. For short video application users, relaxing entertainment enhances their immersion, supporting the findings of [Tian et al. \(2023\)](#) and [Lv et al. \(2022\)](#) that the hedonic motive significantly enhances users' immersive experience.

Fourthly, this study investigates how affective responses, specifically attitude and immersion, predict short video addiction. The findings indicate that both immersion and attitude contribute to increased addiction. Immersion is distinct from related concepts like flow or absorption in this study, and it refers to users losing track of time due to intense focus on short video content, which can lead to addiction and other negative effects ([Tian et al., 2023](#)). Many Chinese users report that time seems to fly by while watching short videos, often expressing this with phrases like “5 min on TikTok feels like an hour.” Additionally, the study confirms that attitude significantly correlates with addictive behaviors, which is consistent with prior research in the context of online video games ([Jeong and Kim, 2011](#)). Attitude reflects an individual's general evaluations regarding extended short video watching. Attitudes are critical to decision-making and behavior in that people tend to engage with short video applications ([Petty and Briñol, 2015](#)). Thus, users' positive evaluation of extended short video watching increases the likelihood of addiction.

Moreover, contrary to the expectation, social interaction does not exert influence on immersion. The insignificant linkage here could possibly be attributable to the fact that users who interact with others may be distracted from watching short videos with full attention. As smartphone applications, short video applications function as compelling sources of distraction, effectively capturing user attention through their engaging content ([Toh et al., 2023](#)). However, to meet their needs for relaxation, entertainment, and social interaction, users can perform multiple tasks on short video applications, including watching, liking, commenting, joining communities, and even chatting with friends. Research indicates that individuals who multitask less frequently tend to process information sequentially and can fully allocate their attentional resources to a single task ([Alloway and Alloway, 2012](#)). Short videos provide a fresh, engaging, and stimulating experience to the audience ([Lu et al., 2022](#); [Dong et al., 2024](#)), making them particularly suited for entertainment compared to other video streaming media services. When individuals engage with short videos for entertainment, this viewing activity itself becomes the primary task. Consequently, users are able to filter out extraneous information and derive pleasure from the enjoyment of short videos, thereby achieving a state of immersion. However, when the motivation for watching short videos is rooted in social interaction, the use of these applications often involves multitasking—such as viewing videos while simultaneously monitoring and engaging with the comments and activities of their social network. This multi-task engagement can disperse attentional resources, thereby hindering the attainment of a fully immersive experience.

Fifthly, as an exploratory endeavor, this study examines how users' motivational and affective factors mediate the relationship between stress and short video addiction. As indicated by the preceding path analysis, social interaction does not influence immersion. Therefore, perceived pressure does not affect short video addiction through a serial mediating pathway consisting of social interaction and immersion. Nevertheless, it is worth emphasizing that perceived stress can influence short video addiction through three distinct serial mediation pathways: the pathway involving social interaction and attitude, the pathway linking relaxing entertainment and attitude, and the pathway connecting relaxing entertainment and immersion. The identified pathways illustrate the complex mechanisms through which stress can indirectly lead to addictive behaviors, specifically in the context of short video consumption. When individuals experience stress, they may seek social interaction and relaxation through short video platforms as a coping mechanism (Sun et al., 2024). These social interactions and relaxing experiences can shape their attitudes toward such platforms, potentially fostering a more positive outlook that encourages sustained use (Curras-Perez et al., 2014). This positive attitude can, in turn, contribute to the development of addictive patterns of behavior. Similarly, individuals under stress may find short videos to be a source of relaxation and escapism (Vaterlaus and Winter, 2021). The immersive nature of these videos can draw users deeper into the content, enhancing their engagement and diminishing their awareness of the external environment (Miranda et al., 2023). This heightened level of immersion can facilitate the transition from casual use to addictive behavior, further exacerbating the cycle of stress and digital media consumption.

Lastly, the PLS-MGA results showed that there are significant differences between the three age groups on the effect of perceived stress on short video addiction and relaxing entertainment, attitude on short video addiction, and immersion on short video addiction. These findings underscore the role of age in shaping these relationships. Specifically, the effects of perceived stress on short video addiction were notable among users aged 21–25 and those older than 25, but were not significant for users aged 14–20. Moreover, the positive influence of immersion on short video addiction is more pronounced among users aged 14–20. One potential explanation is that younger users, especially adolescent users, have lower self-control and find it harder to disengage from watching short videos absorbedly, making them more susceptible to addiction (Lu et al., 2022; Li et al., 2021; Ma et al., 2020; Martins et al., 2020). This implies that individuals with diminished self-control capacities are more prone to becoming deeply immersed in digital environments, especially adolescents. Consistent with this finding, prior research has demonstrated that self-control negatively predicts immersion among adolescents (Ko et al., 2021). Self-control is typically conceptualized as an “individual's motivation and capacity to inhibit or override a desire that stands in conflict with an endorsed self-regulatory goal or value” (Hofmann et al., 2017, p.5). Immersion reflects “a state of deep mental involvement” (Agrawal et al., 2020, p. 404). Furthermore, the effects of self-control and immersion in internet addiction manifest in different directions. Existing studies have illustrated that self-control is negatively related to digital addiction (Błachnio and Przepiorka,

2016; Li et al., 2021). In contrast, immersion has a positive impact on short video addiction (Tian et al., 2023; Yan et al., 2023). Besides, perceived stress has the most substantial effect on relaxation among users older than 25, indicating that managing stress and seeking relaxation are primary needs for this age group. Attitude toward short video content significantly affects addiction in younger users, but this effect is not significant for those aged over 25. The PLS-MGA results did not reveal significant differences between the age groups regarding the effects of perceived stress on social interaction, relaxing entertainment on attitude and immersion, and social interaction on immersion and attitude.

## 6 Implications

### 6.1 Theoretical implications

The empirical findings of the present study have two theoretical implications. First, this study introduces an E-CIU framework to elucidate users' addiction toward short video applications. Previous research has predominantly focused on explaining addictive behavior using a motivational approach, neglecting a comprehensive investigation into affective path. In our framework, we integrate both psychological (i.e., stress), compensatory motivations (i.e., social interaction and relaxing entertainment), and affective responses (i.e., immersion and attitude) into an extended model to examine the impact paths of stress on addictive behavior. Consequently, this research establishes an innovative theoretical framework for understanding the underlying mechanisms in the relationship between stress and short video addiction. Secondly, we conducted a detailed analysis of the intricate interplay between these influencing factors among different groups. The results of this study contribute to the short video addiction literature by highlighting that stress has a great influence on short video addiction among different age groups.

### 6.2 Practical implications

This research also has two key practical implications. Firstly, the study highlights the role of stress perception in contributing to short video addiction. The findings reveal that stress directly influences users' propensity for addiction to short videos. Stress affects users' affective experiences, which in turn indirectly influence their immersion in short video content. Given that short videos have become a significant outlet for stress relief in modern life, it is crucial for designers of these applications to implement features that help users monitor and manage their viewing time. Providing prompts or tools to encourage users to take breaks could address their need for intermittent disconnection.

Secondly, targeted interventions should be developed for different user groups. For adolescents, strategies could include limiting their mobile and short video viewing time to prevent excessive use. For college students, educational programs that raise awareness about the risks and consequences of short video addiction could enhance self-awareness and self-control. For working professionals, promoting effective time management and

encouraging alternative stress-relief activities, such as reading, exercising, or socializing, could help mitigate perceived stress and reduce reliance on short videos.

### 6.3 Limitations and further study

This study possesses certain limitations. Firstly, the quantitative methods employed in online surveys may not fully capture the comprehensive nature of users' short video addiction reasons in China. Future studies could consider using interviews and grounded theory to obtain a more systematic and profound understanding of the underlying reasons for users' addiction to short videos. Secondly, our sample predominantly comprised young individuals (aged 14–30), whereas China's short video users represent a diverse demographic with varying addictive inclinations across different age groups. In the future, it would be advantageous to recruit a broader and more diverse range of participants from various age groups (i.e., Gen X; Gen Y; Gen Z). Finally, the present study adopted a cross-sectional survey design, which presents challenges in establishing causal relationships between variables. Future research efforts could use long-term longitudinal studies to investigate the impact of these variables over time.

### Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

### Ethics statement

The studies involving humans were approved by The Ethics Committee of the Taofen School of Journalism and Communication, University of East China University of Political Science and Law. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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### Author contributions

HH: Writing – original draft, Supervision, Project administration, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. MH: Conceptualization, Formal Analysis, Methodology, Software, Visualization, Writing – review & editing.

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# The relationship between parental smartphone dependence and elementary students' internet addiction during the COVID-19 lockdown in China: the mediating role of parent-child conflict and the moderating role of parental roles

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During the COVID-19 lockdown in China, the shift of family members' work and study to online platforms accelerated internet proliferation and led to a growing prominence of internet addiction among younger age groups, posing a threat to individual and societal health development. Previous research has primarily focused on upper-grade elementary students, with relatively less attention given to younger age groups, resulting in insufficient representativeness of the elementary student samples. Additionally, research exploring how parental addictive behaviors are associated with the mechanisms of internet addiction among elementary students has been limited, which affects the development of scientifically based and effective intervention measures for addressing internet addiction in this population. This study, grounded in Family Systems Theory, explores the associative mechanisms between parental smartphone dependence and elementary students' internet addiction, specifically examining the mediating role of parent-child conflict and the moderating role of parental roles. Using a convenience sampling method, questionnaires were administered to parents from two elementary schools, resulting in 433 valid responses. Structural equation modeling analysis revealed that parental smartphone dependence is associated with elementary students' internet addiction and that this association is further influenced by the mediating role of parent-child conflict. Additionally, parental roles moderate the relationships between parental smartphone dependence and parent-child conflict, as well as between parent-child conflict and elementary students' internet addiction. Compared to mothers, fathers' smartphone dependence is more significantly correlated with parent-child conflict, and conflicts initiated by fathers are more strongly associated with elementary students' internet addiction. This may be related to China's traditional "male breadwinner, female homemaker" family culture. Mothers typically assume more parenting responsibilities and establish closer emotional bonds with their children, serving as a protective factor against internet addiction. Therefore, it is recommended that parents reduce smartphone dependence to avoid parent-child conflicts, and that fathers increase their involvement in parenting activities

to build stronger emotional connections with their children, thereby fostering healthier internet use behaviors among elementary students. The findings provide valuable insights for developing effective family-based interventions to address internet addiction in children.

#### KEYWORDS

smartphone dependence, internet addiction, COVID-19, parent–child conflict, parental role

## 1 Introduction

The prolonged spread of the COVID-19 pandemic has led to widespread changes in lifestyle, with home isolation becoming the primary response to avoid infection (Bozdağ, 2021). The transition of work and study from offline to online platforms has significantly increased the time parents and children spend with smartphones and internet devices. This shift has also heightened the risk of smartphone dependence and internet addiction among family members. On August 28, 2023, the China Internet Network Information Center (CNNIC) released the 52nd Statistical Report on Internet Development in Beijing, indicating that by June 2023, the number of internet users in China had reached 1.079 billion. Among these, 3.8% are under the age of 10, and 13.9% are aged 10 to 19 (China Internet Network Information Center, 2023). This highlights that elementary students (aged 6 to 12) have become a significant group of internet users. Early internet usage can enhance children's digital skills and contribute to the high-quality development of the digital society (China Internet Network Information Center, 2023). However, issues of elementary students' addiction to short videos and online games are also increasingly common (Kawabe et al., 2023). Internet addiction differs from traditional substance addiction; it falls under the category of behavioral addiction. Internet addiction is defined as a phenomenon where individuals exhibit behavior control problems due to prolonged inappropriate internet use, resulting in significant social and psychological impairment (Young, 1998). Internet addiction not only disrupts students' regular learning but can also positively predict suicidal ideation, posing serious threats to both individual and societal health (Mzumara, 2024; Shen et al., 2020). As elementary students are in a critical period for physical and psychological growth and habit formation, fostering healthy internet use behaviors in this group is of great importance for societal development. Understanding the factors associated with internet addiction among elementary students is crucial for informing the development of effective intervention measures. Previous studies have predominantly focused on internet addiction issues among students in fourth grade and above (Jo and Shin, 2004; Kalkim and Emlek Sert, 2021; Li et al., 2021), with relatively limited research on lower-grade students, resulting in insufficient representativeness for the entire elementary student population. This study encompasses elementary students from all grades and investigates the mechanisms associated with their internet addiction, aiming to address the shortcomings in existing research.

Family Systems Theory posits that an individual's behavior is closely related to the patterns of interaction within their family, with factors such as parental behavior, parenting styles, and parent–child relationships influencing children's behavioral habits (Cox and Paley, 1997; Johnson and Ray, 2016). During the COVID-19 lockdown, extended periods of close family interaction provided an opportunity

to explore these behavioral associations. The risk of parental smartphone dependence significantly increased during the pandemic lockdown (Ratan et al., 2021). Parental smartphone dependence has been shown to positively associated adolescent smartphone dependence (Gong et al., 2022), and there is a significant correlation between adolescent smartphone dependence and internet addiction (Ayar et al., 2017). However, evidence regarding whether parental smartphone dependence is related to internet addiction among elementary students remains insufficient. Additionally, parental smartphone dependence can disrupt the quality of parent–child interactions (Kildare and Middlemiss, 2017), and family conflict is a known risk factor for children's internet addiction (Bağatarhan et al., 2023). Whether parental smartphone dependence is related to internet addiction among elementary students through the mediating role of parent–child conflict requires further investigation. Moreover, according to Family Systems Theory (Cox and Paley, 1997), the different roles of parents within the family (father role and mother role) may be associated with varying degrees of correlation with children's behavior. Although existing research has yet to explore whether parental roles moderate the relationship between parental smartphone dependence and internet addiction among elementary students. Therefore, this study aims to explore the mechanisms by which parental smartphone dependence correlated with internet addiction among elementary students during the COVID-19 lockdown, with a particular focus on the mediating role of parent–child conflict and the moderating role of parental roles, based on Family Systems Theory. This research not only offers theoretical innovation but also provides practical insights for fostering healthy family relationships and online environments, thereby promoting the mutual growth of family members.

## 2 Literature review and research hypotheses

Family Systems Theory emphasizes that the behaviors and actions of family members have reciprocal influences on each other (Cox and Paley, 1997; Johnson and Ray, 2016). For elementary students, observing and imitating family members' behaviors is one of the key ways they learn. During the COVID-19 lockdown, parents spent extended periods of time with their children, making them important role models for their children's observational learning. During this period, it has become commonplace for parents to use smartphones for daily activities, work, and entertainment, which can lead to their dependence to smartphones. In psychology, mobile phone dependence is considered a psychological disorder. It is believed that mobile phone dependence is similar to common addictive behaviors, where excessive use of mobile phones for certain reasons leads to

physiological or psychological maladjustment in users. Alternatively, it may result from chronic or cyclical obsession caused by repeated use of mobile phones, creating a strong and sustained sense of demand and dependence (Tian and Zhou, 2023). While there is a correlation between smartphone use and the internet, and smartphone dependence shares certain similarities with internet addiction, smartphone dependence is also closely related to its inherent characteristics, such as portability and immediacy. To clarify the differences between the two, existing studies typically discuss smartphone dependence and internet addiction separately (Choi et al., 2015). In China, parents of elementary school students primarily use smartphones, while the students themselves usually do not own smartphones. They often access the internet through other devices, such as computers and smartwatches, in addition to occasionally using their parents' smartphones. When parents are engrossed in their smartphones, children may become curious about the content their parents are viewing. This curiosity may drive them to access the internet through various devices, leading them to imitate their parents' behaviors and potentially fall into similar patterns of addiction, ultimately resulting in internet addiction. Numerous studies have shown a significant correlation between parents' addictive behaviors and those of their children (Arteaga Gómez, 2020). For example, parents' smartphone dependence has been found to significantly associated with children's addiction to smart devices (Ayar et al., 2017; Mun and Lee, 2021). Based on this, the study proposes Hypothesis H1: Parents' smartphone dependence positively correlated with elementary students' internet addiction.

When parents are absorbed in their smartphones, they often neglect or overlook the people and events around them, which can deteriorate the quality of communication with their children (Gong et al., 2022). Positive parent-child interactions are considered important protective factors against internet addiction (Cai et al., 2021), whereas poor parent-child relationships may lead children to feel rejected, a sensation that is a potential risk factor for internet addiction (Qi et al., 2022). Research by Shayesteh Fard et al. (2016) indicates that children are more likely to become addicted to the internet when their parents exhibit rejection. Conflictual parent-child relationships may result in emotional deprivation in children, driving them to seek psychological compensation in the virtual world. Meta-analysis results also show a significant association between alienated parent-child relationships and a stronger preference for internet use (Zhu et al., 2022), which may lead to internet addiction. Based on this, the study proposes Hypothesis H2: Parents' smartphone dependence positively correlated with elementary students' internet addiction through the mediating role of parent-child conflict.

In every family system, different roles fulfill distinct tasks (Cox and Paley, 1997; Johnson and Ray, 2016). In this study, parental roles are categorized into father roles and mother roles based on gender differences. Traditionally, mothers have assumed greater responsibility for caring for their children (Kwok and Shek, 2010). In China, the deeply ingrained "male breadwinner, female homemaker" cultural ideology results in a division of labor in family caregiving. Fathers typically prioritize their careers and provide material support for the family, leading to less communication with their children, while mothers primarily manage the daily life and education of young children. In this cultural context, children often form stronger emotional bonds with their mothers (Leung and Shek, 2016), and such emotional connections are considered protective factors against

parent-child conflict and internet addiction (Xu et al., 2024; Zhou et al., 2022). Therefore, compared to fathers, mothers may trigger fewer parent-child conflicts due to their stronger emotional attachment with their children, even when exhibiting smartphone dependence. Although conflicts may arise between mothers and children, the mother's predominant caregiving role may lessen the child's sense of emotional deprivation, thereby reducing the risk of internet addiction. Additionally, despite maternal smartphone dependence, as the primary educators of young children, mothers are likely to place greater emphasis on guiding their children away from internet addiction, thus mitigating its occurrence. Based on this, the study proposes the following hypotheses: H3a: Parental role moderates the relationship between parental smartphone dependence and parent-child conflict; H3b: Parental role moderates the relationship between parent-child conflict and elementary students' internet addiction; H3c: Parental role moderates the relationship between parental smartphone dependence and elementary students' internet addiction.

The proposed research model is illustrated in Figure 1.

## 3 Methods

### 3.1 Participants

The study employed a convenience sampling method, selecting parents from two elementary schools in Shaoyang County, Hunan Province, as the research subjects. Data were collected through electronic questionnaires completed by the parents. A total of 501 questionnaires were collected, with 80 completed by fathers, 353 by mothers (coded as 1 for fathers and 2 for mothers), and the remaining 68 by other family members (such as grandparents and relatives). Based on the research objectives, 433 valid questionnaires were ultimately selected as the effective sample for the study. The detailed demographic characteristics are presented in Table 1.

### 3.2 Measurement tools

#### 3.2.1 Smartphone dependence

Smartphone dependence was assessed using the Smartphone Application-Based Addiction Scale (SABAS) developed by Csibi et al. (2018). This scale consists of 6 items that measure aspects such as excessive smartphone use, life interference, emotional fluctuations, and withdrawal symptoms (e.g., "I have had conflicts with my family or friends due to my smartphone usage"). The scale uses a Likert-6 point scoring method, where the sum of all item scores quantifies the level of smartphone dependence, with higher scores indicating stronger dependence tendencies. In this study, the Cronbach's alpha coefficient for this scale was 0.861.

#### 3.2.2 Parent-child conflict

Parent-child conflict was assessed using the Child-Parent Relationship Scale Short-Form developed by Pianta (1992). The original scale includes 15 items that cover two dimensions: close parent-child relationships and conflictual parent-child relationships. This study focused on the conflictual dimension, selecting 7 items (e.g., "I seem to always be struggling to cope with my child"). The scale uses a Likert-5

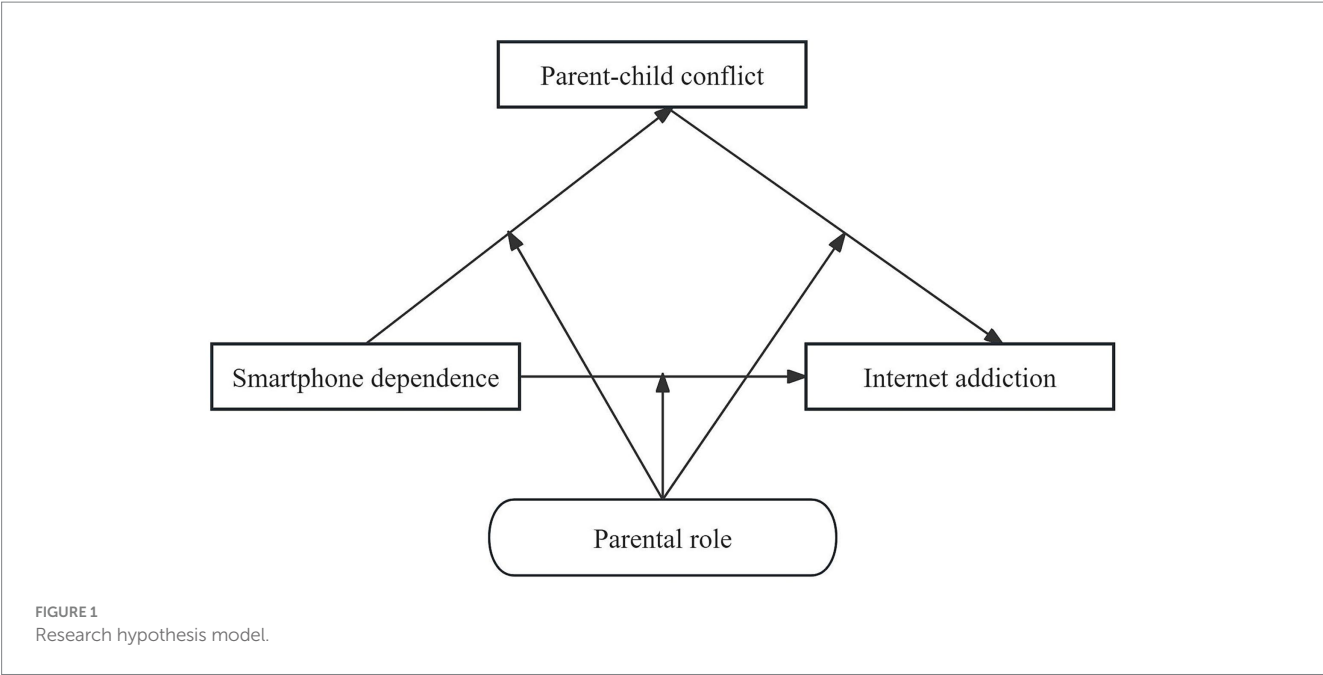


TABLE 1 Demographic profile of the sample (N = 433).

Demographic information	Classification	Frequency (number)	Percentage (%)
Parent roles	Father	80	18.5
	Mather	353	81.5
Child's gender	Male	234	54
	Female	199	46
Elementary grade	First grade	110	25.4
	Second grade	45	10.4
	Third grade	37	8.5
	Fourth grade	75	17.3
	Fifth grade	71	16.4
	Sixth grade	95	22

point scoring method, with parents evaluating their relationship with their child. The total score reflects the level of parent–child conflict, with higher scores indicating more severe conflict. In this study, the Cronbach's alpha coefficient for this scale was 0.809.

### 3.2.3 Internet addiction

Internet addiction in elementary students was assessed using the 8-item Diagnostic Questionnaire of Internet Addiction (IAD-DQ) developed by Young (1998), which is based on the DSM-IV criteria for pathological gambling. The original scale includes 8 items and uses a binary response format (yes/no), with a score of 5 or more considered indicative of internet addiction. However, Li et al. (2012) found that the binary response method with a cutoff score of 5 was unreliable. Therefore, this study used a Likert-5 point scoring method for measurement. Considering that younger elementary students may have difficulty understanding and responding to the questionnaire, parents were asked to rate their child's internet use behavior based on daily observations (e.g., “The child remains engrossed in online activities and feels dissatisfied after stopping”). Higher total scores

indicate stronger characteristics of internet addiction in the child. Previous studies have validated the reliability of the method using parental reports of children's behaviors (Yang et al., 2023). In this study, the Cronbach's  $\alpha$  coefficient of the scale was 0.883, indicating good internal consistency.

### 3.3 Survey procedure

Prior to the formal implementation of this study, the research methods were approved by the Ethics Committee of the School of Psychology at Central China Normal University. During the survey process, informed consent was first obtained from the school administrators, class teachers, and parents. The research team then created an electronic questionnaire using Tencent Survey, which was distributed to parents by the class teachers in a parent group. The survey interface provided detailed information about the purpose of the study, the content of the questionnaire, and instructions for completion. It was also emphasized that the questionnaire was

anonymous, all data would be used solely for scientific research, and personal privacy would be strictly protected. Parents were able to submit the completed questionnaire directly online. The data collection period was from December 2 to December 24, 2022, coinciding with the pandemic control measures in China.

### 3.4 Statistical analysis

Data organization and statistical analysis for this study were conducted using SPSS 23.0 and the PROCESS 3.5 macro. First, SPSS was used to analyze the distribution of each variable and calculate the correlations between them. Subsequently, PROCESS was employed to perform structural equation modeling.

## 4 Results

### 4.1 Test for common method bias

This study primarily used self-report measures to collect data, which might lead to common method bias. To address this issue, Harman's single-factor test was conducted using principal component factor analysis on all items of the variables before data analysis. The results indicated that there were seven factors with eigenvalues greater than 1, with the variance explained by the largest factor being 35.63%, which is below the critical value of 40% (Podsakoff et al., 2003). Therefore, it can be concluded that there is no significant common method bias in this study.

### 4.2 Correlation analysis

Table 2 presents the mean scores, standard deviations, and Pearson correlation matrix for the total scores of parents across the variables. The correlation analysis revealed significant positive correlations at the 0.001 level between parental smartphone dependence, parent-child conflict, and elementary students' internet addiction. Additionally, there are significant correlations between parental roles and smartphone addiction, as well as between parental roles and internet addiction among elementary students.

### 4.3 Test of the mediating effect of parent-child conflict

Following the mediation effect testing procedure, Model 4 was selected in the SPSS macro PROCESS to test the mediation effect. The

bias-corrected percentile Bootstrap method was employed with 5,000 resamples, using a two-tailed test to assess the model fit and the significance of the path coefficients. Specifically, parental smartphone dependence was set as the independent variable, elementary students' internet addiction as the dependent variable, and parent-child conflict as the mediator. The results are presented in Table 3, showing that the 95% confidence intervals did not include zero, indicating that parental smartphone dependence positively correlated with both parent-child conflict and elementary students' internet addiction. Furthermore, parent-child conflict positively correlated with elementary students' internet addiction, supporting Hypothesis H1. Additionally, the total effect value of the model was 0.63, with the indirect effect value of 0.11, and the relative effect of the mediation path was 17.5%, supporting Hypothesis H2.

### 4.4 Moderation effect test of parental roles

Based on PROCESS Model 59, parental roles were set as the moderating variable, with the child's grade and gender controlled as covariates. To ensure the reliability of the interaction analysis and reduce the bias caused by unequal sample distribution of parental roles, SPSS was used to standardize the four variables: parental smartphone dependence, parent-child conflict, elementary school students' internet addiction, and parental roles, converting them into standardized scores. Subsequently, the Bootstrap method was applied with 5,000 resamples to examine the moderating effect of parental roles. The results, as shown in Table 4, indicate that the interaction between parental smartphone dependence and parental roles is significantly negatively correlated with parent-child conflict ( $\beta = -0.11, p < 0.01$ ), but not significantly correlated with elementary students' internet addiction. This finding suggests that parental roles moderated the relationship between parental smartphone dependence and parent-child conflict, supporting Hypothesis H3a. However, parental roles did not moderate the relationship between smartphone dependence and elementary students' internet addiction, thus not supporting Hypothesis H3c. Additionally, the study found that the interaction between parent-child conflict and parental roles was significantly negatively correlated with elementary students' internet addiction ( $\beta = -0.13, p < 0.01$ ), indicating that parental roles moderated the path between parent-child conflict and elementary students' internet addiction, supporting Hypothesis H3b. The moderating effects under different conditions are shown in Table 5. For the father's role, the correlation coefficient between smartphone dependence and parent-child conflict is 0.60 ( $p < 0.001$ ); for the mother's role, the correlation coefficient between smartphone dependence and parent-child conflict is 0.31 ( $p < 0.001$ ). Furthermore, the correlation coefficient between father-induced parent-child conflict and elementary school students' internet addiction is 0.54, while the

TABLE 2 The mean, standard deviation, and correlation of research variables.

Variable	M	SD	1	2	3	4
1. Smartphone dependence	2.67	1.14	1			
2. Parent-child conflict	2.41	0.93	0.39***	1		
3. Internet addiction	2.11	0.88	0.61***	0.47***	1	
4. Parental role			-0.12*	-0.04	-0.24***	1

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

TABLE 3 Testing the mediation model of parent–child conflict.

Independent variable	Dependent variable	$R^2$	$\beta$	$t$	95%CI
Smartphone dependence	Parent–child conflict	0.15	0.37	8.78***	[0.29, 0.46]
Smartphone dependence	Internet addiction	0.43	0.52	12.77***	[0.44, 0.60]
Parent–child conflict			0.29	6.82***	[0.21, 0.38]
Indirect effect			0.11		[0.62, 0.16]

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

TABLE 4 Testing the moderating effect of parental role.

Independent variable	Parent–child conflict (dependent variable)			Internet addiction (dependent variable)		
	$\beta$	$t$	95% CI	$\beta$	$t$	95% CI
Smartphone dependence	0.36	8.01***	[0.27,0.45]	0.46	11.79***	[0.38,0.53]
Parent–child conflict				0.27	7.06***	[0.20,0.35]
Parental role	0.04	0.91	[−0.48;0.13]	−0.16	−4.57***	[−0.23, −0.09]
Int1	−0.11	−2.88**	[−0.19;−0.04]	0.02	0.46	[−0.06, 0.10]
Int2				−0.13	−2.93**	[−0.21, −0.42]
Elementary grade	−0.01	−0.25	[−0.05;0.04]	0.05	−2.83**	[0.02, 0.09]
child's gender	−0.17	−1.89	[−0.34;0.01]	0.18	2.51*	[−0.32, −0.04]
$R^2$	0.18			0.49		

Int1 = Smartphone dependence \* Parental role; Int2 = Parent–child conflict \* Parental role \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

TABLE 5 Effect sizes across different parental roles.

Independent variable	Dependent variable	Parental role	$\beta$	$t$	95%CI
Smartphone dependence	Parent–child conflict	Father's role	0.60	7.09***	[0.44, 0.77]
		Mother's role	0.31	5.99***	[0.21, 0.41]
Parent–child conflict	Internet addiction	Father's role	0.54	5.20***	[0.34, 0.75]
		Mother's role	0.22	5.31***	[0.21, 0.41]

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

correlation coefficient between mother-induced parent–child conflict and elementary school students' internet addiction is 0.22.

To visually present the moderation effect, simple slope graphs were plotted. Due to the transformation of variables through standardized coefficients, the mean values of parental smartphone dependence, parent–child conflict, and elementary school students' internet addiction are all 0, with a standard deviation of 1. As shown in Figure 2, when the father's smartphone dependence is at a low level (M-1SD), the standardized value of parent–child conflict is −0.70; whereas when the father's smartphone dependence is at a high level (M + 1SD), the standardized value of parent–child conflict increases to 0.50, the slope  $k$  is 0.6. Similarly, when the mother's smartphone dependence is at a low level (M-1SD), the standardized value of parent–child conflict is −0.30, and at a high level (M + 1SD), it is 0.31, the slope  $k$  is 0.305. This suggests that the father's smartphone dependence is associated with a greater likelihood of parent–child conflict compared to the mother's. As shown in Figure 3, when the father-induced parent–child conflict is at a low level (M-1SD), the standardized value of elementary school students' internet addiction is −0.20; when the father-induced parent–child conflict is at a high level (M + 1SD), the standardized value of internet addiction rises to 0.88, the slope  $k$  is

0.54. In contrast, when the mother-induced parent–child conflict is at a low level (M-1SD), the standardized value of internet addiction is −0.29, and at a high level (M + 1SD), it is 0.13, the slope  $k$  is 0.21. This further demonstrates that father-induced parent–child conflict is more likely to be related to elementary school students' internet addiction compared to the mother's. Furthermore, the index of moderated mediation (Index of Moderated Mediation) is −0.26, with a 95% confidence interval of [−0.42, −0.10], further confirming that parental roles moderate the mediating effect of parental smartphone dependence on elementary school students' internet addiction through parent–child conflict.

## 5 Discussion

### 5.1 Parental smartphone dependence positively correlated with elementary students' internet addiction

The study found that parental smartphone dependence directly correlated with elementary students' internet addiction, with an effect size of 0.50, supporting Hypothesis H1. This result not only validates

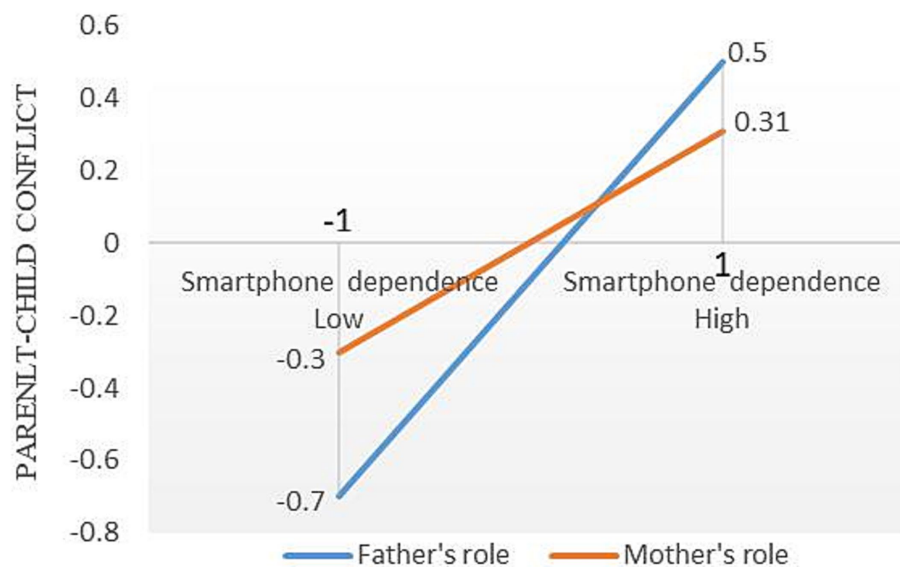


FIGURE 2

The slope plot of the moderating effect of parental roles on the relationship between parental smartphone dependence and parent–child conflict.

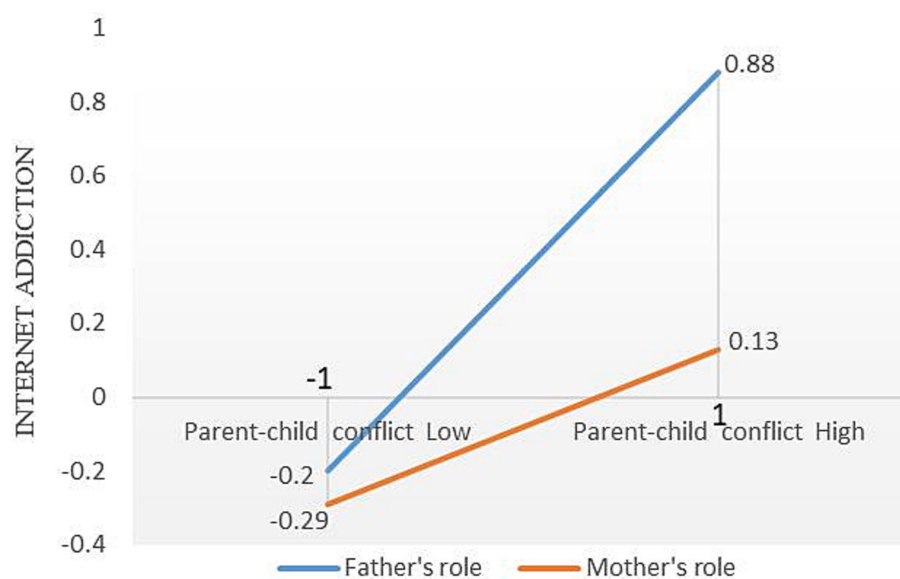


FIGURE 3

The slope plot of the moderating effect of parental roles on the relationship between parent–child conflict and elementary school students' internet addiction.

the Family Systems Theory, which posits that parents' behaviors significantly associated with their children's attitudes and behaviors (Cox and Paley, 1997), but also aligns with previous research findings that parental addictive behaviors positively correlated with children's addictive behaviors (Arteaga Gómez, 2020; Ayar et al., 2017). Particularly during the elementary school years, children are in a critical period for observational learning and habit formation. During the COVID-19 lockdown, with parents and children spending extended time together, parents served as crucial role models in the

development of children's problematic behaviors (Mun and Lee, 2021). Therefore, to prevent internet addiction in elementary students, parents should first reduce their dependence on smartphones to avoid setting a negative example for their children. Engaging in alternative parent–child activities, such as reading together, participating in physical exercises, and playing games, can effectively reduce the time spent on smartphones or the internet within the family, thereby lowering the risk of addictive behaviors in children. These alternative activities not only help strengthen parent–child relationships but also

provide a healthy environment for children's development, further reducing their reliance on the internet.

## 5.2 Parental smartphone dependence positively correlated with elementary students' internet addiction through parent–child conflict

Here found that parental smartphone dependence can also correlated with elementary students' internet addiction through parent–child conflict, supporting Hypothesis H2. This result is consistent with previous research, which suggests that parental smartphone dependence associated with the quality of parent–child relationships (Huang et al., 2021; Mun and Lee, 2021), and that the quality of these relationships is closely related to children's addictive behaviors (Gong et al., 2022; Qi et al., 2022). Parental smartphone dependence not only sets a poor behavioral example but may also lead to neglect of communication with their children as they focus on their devices, failing to meet the emotional needs of the children. This communication barrier may deteriorate the parent–child relationship, potentially leading to conflicts. These conflicts further exacerbate the children's negative emotions, pushing them to rely more on the online world to compensate for emotional voids, thereby intensifying their internet addiction (Duchesne et al., 2017; Seidman, 2013; Wong et al., 2015). Therefore, parents need to be mindful of their smartphone dependence and should focus on effective communication with their children to establish a healthy parent–child relationship, reducing the risk of internet addiction caused by emotional deprivation. This is particularly crucial in stressful family situations, such as during the COVID-19 lockdowns, when parents and children are confined together at home, potentially heightening anxiety and leading to parent–child conflicts. In such cases, parents should engage in activities that maintain a warm parent–child relationship and alleviate negative emotions, thereby reducing the likelihood of children turning to smartphones or the internet for emotional solace.

## 5.3 The moderating role of parental roles

The study also found that parental roles moderated the pathways between parental smartphone dependence and parent–child conflict, as well as between parent–child conflict and elementary students' internet addiction, supporting Hypotheses H3a and H3b. This result validates the family Systems Theory's perspective that different family members, with varying roles and responsibilities, have differential impacts on each other (Cox and Paley, 1997). The study shows that although both parental smartphone dependence and parent–child conflict positively correlated with children's internet addiction. However, compared to mothers, fathers' smartphone dependence is more likely to be associated with parent–child conflicts, and father-induced conflicts show a stronger correlation with internet addiction among elementary school students. This finding is innovative. This phenomenon may be related to traditional Chinese family culture. In Chinese families, mothers typically take on the primary responsibility for daily child-rearing, thus they are more attuned to their children's needs and form close emotional bonds with them. Even if mothers exhibit smartphone dependence, they may still fulfill their

child-rearing duties and maintain emotional trust with their children. As a result, even in the presence of parent–child conflict, children may still feel cared for by their mothers, which reduces the likelihood of developing internet dependence. On the other hand, fathers, who may have fewer opportunities to participate in child-rearing, often fail to establish strong, intimate relationships with their children. Therefore, fathers' smartphone dependence tends to be more closely associated with parent–child conflict, and this conflict is linked to a higher likelihood of children's internet addiction. This suggests that in family education, it is crucial to encourage both parents to equally share in child-rearing responsibilities and to build close relationships with their children as a protective factor against negative behaviors.

However, the study did not confirm that parental roles moderated the direct pathway between parental smartphone dependence and elementary students' internet addiction, thus not supporting Hypothesis H3c. This suggests that parental smartphone dependence, whether by the father or the mother, is similarly associated with children's internet addiction. This finding aligns with previous research, which has shown that parental smartphone dependence significant correlation with children's addictive behaviors (Gong et al., 2022). Therefore, both parents should be vigilant about their smartphone dependence and avoid setting poor examples for their children.

## 5.4 Significance of the study

Internet addiction poses a significant threat to the healthy development of elementary students. With the widespread use of the internet, internet addiction among elementary students has gradually become one of the major challenges faced by contemporary education. However, systematic discussion and in-depth research targeting this specific group remain relatively scarce. This study focuses on the elementary student population and broadens the sample scope, aiming to gain a more comprehensive understanding of and response to this pressing issue, which holds significant practical implications. Furthermore, compared to schools and society, the family environment exerts a more direct and profound influence on the growth of elementary students. Based on Family Systems Theory, this study explores how parental smartphone dependence behaviors impact elementary students' internet addiction within the context of prolonged family cohabitation during the COVID-19 lockdown. This research not only tests and enriches the application of Family Systems Theory in the study of internet addiction among elementary students but also provides empirical results that can provide parents with a scientific reference for family education guidance to prevent internet addiction among elementary students. Given the universal nature of the research issues, the findings also hold significant reference value in non-pandemic contexts.

## 5.5 Limitations and future directions

This study has several limitations that need to be addressed. First, the gender distribution of parents in the sample was uneven, with a higher number of mothers participating. This imbalance may have introduced data bias, reflecting characteristics specific to the mother's role. Future research should aim to increase the sample size of fathers

to validate the robustness of the findings. Second, this study primarily employed a cross-sectional design to explore the relationship between parental smartphone dependence and internet addiction among elementary students, which only allows for the establishment of correlations. Future longitudinal research could be conducted to better establish causal relationships. Finally, future studies should explore effective interventions for internet addiction in elementary students from multiple dimensions, including parental smartphone dependence and parent–child conflict. Such research would provide stronger empirical support for scientifically guiding family education and hold significant practical value for broader applications.

## 6 Conclusion

The empirical research revealed that during China's COVID-19 lockdown, parental smartphone dependence not only positively correlated with internet addiction among elementary students but also this relationship was further associated with parent–child conflict as a mediating factor. Additionally, the parental role moderated the relationships between smartphone dependence and parent–child conflict, as well as between parent–child conflict and elementary students' internet addiction. Compared to mothers, fathers' smartphone dependence was more closely associated with parent–child conflict, and such conflict initiated by fathers more significantly linked to internet addiction in elementary students.

## Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/supplementary material.

## Ethics statement

The studies involving humans were approved by Ethics Committee of the School of Psychology, Central China Normal University. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin in accordance with the local legislation and institutional requirements. This study was conducted using an electronic

questionnaire. On the first page of the questionnaire, we clearly explained the purpose of the research and informed participants that all data would be used solely for academic purposes, handled with strict confidentiality, and collected anonymously. The questionnaire did not include any sensitive information, and the participant group did not involve minors or other vulnerable populations. Therefore, a waiver of written informed consent was obtained.

## Author contributions

CL: Data curation, Funding acquisition, Methodology, Resources, Writing – original draft, Writing – review & editing. JL: Investigation, Resources, Writing – review & editing, Data curation. YW: Investigation, Writing – review & editing, Resources, Data curation. SL: Methodology, Validation, Writing – original draft.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Perceived discrimination as a predictor of cyberbullying: the mediating role of self-esteem and moderating role of self-compassion

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With the popularity of the internet, cyberbullying has emerged as an increasingly serious social issue, particularly affecting college students' behavioral health. This study explores the relationship between perceived discrimination and cyberbullying, as well as the mediating role of self-esteem and the moderating role of self-compassion (SC) in this relationship. Using a longitudinal design, data were collected from 892 Chinese college students (414 females, 478 males) in two waves spanning 1 year. The present study measured the compassionate self-responding (CS) and reduced uncompassionate self-responding (RUS) as the two dimensions of self-compassion. The study found that (1) perceived discrimination was significantly and positively correlated with cyberbullying ( $r = 0.085$ ,  $p < 0.05$ ); (2) self-esteem mediated the relationship between perceived discrimination and cyberbullying (Indirect effect = 0.010, SE = 0.004, Boot 95% CI [0.003, 0.019]); (3) RUS moderated both the direct relationship between perceived discrimination and cyberbullying ( $b = -0.045$ , SE = 0.019, 95% CI [-0.082, -0.008]) as well as the indirect relationship through self-esteem ( $b = -0.081$ , SE = 0.033, 95% CI [-0.146, -0.015]). Simple slope analysis revealed that college students with high RUS exhibited less cyberbullying when facing discrimination, while those low in RUS were more likely to engage in cyberbullying. The SC exhibited similar moderating effects, but CS did not demonstrate significant moderating effects in those relationships. This study sheds light on the complex interplay between perceived discrimination, self-esteem, self-compassion, and cyberbullying and offers novel insights into the psychological mechanisms underlying cyberbullying among college students. The findings underscore the importance of interventions aimed at enhancing self-esteem and fostering self-compassion, particularly by addressing uncompassionate self-responding, as a strategy to prevent cyberbullying among disadvantaged college students.

## KEYWORDS

perceived discrimination, cyberbullying, self-esteem, self-compassion, compassionate self-responding, reduced uncompassionate self-responding, longitudinal study

## Introduction

With the continuous rise in internet penetration, people enjoy the convenience of online social interactions and also face the potential threat of cyberbullying. Cyberbullying can lead to a range of physical and mental health problems in victims, such as depression, suicidality, and anti-social behavior (Bansal et al., 2023; Wolke and Lereya, 2015). Cyberbullying refers to an aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself (Smith et al., 2008). College students' lives are highly dependent on electronic devices, and using online social networks has become one of their primary methods of socializing. This dependency increases their susceptibility to becoming victims of the harms associated with virtual, anonymous, and instantaneous cyberbullying through social media, or even potential perpetrators (Shaikh et al., 2021). Although numerous studies have explored the negative effects of cyberbullying on the global health and well-being of victims, there has been limited research into potential predictors of why and when young people are more likely to become involved in cyberbullying. This research explored how social class-based discrimination links to cyberbullying among college students over time, providing critical insights for developing interventions to reduce cyberbullying behaviors among youth experiencing discrimination.

## Perceived discrimination among college students

It is essential to understand the role of specific social circumstances in cyberbullying among college students. Studies on the predictive factors of cyberbullying have shown that socioeconomic status, peer norms, and parental educational levels are significant influences (Bullo and Schulz, 2022; Lapierre and Dane, 2020; Uludasdemir and Kucuk, 2019). However, research is lacking on the risk factors of social circumstances related to cyberbullying behavior among college students (Peterson and Densley, 2017; Shaikh et al., 2021). A considerable number of young people are likely to face significant social challenges, such as perceived discrimination, due to being in the transitional phase of their social roles (Wu et al., 2022). For example, the rising cost of higher education is forcing many young people to rely on student loans to cover tuition fees and increasing their financial burden (Avery and Turner, 2012; Britt et al., 2017; Xiao et al., 2020). Meanwhile, as socioeconomic inequalities and structural barriers impede social mobility, the job market is becoming increasingly competitive, making it difficult for many students to secure satisfactory employment (Changjun and Liping, 2019; Chu et al., 2020). These factors contribute to a perception of social class discrimination among young people and lead them to a sense of greater inequality and differential treatment in their lives and career development. Facing severe social challenges, young people are more likely to use social networks covertly to express their dissatisfaction and compensate for what they feel is lacking in their offline social activities.

Frustration-aggression hypothesis (Berkowitz, 1989) provides theoretical support to understand the relationship between perceived discrimination and cyberbullying. Berkowitz (1989) argued that frustration can generate a tendency towards aggressive behavior because it instils aversive feelings and restricts people from achieving

their goals. Even in situations not involving direct and personal discrimination, such as perceived disadvantages associated with socioeconomic status or race, people may still exhibit aggressive behavior. These arguments are supported by numerous empirical findings that perceived racial discrimination is positively related to aggressive behavior among youth (Burt et al., 2012; Hautala and Sittner, 2019). An empirical study by Bedrosova et al. (2022) demonstrated that both individual-based discrimination (e.g., related to physical characteristics such as height or weight) and group-based discrimination (e.g., linked to family origin) were significantly associated with increased cyberbullying behaviors among adolescents. Moreover, a longitudinal study indicated that socioeconomic status disadvantage can predict higher aggressive behavior 1 year later (Santiago et al., 2011). However, to the best of our knowledge, there is no direct empirical evidence for a longitudinal relationship between perceived discrimination and cyberbullying. To address this gap in the literature, the current study explores the association between perceived discrimination and cyberbullying, proposing the following hypothesis:

*Hypothesis 1: Perceived discrimination is significantly associated with higher rates of cyberbullying among students who experience social discrimination.*

## Roles of self-esteem and self-compassion

Studies have indicated that frustration, such as that stemming from discriminatory experience, can produce compliance with social norms rather than aggression (Leander et al., 2020), and others have suggested that the mechanism of the relationship between frustration and aggression needs further exploration (Berkowitz, 1989; Hautala and Sittner, 2019). The self-evaluation maintenance theory suggests that individuals strive to maintain a positive self-concept, and when their self-image was threatened (e.g., by perceived discrimination), they may resort to externalizing behaviors to restore their sense of self-worth (Tesser, 1988). As a global evaluation of a person's own value and capacity, self-esteem may serve as a potential pathway to understand the complex relationship between perceived discrimination and cyberbullying. Low self-esteem is one of the outcomes most commonly associated with discrimination (Alsawalqa, 2021; Zhang et al., 2023). Moreover, Baumeister et al. (1996) suggested that aggression occurs when an individual's self-evaluation is threatened by negative evaluations from others, such as through discrimination. Self-esteem reflects an individual's subjective assessment of their important social relationships. Respect and a sense of belonging from others were fundamental psychological needs (Kruglanski et al., 2023; Liu et al., 2024). When these needs are frustrated, particularly by external rejection or insult, the individual's self-esteem was threatened, triggering feelings of anger and hostility towards others. Thus, individuals perceive a threat to their self-esteem, they may adopt defensive or aggressive behaviors to protect and recover it.

Research has indicated that perceived discrimination can damage self-esteem and then increase online bullying behavior (Lei et al., 2020). However, the relationship between self-esteem and cyberbullying is complex (Shi et al., 2017). On the one hand, studies have indicated a negative correlation between self-esteem and

cyberbullying (Ding et al., 2018). On the other hand, other researchers contend that this correlation is positive, suggesting that individuals with higher self-esteem are more likely to engage in cyberbullying (Fan et al., 2019). As a trait-like individual characteristic, self-esteem comprises both stable and unstable components (Braun et al., 2021). This implies that the relationship between self-esteem and cyberbullying may be affected by other factors (Lei et al., 2020). Thus, the present study further explores the role of self-esteem in the relationship between perceived discrimination and cyberbullying, specifically by examining when threats to self-esteem become linked to cyberbullying. We propose the following hypothesis:

*Hypothesis 2: The positive effect of perceived discrimination on cyberbullying is mediated by self-esteem.*

Self-compassion has been found to weaken the association between a frustrating situation and cyberbullying perpetration (Geng and Lei, 2021). Self-compassion, defined as compassion for one's own suffering, is an effective approach to managing distressing thoughts and emotions and can promote mental and physical well-being (Neff, 2023). According to stress coping theory, individuals adopt different coping styles when confronted with stressful situations (Lazarus, 1993). As a positive coping strategy, self-compassion can mitigate aggression resulting from discrimination. College students can experience self-indifference and self-doubt due to unfair treatment (Wondra and McCrea, 2022), but self-compassion can help mitigate the negative effect of discriminatory experiences and protect their emotional well-being in tough social situations (Li et al., 2022). Accordingly, when the degree of negative emotion stimulated by a frustrating experience (e.g., discrimination) is reduced, an individual's tendency towards aggression may also weaken. Furthermore, the association between damaged self-esteem and cyberbullying can also be moderated by self-compassion. Recent empirical studies have shown that self-compassion can decrease cyberbullying perpetration among college students and enhance the psychological functioning of young people with low self-esteem who encounter stigma or discrimination (Langford et al., 2022). In line with these previous findings, we propose that self-compassion buffers the direct association between perceived discrimination and cyberbullying and moderates the indirect association between perceived discrimination and cyberbullying through self-esteem.

*Hypothesis 3: The positive relationship between perceived discrimination and cyberbullying is weaker among college students with high levels of self-compassion than among those with low levels of self-compassion.*

*Hypothesis 4: The positive effect of perceived discrimination on cyberbullying through low self-esteem is weaker among college students with high levels of self-compassion than among those with low levels of self-compassion.*

Furthermore, the moderating role of different components of self-compassion remains underexplored in the literature. Recent studies have introduced a new framework that divides self-compassion into two components that distinguish the positive and reduced negative aspects of self-compassion: compassionate self-response (CS) (self-kindness, common humanity, mindfulness) and reducing

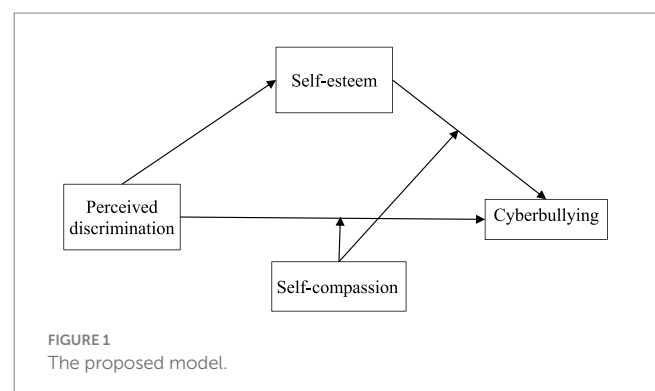
uncompassionate responses (RUS) (self-judgment, isolation, over-identification) (Neff et al., 2018). Although CS and RUS have been shown to alleviate mental health problems and enhance healthy psychological functioning (Germer and Neff, 2013; Raes, 2011), RUS is more strongly linked to self-evaluation than CS (Neff et al., 2018). Individuals with low self-esteem often struggled with social connections, leading to poor social adaptation and increased aggression (Hirschi, 1969). Uncompassionate self-responding, characterized by dehumanization, allowed individuals to minimize the severity of their bullying behavior and avoid self-sanctions, increasing the likelihood of online aggression (Runions et al., 2019). Reducing uncompassionate self-responding is crucial for mitigating the impact of low self-esteem on online bullying.

Reducing uncompassionate responses is more likely to help break the vicious cycle of negative self-evaluation and self-criticism, which in turn decreases an individual's aversive feelings and consequently reduces cyberbullying (Ding et al., 2018). An empirical study showed that CS and RUS differed in their moderating effects on the relationship between perceived discrimination and psychopathological outcomes (Li et al., 2022). To summarize, the present study examines the moderating effects of SC, RUS, and CS on the indirect and direct relationships between perceived discrimination and cyberbullying (the proposed model is shown in the Figure 1).

## Method

### Participants and procedure

We distributed 1,000 questionnaires to eligible participants, and received 909 (90.9%) completed responses at the first survey. During the T2 data collection, 17 students failed to return their answers. Finally, data were collected from 892 university students (414 females and 478 males) across two survey waves with a one-year interval. We recruited eligible participants (full-time undergraduates aged 18 years and over) through the student affairs officers at a university in Guangdong Province, China. We excluded students who were on leave of absence or unable to provide informed consent. These criteria were chosen to ensure the study population represented actively enrolled undergraduates while minimizing potential biases associated with irregular academic status. The average age of the participants at the baseline survey was 20.47 years ( $SD = 1.37$ ). The educational attainment of 26.7% of the participants' fathers and 46.9% of their mothers was primary school or below. Their average family monthly



income was RMB 6522. The research procedures performed in this study involving human participants were approved by the Institutional Review Board of the XXX University.

Participants were recruited through convenience sampling, with student affairs officers distributing invitations during university events to ensure accessibility. Retention strategies included clear instructions, regular follow-ups, practice credits for academic purposes, and assurances of confidentiality. Data collection occurred in September 2020 (T1) and September 2021 (T2), allowing for a 1-year interval to capture meaningful changes in variables like self-esteem while minimizing bias and fatigue. Data collection was conducted face-to-face during designated university activities for two waves (T1 and T2). To address missing data, we conducted a demographic and baseline analysis comparing participants who completed all three waves with those who dropped out, finding no significant differences. In present study, missing data were handled using full information maximum likelihood (FIML) estimation.

## Measures

The demographic variables (age, gender, parents' educational level, and household income) were assessed in the baseline survey. Moreover, the subjective socioeconomic status (SSES) of participants was measured by a visual scale with 10-rung ladders (Cheng et al., 2013).

### Perceived discrimination

Perceived discrimination was assessed using the 6-item Perceived Discrimination Scale (Shen et al., 2009). Participants reported their perceived discrimination on a 5-point Likert scale (ranging from 1 = *strongly disagree* to 5 = *strongly agree*). An example item is "I feel that people treat me differently because of my family social class background." The mean score of all items was calculated, with a high score representing a higher level of perceived discrimination. In the present study, Cronbach's  $\alpha$  of the scale was 0.89.

### Self-compassion

Participants' self-compassion was assessed by The Chinese version of the Self-Compassion Scale, with 26 items (Chen et al., 2011; Neff, 2003). The participants responded on their feelings of inadequacy or suffering experience on a 5-point Likert scale (ranging from 1 = *almost never* to 5 = *almost always*). The self-compassion scale consists of six dimensions: self-kindness, common humanity, mindfulness, self-judgement, isolation, and over-identification. The CS score was the mean of self-kindness, common humanity, and mindfulness. The scores for items on the self-judgement, isolation, and over-identification subscales were reverse-coded and their mean scores were calculated as the RUS score. The overall self-compassion (SC) score was taken as the mean score of all items. High RUS, CS, and SC scores indicated higher levels of the corresponding variables. In the present study, Cronbach's  $\alpha$  of SC, CS, and RUS was 0.83, 0.87, and 0.86, respectively.

### Self-esteem

Participants' self-esteem was measured using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), a widely validated instrument across cultural contexts, including China. Studies have demonstrated the scale's reliability and validity in Chinese populations (e.g., Li et al., 2019), with comparable factor structures and internal consistency. In

this study, participants rated their agreement with 10 items (e.g., "On the whole, I am satisfied with myself") on a 4-point Likert scale (1 = *strongly disagree* to 4 = *strongly agree*). Five items were reverse-coded, and higher total scores indicated higher self-esteem. Cronbach's  $\alpha$  for this scale in our study was 0.84.

## Cyberbullying

Cyberbullying was assessed using the Cyber Aggression Scale (Kurek et al., 2019). Participants rated the frequency of specific online behaviors over the past month (e.g., "Posted something online about someone else to make others laugh") on a 5-point Likert scale (1 = *never* to 5 = *7 or more times*). To ensure its cultural applicability, we conducted a confirmatory factor analysis, which confirmed the one-factor model's fit (RMSEA = 0.08, CFI = 0.97, TLI = 0.95, SRMR = 0.02). Cronbach's  $\alpha$  for this scale in our study was 0.88, demonstrating strong reliability in the Chinese context.

## Data analyses

Harman's single factor test was conducted to examine whether common method bias was a serious issue in the present study. The results of an exploratory factor analysis showed that the extracted first component accounted for 23.57% of the total variance, which indicated that the common method bias was not severe.

Descriptive statistics were generated and correlation analyses performed to describe the demographic information of the participants and examine the bivariate correlations among the variables of interest. To further investigate the hypothesized moderated mediation model, a series of analyses were performed using the SPSS PROCESS macro (Hayes, 2013).

First, the mediating role of self-esteem in the relationship between perceived discrimination and cyberbullying was examined using the PROCESS macro (Model 4) and bootstrapping approaches (Hayes and Preacher, 2014). This model was chosen because it directly evaluates the indirect effect of the perceived discrimination on the cyberbullying via the self-esteem. The indirect relationship between perceived discrimination and cyberbullying through self-esteem was considered significant if the bootstrapped 95% confidence intervals (boot 95% CIs) did not include zero (Aiken et al., 1991).

Second, the moderated mediation effect was examined using the PROCESS macro (Model 15). This model was selected because it allows for the investigation of whether the mediation effect was conditional on a moderator. Demographic variables (age, gender, health, SSES) at T2 were controlled in the analysis. The conditional indirect effect analysis to examine whether the direct and indirect effect of perceived discrimination on cyberbullying significantly differed at high (mean + 1 standard deviation) and low (mean - 1 standard deviation) levels of each moderator (CS, RUS, SCS). Additionally, a simple slope analysis was conducted to explore the nature of the moderation models.

## Results

### Bivariate correlation analysis

The descriptive information and bivariate correlations among the key variables are presented in Table 1. Perceived discrimination (PD)

TABLE 1 Descriptive statistics and bivariate correlation analysis.

Variable	Mean	SD	PD (T1)	RUS (T2)	CS (T2)	SC (T2)	S-E (T2)	CB (T2)
PD (T1)	2.545	0.754	—					
RUS (T1)	2.935	0.539	−0.498***	—				
CS (T1)	3.464	0.495	−0.140***	0.017	—			
SC (T1)	3.199	0.369	−0.458***	0.742***	0.683***	—		
S-E (T2)	2.888	0.453	−0.331***	0.424***	0.339***	0.514***	—	
CB (T2)	1.073	0.260	0.085*	−0.098**	−0.028	−0.086*	−0.118**	—

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ; T1, Time 1; T2, Time 2; PD, perceived discrimination; S-E, self-esteem; CS, compassionate self-response; RUS, reduced negative self-responding; SC, self-compassion; CB, cyberbullying.

TABLE 2 Multiple regression analysis.

	Model 1			Model 2		
	Outcome: S-E (T2)			Outcome: CB (T2)		
	<i>B</i>	Boot SE	Boot 95% CI	<i>B</i>	Boot SE	Boot 95% CI
Gender	0.027	0.028	[−0.029, 0.082]	0.067***	0.017	[0.033, 0.101]
Age	0.011	0.010	[−0.008, 0.031]	0.005	0.006	[−0.007, 0.017]
SSES	0.078***	0.012	[0.054, 0.102]	0.002	0.008	[−0.013, 0.017]
PD (T1)	−0.173***	0.020	[−0.212, −0.135]	0.017	0.012	[−0.007, 0.041]
S-E (T2)				−0.061**	0.020	[−0.100, −0.021]
<i>F</i>	39.174***			6.444***		
<i>R</i> <sup>2</sup>	0.150			0.035		

Total effect = 0.028, SE = 0.01, 95% CI [0.004, 0.051]. Direct effect = 0.017, SE = 0.012, 95% CI [−0.007, 0.041]. Indirect effect = 0.010, SE = 0.004, Boot 95% CI [0.003, 0.019]. \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ; number of bootstrap samples = 5,000; SSES, subjective socioeconomic status; PD, perceived discrimination; S-E, self-esteem; CB, cyberbullying.

at T1 was positively associated with cyberbullying (CB) at T2 and negatively associated with self-esteem (S-E), CS, RUS, and SC at T2. The result suggests that individuals who perceive higher levels of discrimination are more likely to experience threats to their self-esteem and engage in cyberbullying.

Moreover, CB at T2 was negatively associated with S-E, CS, RUS, and SC at T2, while was not significantly associated with age and SSES. The finding indicates that higher levels of cyberbullying behaviors were associated with lower self-esteem and lower self-compassion. Additionally, the results of Spearman correlation analysis showed that CB was positively associated with gender ( $r = 1.115$ ,  $p < 0.001$ ; male = 1). The finding indicates that males were more likely to engage in cyberbullying than females.

### Mediation analysis

Table 2 presents the results of the mediation analysis. After controlling for age, gender, health, and SSES, the results of Model 1 showed that PD at T1 negatively predicted self-esteem at T2 ( $B = -0.173$ ,  $SE = 0.020$ , Boot 95% CI [−0.212, −0.135]), and the results of Model 2 showed that S-E at T2 negatively predicted CB at T2 ( $B = -0.061$ ,  $SE = 0.020$ , Boot 95% CI [−0.100, −0.021]). The findings indicated that the total effect of PD at T1 on CB at T2 was significant (total effect = 0.028,  $SE = 0.001$ , Boot 95% CI [0.004, 0.051]). Moreover, the indirect effect of PD at T1 on CB at T2 through S-E at T2 was significant (indirect effect = 0.009,  $SE = 0.003$ , Boot 95%

CI [0.003, 0.019]), although the direct effect of PD at T1 on CB at T2 was non-significant (direct effect = 0.017,  $SE = 0.012$ , 95% CI [−0.007, 0.041]).

### Test of moderated mediation model

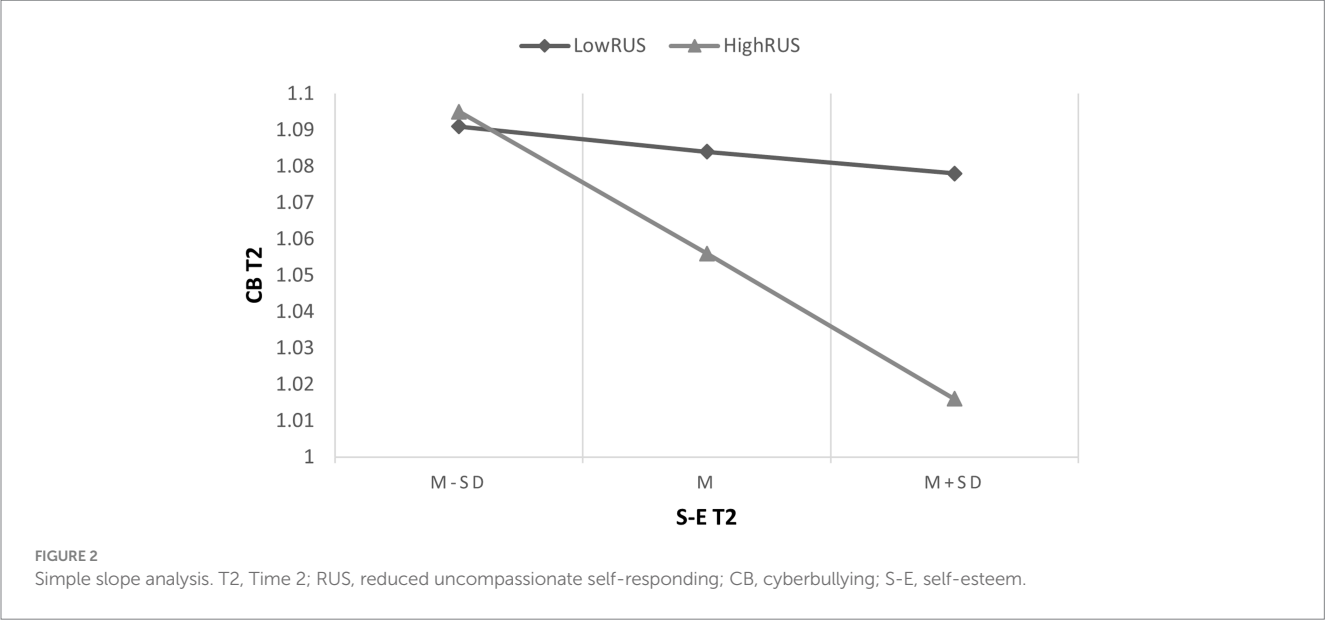
The PROCESS macro (Model 15) was used to examine the hypothesized moderated mediation model, and the results are shown in Table 3. First, the interaction between RUS at T1 and PD at T1 had a significant effect on CB at T2 ( $B = -0.045$ ,  $SE = 0.019$ , 95% CI [−0.082, −0.008]), indicating that RUS at T1 significantly moderated the direct association between PD at T1 and CB at T2. Moreover, the interaction between RUS at T1 and S-E at T2 had a significant effect on CB at T2 ( $B = -0.081$ ,  $SE = 0.033$ , 95% CI [−0.146, −0.015]), indicating that RUS at T1 significantly moderated the indirect association between PD at T1 and CB at T2 through S-E at T2. According to the result of the conditional direct effect analysis, compared with individuals with low levels of RUS at T1 (i.e., the level of RUS at  $M - 1SD$ ), the indirect effect of PD at T1 on CB at T2 through S-E at T2 was weaker among individuals with high levels of RUS at T1 (i.e., the level of RUS at  $M + 1SD$ ). The result of simple slope analysis is shown in Figure 1.

Second, the results of Model 5 are shown in Table 3. The interaction between SC at T1 and PD at T1 had a significant effect on CB at T2 ( $B = -0.076$ ,  $SE = 0.031$ , 95% CI [−0.137, −0.014]), indicating that SC at T1 significantly moderated the direct

TABLE 3 Moderated mediation model.

	Outcome: CB (T2)		
	<i>B</i>	SE	95% CI
Model 3			
PD (T1)	0.008	0.014	[−0.019, 0.035]
RUS (T1)	−0.023	0.020	[−0.062, 0.016]
S-E (T2)	−0.051*	0.021	[−0.092, −0.010]
RUS (T1) × PD (T1)	−0.045*	0.019	[−0.082, −0.008]
RUS (T1) × S-E (T2)	−0.081*	0.033	[−0.146, −0.015]
Model 4			
PD (T1)	0.021	0.013	[−0.003, 0.046]
CS (T1)	0.006	0.019	[−0.031, 0.043]
S-E (T2)	−0.058**	0.021	[−0.099, −0.017]
CS (T1) × PD (T1)	−0.011	0.021	[−0.052, 0.030]
CS (T1) × S-E (T2)	−0.027	0.035	[−0.096, 0.043]
Model 5			
PD (T1)	0.017	0.013	[−0.009, 0.043]
SC (T1)	−0.017	0.028	[−0.075, 0.036]
S-E (T2)	−0.051*	0.022	[−0.095, −0.008]
SC (T1) × PD (T1)	−0.076*	0.031	[−0.137, −0.014]
SC (T1) × S-E (T2)	−0.103*	0.044	[−0.189, −0.017]

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ; T1, Time 1; T2, Time 2; PD, perceived discrimination; S-E, self-esteem; CS, compassionate self-response; RUS, reduced negative self-responding; SC, self-compassion; CB, cyberbullying.



association between PD at T1 and CB at T2. Moreover, the interaction between SC at T1 and S-E at T2 had a significant effect on CB at T2 ( $B = -0.103$ ,  $SE = 0.044$ , 95% CI  $[-0.189, -0.017]$ ), indicating that SC at T1 significantly moderated the indirect association between PD at T1 and CB at T2 through S-E at T2. According to the results of the conditional direct effect analysis, compared with individuals with low levels of SC at T1 (i.e., the level of SC at  $M - 1SD$ ), the indirect effect of PD at T1 on CB at T2 through S-E at T2 was weaker among individuals with high levels of SC at T1 (i.e., the level of SC at  $M + 1SD$ ). The simple slope analysis is shown in Figures 2, 3. Additionally, the results of Model 4 indicated that the moderating effect of CS at T1 on the direct and indirect association between PD at T1 and CB at T2 through decreased S-E was non-significant (Table 3).

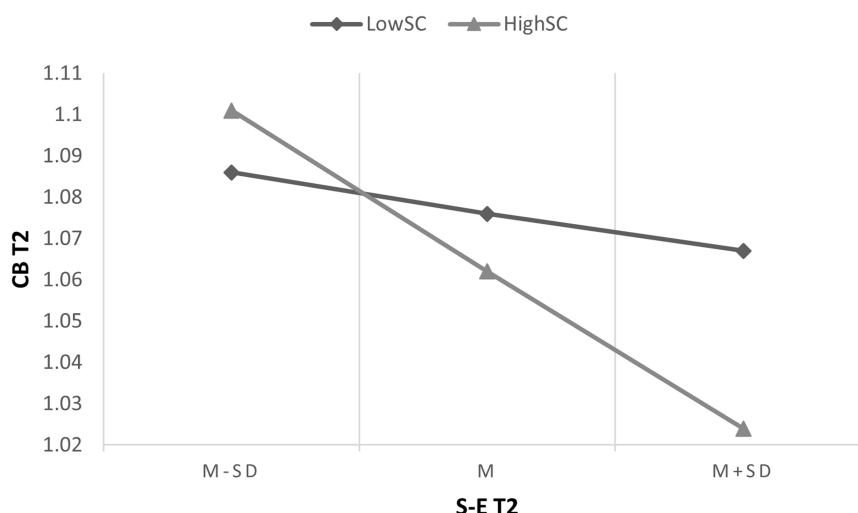


FIGURE 3

Simple slope analysis for overall self-compassion. T2, Time 2; CB, cyberbullying; SC, self-compassion; S-E, self-esteem.

## Discussion

The purpose of this study was to explore how perceived discrimination is related to cyberbullying through self-esteem and test the moderating roles of compassionate self-response, reducing uncompassionate responses, and overall self-compassion in reducing cyberbullying. This aligns with the stress coping theory (Lazarus, 1993). Cyberbullying has been previously identified as a negative coping behavior in response to stressful events (e.g., perceived discrimination) (Wang et al., 2022), and the same pattern was observed in our study among college students. The findings highlight that perceived discrimination can lead to decreased self-esteem, which in turn increases cyberbullying among college students.

The findings indicate that the relationship between perceived discrimination and cyberbullying is mediated by self-esteem, which highlights the role of global self-esteem in this dynamic. Self-esteem is understood as an individual's subjective evaluation of their relationships with society and significant others, reflecting their status in interpersonal relations. Individuals with low self-esteem may internalize feelings of rejection from their experiences of frustration, which can lead to aggressive behaviors such as cyber aggression (Barry et al., 2007). Specifically, when individuals face criticism, rejection, exclusion, or discrimination from others they may experience feelings of inferiority and shame, and these feelings can trigger anger and hostility towards others, potentially leading to cyberbullying (Shi et al., 2017). Moreover, the theory of threatened egotism (Baumeister et al., 1996) posits that individuals with fragile self-esteem are particularly vulnerable to threats to their self-worth, such as perceived discrimination. When their self-esteem is challenged, they may experience a heightened sense of threat to their social identity, leading to defensive behaviors. Low self-esteem heightens psychological vulnerability, shaping individuals' maladaptive coping strategies. As a maladaptive response, some students may engage in cyberbullying to regain a sense of control in online interactions. The anonymity and reduced accountability of digital spaces can further contribute to such behaviors. Accordingly, addressing self-esteem as a

mediating factor is crucial in interventions targeting cyberbullying reduction.

Moreover, this study is the first to explore the buffering role of different dimensions of self-compassion in understanding the indirect association between perceived discrimination and cyberbullying. The findings reveal that uncompassionate self-responding can weaken the direct association of between perceived discrimination and cyberbullying and its indirect association through self-esteem. According to stress coping theory, individuals with low RUS levels are more likely to engage in cyberbullying. Previous studies have found that higher self-compassion is associated with greater use of adaptive coping strategies and less use of maladaptive coping strategies in stressful situations, such as discrimination (Ewert et al., 2021). This implies that college students with high RUS are more likely to use adaptive coping strategies rather than resorting to cyberbullying to manage stressful events.

Furthermore, individuals with high level of RUS are more likely to reduce the negative effects of a damaged self-esteem and less likely to engage in cyberbullying when they experience high levels of discrimination. The findings highlight the importance of developing self-compassion as a potent psychological resource for the prevention and reduction of cyberbullying behavior, particularly for individuals facing frustration. This study did not find any moderating effect of CS on the examined pathways. Empirical studies have indicated that CS is more strongly associated with the disappearance of internalizing symptoms (Li et al., 2022; Muris et al., 2021) whereas uncompassionate self-responding is more likely to be related to external behavior, such as behavior disorders (Bicaker and Racine, 2022). These findings suggest that CS is more effective in reducing internalizing symptoms rather than behaviors that involve outward aggression, such as cyberbullying. This might explain the minimal correlation between CS and the problematic behavior of cyberbullying found in the present study.

The moderating effect of RUS on the relationship between perceived discrimination and cyberbullying is a critical finding in

understanding how individuals can manage negative emotional responses to discrimination. This distinction between CS and RUS highlights the importance of considering different aspects of self-compassion in interventions aimed at reducing cyberbullying. The finding implicates that RUS may serve as a more relevant resource for managing the negative effects of perceived discrimination, particularly in situations where individuals are at risk of engaging in harmful external behaviors. RUS refers to the reduction of harsh, self-critical, and uncompassionate thoughts and behaviors, fostering a more balanced and compassionate self-view (Neff et al., 2018). Specifically, individuals with high RUS are more likely perceived less the negative emotional consequences of perceived discrimination, such as feelings of shame, anger, and frustration, which can further reduce the risk of engaging in aggressive behaviors like cyberbullying. By cultivating a more compassionate and less judgmental response to their own emotional pain, individuals can reduce the likelihood of externalizing these emotions in aggressive ways.

A number of limitations of the present study should be considered. First, data were collected from only two waves to examine the longitudinal mediation mechanism, which may lead to biased results. Future research should consider collecting data across three or more waves to examine the temporal stability of these relationships and to explore how changes in self-esteem over time may influence the occurrence of cyberbullying. Second, the data were collected from Chinese university students, which may limit the generalizability of the findings. Thus, future studies should aim to include more diverse populations, such as students from different countries, adolescents, or individuals from varying socioeconomic backgrounds, to examine whether these findings hold across different contexts.

In summary, this study highlights the mediating role of impaired self-esteem in the pathway from perceived discrimination to cyberbullying behavior, and examines the role of RUS in mitigating impaired self-esteem to reduce cyberbullying in the context of discrimination experiences. This research provides new insights for the development of interventions to reduce cyberbullying and maintain a civilized online environment. Given the pivotal role of reduced uncompassionate self-judgment (RUS) in this process, targeted interventions, such as cognitive-behavioral techniques and RUS-focused mental health programs, could effectively prevent cyberbullying, especially among students experiencing perceived discrimination.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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## Conflict of interest

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# Intention to khat chewing among youths in Raya-Azebo district, southern zone of Tigray, Ethiopia: application of the theory of planned behavior

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**Background:** Khat chewing has become a global phenomenon, resulting in significant physical and mental health issues as well as socioeconomic crises. However, evidence is scarce on Ethiopian youths' behavioral intentions toward khat chewing, particularly in the Raya-Azebo district of the southern zone of the Tigray region. As a result, this study aimed to assess the intention to chew among youths in Raya-Azebo district, Southern Tigray, Ethiopia.

**Methods:** A community-based cross-sectional survey was conducted among 627 youths in northern Ethiopia's Raya-Azebo district. Data were collected using a structured, interviewer-administered questionnaire. A multivariable linear regression model was used to predict the contribution of independent variables and identify variables strongly associated with chewing among youths.

**Results:** A considerable proportion, 192 (30.62%) of youths, had the intention to chew khat in the next 6 months. The component of the theory of planned behavior independently explained the variance in intention to chew by 83%. The strongest predictors of intention to chew were attitude ( $\beta = 0.35$ ,  $p < 0.001$ ), subjective norm ( $\beta = 0.297$ ,  $p < 0.001$ ), and perceived behavioral control ( $\beta = 0.15$ ,  $p = 0.01$ ).

**Conclusion:** Behavioral intention toward khat chewing was a function of attitude, subjective norm, and perceived behavioral control toward khat chewing. Strategies to empower youths to change a positive attitude toward khat chewing, programs targeted at resisting social pressures, and increasing self-efficacy to combat chewing are needed.

## KEYWORDS

khat, khat chewing, youths, intention, theory of planned behavior, Raya Azebo, Ethiopia

## Background

Khat (*Catha edulis Forsk*) is an evergreen flowering tree found in Yemen by botanist Forskal in 1762. The plant belongs to the *Spinosa* genus; however, currently, it is classified under the family *Celastraceae*. Khat grows well and is primarily cultivated at high altitudes in East Africa and the Arabian Peninsula (1). Khat produces cathinone and cathine which are accountable for physical and mental health problems (2). Simultaneous intake of khat with drugs can lead to interaction and reaction (3). Ethiopia is the origin of khat, and chewing began in the 15th century, long before coffee was introduced. Ethiopia continues to produce the world's largest khat (1, 4). The exact global prevalence of khat chewing is unknown, but it is estimated that between 5 and 10 million people engage in this practice. It is widely chewed in southwestern Arabia and eastern Africa (5, 6).

Khat consumption is widespread in Yemeni society, where it is commonly consumed at social events (7). In Ethiopia, khat chewing is becoming a habit and spreading to new areas where it is not cultivated. In Ethiopia, young people, including high school, college, and university students, are more likely to use khat (8). According to the 2016 Ethiopian Demographic Health Survey (EDHS), 12% of women and 27% of men reported having used khat. The highest prevalence of khat use was among men (34%) and women (15%) aged 30–34 (9). The burden of lifetime khat consumption rests in Yemen (43.27%), Saudi Arabia (37.32%), and Ethiopia (24.82%) (2).

Ethiopia signed and ratified various International Conventions on Drug Control (ICDC) at different times. The Convention against the Illicit Traffic of Narcotic Drugs and Psychotropic Substances was signed in 1971 and 1988. In 1993, the government formulated a detailed policy to control and prevent the production, trafficking, and use of narcotic drugs and psychotropic substances (10, 11). Despite this, there has been an increase in substance abuse, khat production, and chewing across the country, as well as a decline in cross-border drug trafficking. There are several reasons why the rules and regulations have failed to achieve the desired results.

First, there has been a lack of community participation. Furthermore, khat chewing is culturally acceptable, making it difficult to impose regulations, and countries do not agree on how to control substances. The failure can also be attributed to a lack of a multi-agency approach and a comprehensive community education campaign. Finally, there is a conflict between the human right to health and the human right to adequate food, making it difficult to achieve a balance (10, 11).

Different theories and models are applied to change and predict behaviors, particularly in substance use, such as cigarette smoking, alcohol drinking, and khat chewing. The transtheoretical model (TTM) is applied to change unwanted problematic behavior to desired behavior through stages and a process of change (12). TTM is used to assess individuals' stages of change from actual undesired behavior to desired behavior; i.e., from smokers, and khat chewers to nonsmokers (13, 14) and nonchewers (15, 16) respectively. Social learning theory (SLT) is another theory used in substance use in both acceptable and deviant actual behaviors. It assumes that behavior is learned and learning occurs through differential association, reinforcement, definition, and imitation and is influenced by attention, attitude, motivation, and emotions. Engagement, replacement, or elimination of substance use can be more or less problematic according to the social influences and the extent to which individuals are reinforced for the behavior (17–21).

The theory of planned behavior (TPB) is the extension of the Theory of reasoned action (TRA) and is used to predict an individual's intention to engage in new behavior at a specific time and place. Behavioral intention is the most immediate and best predictor of behavior which in turn is determined by three conceptually independent determinants postulated by TPB. The first is the attitude toward the behavior, the second predictor is a social factor termed subjective norm, and the third antecedent of intention is the degree of perceived behavioral control (PBC). The relative importance of attitude, subjective norm, and perceived behavioral control in the prediction of intention is expected to vary across behaviors and situations. Therefore, attitude may have a significant impact on intention or attitude, and subjective may have a significant impact on intention or other possible (22, 23).

TPB has three types of belief and it explains their difference among them. Behavioral beliefs are assumed to influence attitudes toward the behavior, normative beliefs that constitute the underlying determinants of subjective norms, and control beliefs that provide the basis for perceptions of behavioral control (23). TPB constitutes a proficient framework and Ajzen noticed the possibility of adding other determinants only if they contribute to the variance explained in behavioral intention (24, 25). In this particular study, a conceptual framework was adapted from TPB and modified using additional elements with TPB to maximize the variance explained in the outcome variable. Socio-demographic characteristics, knowledge, and previous experiences as additional predictors of behavioral intention based on the reading of different research works of literature.

Previous researches focused on the prevalence, causes, and consequences of khat chewing but did not examine attitudes, subjective norms, perceived behavioral control, or behavioral intention toward khat chewing. The theory of planned behavior (TPB) looks into the relationship between attitudes, social norms, perceived behavioral control, and the intention to chew khat. However, the majority of the research has been carried out in institutions that may not be representative of the wider community. The purpose of this study was to assess the likelihood of khat chewing in a community over the next 6 months using a representative sample from the Raya-Azebo district. This study's findings will provide valuable insights to policymakers, health professionals working on substance abuse, health facility experts and managers, as well as researchers interested in this area.

## Methods

### Study design and settings

A community-based cross-sectional study was conducted from March to May 2019 among 627 randomly selected youths from Raya Azebo district in southern Tigray, Ethiopia. Raya-Azebo is situated in the southern part of the Tigray regional state, 678 kilometers north of Addis Ababa. According to Central Statistical Agency (CSA) data from 2007, the district's total population is 135,870.

### Study participants

The study included non-khat users whose ages ranged from 15 to 24 years. To reduce deviant perceptions of chewing behavior caused

by increased awareness, information, and exposure, people who had lived in the study area for less than 6 months were excluded.

## Sample size determination and sampling technique

The sample size was calculated using a single population formula for the mean difference of a finite population. To predict intention, the variance was set to 50% ( $\sigma = 0.5$ ) with a 95% confidence interval ( $\alpha = 0.05$ ) and a 5% tolerance for marginal sampling error. With these assumptions, the sample size was 384; adding a 10% non-response rate and accounting for the 1.5 design effect resulted in a final sample size of 641 youths. Adjusting the sample size for the non-response rate is crucial to keep our sample size representative. The final sample size was determined by adding a non-response rate to the calculated sample by using the loss adjustment formula. The adjustment was made by dividing the calculated sample size ( $n$ ) by  $(1-X)$  where “ $X$ ” is the proportion of the expected to withdraw or non-response rate.  $N = n/(1-X)$ ,  $N = 384/(1-0.1) = 384/0.9 = 426.67 \sim 427$ . Then,  $427 \times 1.5 = 640.5 \sim 641$ .

Multistage cluster sampling was used to reach the household level. The final sample size was proportionally allocated based on the households of each kebele, and then a simple random sampling technique was applied to select study participants.

## Data collection tool and procedure

A context-specific, pretested, and structured interviewer-administered questionnaire was used to collect the needed data from the participants. The questionnaire was developed based on TPB questionnaire development guidelines (26), different related kinds of literature, and after conducting an elicitation study in the study area to elicit the commonly held salient beliefs, indirect measures of attitude, subjective norm, and PBC. Language experts translated the questionnaire into Tigrigna and then back into English to maintain the consistency of the tool. Pretesting was carried out in a different district on 5% of the total sample size 1 week before data collection began. Trained data collectors and supervisors were in charge of data collection and supervision, respectively.

## Measurements and scoring

The measurement and scoring methods applied in this study were based on the TPB construct questionnaire development guideline (26). The intention was measured by four items with seven Likert scales ranging from strongly disagree to strongly agree. It was calculated by adding the scores of the items, and the total score of the items ranges from 4 to 28. If the calculated intention composite score is a high composite score; they have an intention toward khat chewing. If the calculated intention composite score is a low composite score, they have no intention toward khat chewing.

The direct attitude was measured by four items with seven Likert scales on the Semantic Differential Scale (SDS), ranging from extremely bad to extremely good. It was calculated by adding the scores of the items, and the total score of the items ranges from 4 to

28. If the calculated attitude composite score is a high composite score, they have a positive attitude toward khat chewing. If the calculated attitude composite score is a low composite score, they have a negative attitude toward khat chewing. Behavioral belief was measured using six items with seven Likert scales on bipolar differential scales. Six items with seven Likert scales were used to measure the evaluation of khat chewing beliefs.

A new variable was formed that represents the weighted score by multiplying each behavioral belief with an evaluation of the belief. Finally, the summation of each product of beliefs was done to create an indirect attitude as a new variable. One behavioral belief measurement item is followed by a single measurement item of behavioral outcome evaluation. Hence, indirect attitude was measured using 12 items with seven Likert scale and the total score ranges from (−126) to (+126). Besides, the normative belief of khat chewing with motivation to comply and each control belief with perceived power were weighted to create new variables that represent weighted scores for each normative belief and control belief, respectively.

The summation of each weighted belief was done to create a new indirect subjective norm and indirect PBC. Indirect subjective norm was measured by 8 items with seven Likert scale (4 items of normative belief and 4 items of motivational to comply) and the total score ranges from (−84) to (+84). Each question items of motivational to comply is placed next to a single question item of normative belief. Besides, the indirect PBC was measured by 18 items with seven Likert scale (9 items of control belief and 9 items of perceived power) and the possible total score ranges from (−189) to (+189). Each questioning item of perceived power is placed next to a single question item of control belief.

Regarding subjective norm, it was measured by four items with seven Likert scales ranging from strongly disagree to strongly agree or should to should not. It was calculated by adding the scores of the items, and the total score of the items ranges from 4 to 28. If the calculated subjective norm composite score is a high composite score, the social pressure is in favor of khat chewing. If the calculated subjective norm composite score is a low composite score, the social pressure is against khat chewing.

Perceived behavioral control was measured by four items with seven Likert scales on SDS ranging from strongly disagree to strongly agree or extremely difficult to extremely easy. It was calculated by adding the scores of the items, and the total score of the items ranges from 4 to 28. If the calculated perceived behavioral control composite score is high, they have a strong perceived ability, less difficulty, or are easy to chew. If the calculated perceived behavioral control composite score is a low composite score, they have a weak perceived ability or difficulty chewing khat.

## Data analysis

Data were checked for clarity, completeness, and consistency, edited, coded, and entered into Epi Data version 4.4.2, and then exported to SPSS version 25 for analysis. Descriptive statistics were presented in mean (standard deviation) or median (inter-quartile range, IQR) for numerical variables, depending on data distribution and frequency percentage for the categorical variables. An independent *t*-test and one-way ANOVA with post-hoc comparisons were done to see the association and mean difference between

intention and categorical independent variables. Bivariate correlation analysis was done between the indirect and direct measures of the same construct (direct attitude versus indirect attitude, direct subjective norm versus indirect subjective norm, and direct PBC versus indirect PBC) to check the validity of the measurement tool.

Next, to bivariate analysis and selection of variables with a  $p$ -value  $< 0.25$ , a multiple linear regression was done to see the contribution of direct TPB constructs on behavioral intention to chew khat, show the standardized regression coefficient ( $\beta$ ), and control confounders. The summary measures of the estimated unstandardized and standardized regression coefficient ( $\beta$ ) with a 95% confidence interval were presented, a  $p$ -value  $< 0.05$  was used to declare statistical significance, and the goodness of fit of the model was assessed using R-square and adjusted R-square (Adj.  $R^2$ ).

## Results

The study was conducted among 627 randomly selected youths of the Raya-Azebo district, with a response rate of 97.82%. The median age of the participants was 20, with an IQR of 18–23 years. Out of the study participants, 418 (66.7%) were males, 284 (45.30%) were Orthodox, 343 (54.70%) were Muslims, 410 (65.39%) were single, and 162 (25.84%) were married. All the interviewed youths were Tigrayans (Table 1).

## Knowledge of khat and past experiences of substance abuse

All participants had ever heard about khat chewing, and the information was found from teachers, health professionals, religious leaders, administrative leaders, friends, and social media. Regarding knowledge, 500 (79.75%) participants agreed that chewing causes addiction and diseases. Among these, 93 (18.6%), 219 (48.8%), and 188 (37.6%) relied on the fact that chewing causes physical health problems, mental health problems, and both, respectively. According to the previous behavioral experiences, 263 (41.95%), 261 (41.63%), and 202 (32.22%) participants had experienced khat chewing, other substances, and both, respectively. Among other substance users, 80 (31.01%) were cigarette smokers, 110 (38.7%) were shisha smokers, and 130 (50.39%) were alcohol drinkers.

## Analyzing the mean difference between predictor variables with intention

### Socio-demographic variables and intention to khat chewing

An independent  $T$ -test was conducted to determine if there is a difference existed between the mean of the two groups of independent variables to the intention of khat chewing. In addition to this One-way ANOVA was done to check the existence of and calculate the difference among the mean of the three and above groups of independent variables to the intention of khat chewing. From the independent  $T$ -test analysis done, there was a statistically significant difference between Orthodox followers and Muslims mean in the intention scores of khat chewing ( $t$  (625) =  $-10.898$ ,

$p < 0.01$ , 95% CI =  $-8.52682$ ,  $-5.92304$ ). The mean values indicate that Muslims had more intention toward khat chewing ( $n = 343$ ,  $M = 15.8834$ ) than orthodox followers ( $n = 284$ ,  $M = 8.6585$ ) (Table 2).

One-way ANOVA was done for the socio-demographic characters that have more than two levels of groups. The results of the analysis indicate that the marital status of participants had a significant effect on the intention toward khat chewing ( $F$  (3, 623) = 8.506, mean square = 666.10,  $p < 0.001$ ). The mean values indicate that divorced had more intention toward khat chewing ( $n = 53$ ,  $M = 18.39$ ) than single ( $n = 410$ ,  $M = 12.09$ ) and married ( $n = 162$ ,  $M = 11.97$ ). A *post hoc* comparison was used to show the location of the difference between marital status. The results of post hoc comparison analysis indicate that the divorced marital status was significantly different from both the single and married marital status. The results show that the overall difference in intention of khat chewing among the marital status was because of the significantly greater amount of intention toward khat chewing by the participants in the divorced marital status (Table 3).

## Reliability and correlation of theory of planned behavior constructs

Before the use of the instrument, the test–retest reliability was done to determine the reliability of the indirect measure of the TPB model (Figure 1). The correlation coefficient for the TPB constructs is between 0.96 and 0.976, indicating that the measurement of TPB is valid. Internal consistency among the items of the TPB model constructs Cronbach  $\alpha$  coefficient was between 0.704 and 0.977, indicating that the internal consistency reliability of all items is good (Table 4).

The correlation between the direct and respective indirect measures of TPB was 0.784 to 0.823, strongly positive ( $r > 0.7$ ), which indicates that the indirect measures are valid, well-constructed, and adequately cover the breadth of measured constructs, which means the direct measure is also reliable and valid (Table 5).

## Direct theory of planned behavior components with intention toward khat chewing

All direct components of TPB and intention to khat chewing had a low mean score. Direct PBC, SN, and attitude had a mean score of 14.537 (SD = 6.984), 11.963 (SD = 7.704), and 11.145 (SD = 8.856), respectively (Table 4). The bivariate analysis done indicates that attitude ( $\beta = 0.9$ , 95% CI 0.863, 0.937), subjective norm ( $\beta = 0.99$ , 95% CI 0.941, 1.039), and PBC ( $\beta = 1.038$ , 95% CI 0.977, 1.098) were highly statistically significant in the predicting of intention of youths toward khat chewing and 78.3% of the variation in the prediction of intention toward khat chewing was explained by attitude ( $R^2 = 0.783$ ). Subjective norm accounted for 71.7% of the variability in the prediction of intention to khat chewing and 64.7% of the variation in predicting intention to khat chewing was explained by PBC (Table 6).

## Indirect components of the theory of planned behavior

Indirect attitude was statistically significant in predicting of direct attitude ( $\beta = 0.159$ , 95% CI 0.15, 0.167). An indirect subjective norm was a predictor of a direct subjective norm ( $\beta = 0.119$ , 95% CI 0.113, 0.126). Indirect PBC also predicted direct PBC ( $\beta = 0.077$ , 95% CI

TABLE 1 Socio-demographic characteristics of study participants in Raya-Azebo district, Southern Tigray, Ethiopia, 2019 (*n* = 627).

Variables	Characteristics	Frequency ( <i>n</i> )	Percentage (%)
Age (years)	15–19	232	37.00
	20–24	395	63.00
Sex	Male	418	66.67
	Female	209	33.33
Marital status	Single	410	65.39
	Married	162	25.84
	Divorced	55	8.80
Religion	Orthodox	284	45.30
	Muslim	343	54.70
Education	Unable to read and write	91	14.51
	Able to read and write but no formal education	160	25.52
	Grade 5–8	116	18.50
	Grade 9–10	181	28.87
	Grade 11–12	35	5.58
	Diploma	22	3.5
	Others	22	3.5
Occupational status	Farmer	197	31.42
	Spouse	56	8.93
	Private employee	29	4.63
	Student	194	30.94
	Daily laborer	11	1.75
	Government employee	30	4.78
	Others	110	17.54
Income (Ethiopian Birr)	≤ 100	19	3.0
	101–299	64	10.2
	300–499	19	3.0
	500–999	108	17.2
	≥ 1,000	231	36.8
Source of income	Agriculture	235	37.5
	Parents	181	28.9
	Salary	58	9.3
	Khat selling	51	8.1
	Coffee/tea and shopping	39	6.2
	No source of income	35	5.6
	Others	28	4.5

0.072, 0.081). Therefore, the predictive power of the constructs to intention, capturing the dimension of the population interest salient beliefs and validity of the data collection tool was high (Table 7).

### Multiple linear regression analysis

In the final regression model, 83.2% of the variability of intention to khat chewing was explained by the independent variables ( $R^2 = 0.832$ , Adj.  $R^2 = 0.787$ ,  $p < 0.001$ ). Socio-demographic, knowledge, and past behavioral experience variables explained the model by 62.4%. When the TPB direct measures were added to the final model the variance of the

dependent variable was changed by 20.8%. However, the components of TPB independently accounted for 83% of the variability of intention to chew khat which direct measures of TPB exclusively explained it. A unit positive change attitude toward advantage associated with the chewing of khat will change the intention to chew khat by 0.35 while keeping other variables constant ( $\beta = 0.35$ , 95% CI 0.196, 0.49).

At the same time, for a unit positive change in the individual's perception of very important persons thought them to chew khat as a normative action will change the intention to chew khat by 0.297 when the other factors remained unvaried ( $\beta = 0.297$ , 95% CI 0.166,

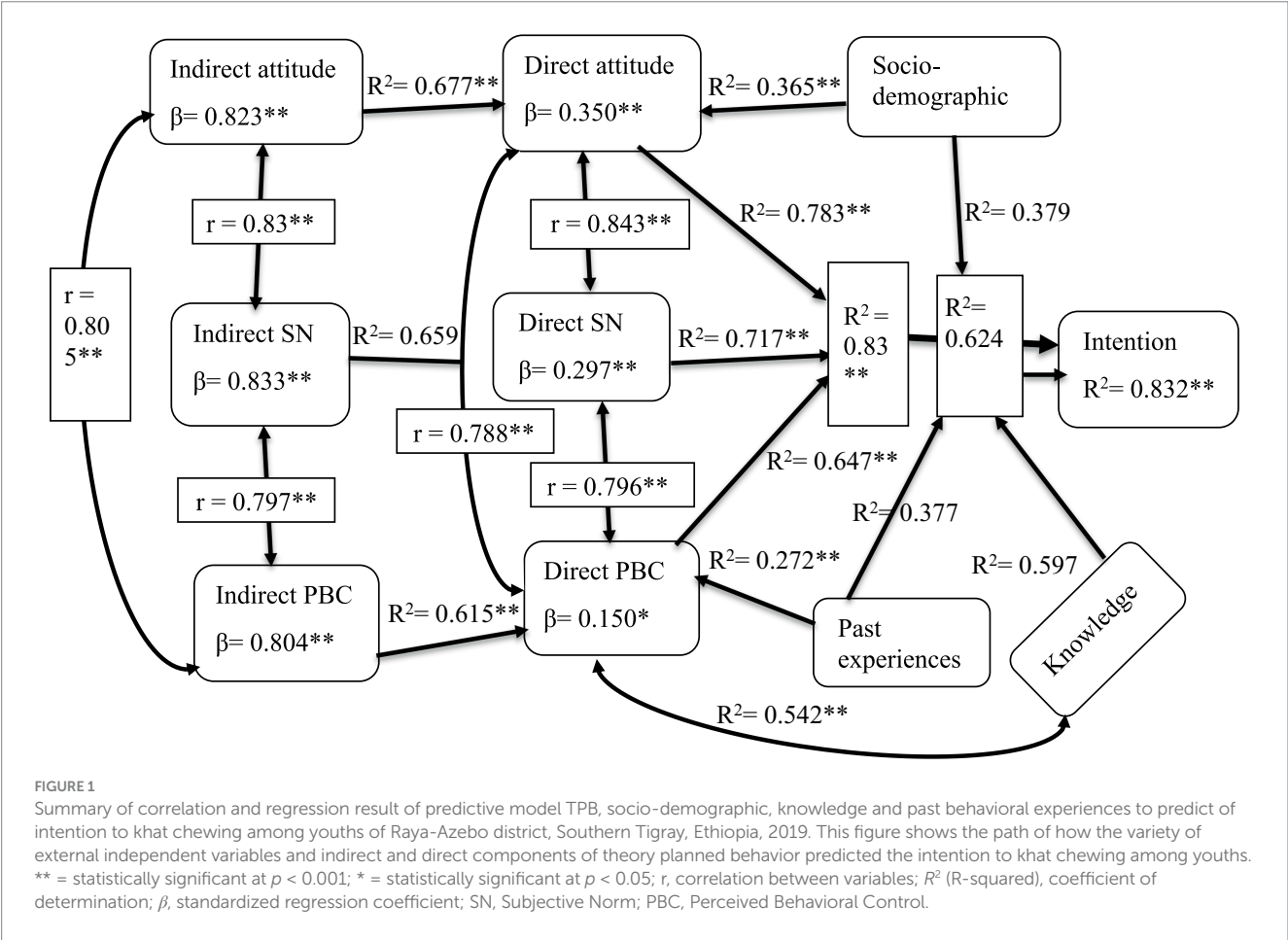
TABLE 2 Summary of Independent t-test of socio-demographic characters with intention among the youth of Raya-Azebo, Southern Tigray, Ethiopia, 2019.

Variables	Values	N	Mean	SD	T	p-value	95% CI		Effect size
							Lower	Upper	
Sex	Male	418	13.06	9.11	1.778	0.041	−0.142	2.85	0.005
	Female	209	11.71	8.75					
Religion	Orthodox	284	8.66	6.27	−10.898	<0.001	−8.53	−5.92	0.160
	Muslim	343	15.88	9.61					
Age (year)	15–19	232	10.595	8.69	−4.356	<0.001	−4.643	−1.757	0.029
	20–24	395	13.795	8.99					

SD, standard deviation; T, T-test.

TABLE 3 Summary of one-way ANOVA for socio-demographic variables with intention among the youth of Raya-Azebo, Southern Tigray, Ethiopia, 2019.

Variables	M - square	F	p-value	Effect size
Marital status	666.10	8.506	<0.001	0.039
Educational level	899.64	12.52	<0.001	0.124
Occupation	1238.77	17.72	<0.001	0.146
Source of income	1464.21	21.70	<0.001	0.174
Income	1033.51	13.84	<0.001	0.109



**TABLE 4** Descriptive statistics theory of planned behavior variables' mean score, internal consistency, and test–retest reliability, among youths of Raya-Azebo district, Southern Tigray, Ethiopia, 2019 ( $n = 627$ ).

Variables	Items	Possible min-max	Observed min-max	Mean	SD	$\alpha$ & $r$
Intention	4	4–28	4–28	12.611	9.007	0.977 <sup>†</sup>
Direct Attitude	4	4–28	4–28	11.145	8.856	0.958 <sup>†</sup>
Direct SN	4	4–28	4–28	11.963	7.704	0.829 <sup>†</sup>
Direct PBC	4	4–28	4–28	14.537	6.984	0.704 <sup>†</sup>
Indirect attitude	12	–126-(+126)	–126-(+126)	–18.423	45.861	0.976 <sup>**</sup>
Indirect SN	8	–84-(+84)	–84-(+84)	–26.362	52.334	0.970 <sup>**</sup>
Indirect PBC	18	–189-(+189)	–140-(+163)	–10.499	71.462	0.960 <sup>**</sup>

SD, standard deviation; <sup>†</sup> =  $\alpha$  = Cronbach's alpha for the direct measures' internal consistency, <sup>\*\*</sup> =  $r$  = average item-total correlation for the indirect measures' temporal stability, SN, subjective norm; PBC, Perceived behavioral control; Min-max, minimum and maximum values.

**TABLE 5** Correlations (Karl Pearson's "r") of indirect and direct measures of theory of planned behavior constructs among youths of Raya-Azebo, Southern Tigray, Ethiopia, 2019 ( $n = 627$ ).

Variables	Attitude	SN	PBC	Indirect attitude	Indirect SN	Indirect PBC
Attitude	1					
SN	0.843**	1				
PBC	0.788**	0.796**	1			
Indirect attitude	0.823**	0.773**	0.725**	1		
Indirect SN	0.833**	0.812**	0.711**	0.830**	1	
Indirect PBC	0.804**	0.758**	0.784**	0.805**	0.797	1

\*\* = Correlation is significant at  $p < 0.01$  level (2-tailed), SN, Subjective norm; PBC, Perceived behavioral control.

**TABLE 6** Bivariate analysis of theory of planned behavior's explanatory variables in predicting intention toward khat chewing among youths of Raya-Azebo district, Southern Tigray, Ethiopia, 2019.

Variables	$\beta$	$p$ -value	95% CI		$R^2$ (R-square)	Adj. $R^2$
			Lower	upper		
Attitude	0.900	<0.001	0.863	0.937	0.783	0.782
Subjective norm	0.990	<0.001	0.941	1.039	0.717	0.717
Perceived behavioral control	1.038	<0.001	0.977	1.098	0.647	0.647

Adj.  $R^2$ , Adjusted R-square;  $\beta$ , Unstandardized regression coefficient.

**TABLE 7** Bivariate analysis of indirect theory of planned behavior's explanatory variables in predicting of their corresponding direct measure toward khat chewing among youths of Raya-Azebo district, Southern Tigray, Ethiopia, 2019 ( $n = 627$ ).

Variables	$\beta$	$p$ -value	95% CI		$R^2$ (R-square)	Adj. $R^2$
			Lower	upper		
Indirect attitude	0.159	<0.001	0.150	0.167	0.677	0.676
Indirect subjective norm	0.119	<0.001	0.113	0.126	0.659	0.658
Indirect perceived behavioral control	0.077	<0.001	0.072	0.081	0.615	0.615

Adj.  $R^2$ , Adjusted R-square;  $\beta$ , Unstandardized regression coefficient.

0.490). In addition to this, a unit positive change in the perceived control about facilitators associated with the chewing of khat as a perceived action will change the intention to chew khat by 0.15 by keeping the other variables unchanged ( $\beta = 0.15$ , 95% CI 0.055, 0.404) (Table 8).

## Discussion

This study shows that there was a low intention not to chew khat. However, there were significant numbers that had the intention of chewing. Even though behavioral intention is the most

**TABLE 8** Multivariable regression analysis of intention toward khat chewing as a dependent variable predicted by independent variables among youths of Raya-Azebo district, Southern Tigray, Ethiopia, 2019 ( $n = 627$ ).

Variables	$\beta$	$\beta$	$p$ -value	95% CI	
				Lower	Upper
Attitude	0.343	0.350	<0.001	0.196	0.490
Subjective norm	0.328	0.297	<0.001	0.166	0.490
Perceived behavioral control	0.229	0.150	0.010	0.055	0.404

$\beta$ , Unstandardized regression coefficient;  $\beta$ , Standardized regression coefficient.

$R^2 = 0.832$ , Adjusted  $R^2 = 0.787$ ,  $F$  change = 18.591,  $p = <0.001$ .

proximal and predominant construct of a behavior, an individual who has a high intention does not mean surely performing that behavior or action. There was no significant association between the socio-demographic characteristics of the participants and their intention to chew. This finding is in line with the study conducted at Jimma University, which found that age, marital status, and family sources of income were not significantly associated with khat chewing (27).

This implies that the prediction of attitude, subjective norm, and perceived behavioral control is not different among the various categories of socio-demographic characteristics of participants. However, the present finding is in contrast with the studies done in Mana district, Nekemete town, and the systematic and meta-analysis was done among Ethiopian University students; sex, religion, marital status, and educational status were significantly associated and predictors of khat chewing (1, 4, 5). The difference could be due to the studies being done in different settings and socio-demographic characteristics age, educational status, and marital status so different among the studies' participants.

Intention to khat chewing was mainly due to attitude, subjective norm, and perceived behavioral control while the other external to TPB variables were insignificantly predictors. The simultaneous predictive power of attitude, subjective norm, and perceived behavioral control in terms of adjusted R-squared was 82.9%. The theory of planned behavior components and external to TPB variables on intention in terms of R square and adjusted R squared were 0.832 and 0.787, respectively. This finding is near to the perfect relationship and cause-effect level of determination.

This predictive power is higher than the other different systematic reviews, and a meta-analysis was done using TPB to predict the behavioral intention of smoking and alcohol consumption (28, 29). The implication is that the internal consistency among items is higher, and the correlation between the direct measure of the theory of planned behavior and the intention to chew is stronger.

The behavioral intention of khat chewing was primarily under the attitudinal influence. This implies that youths' favorable attitudes toward khat chewing will lead them to chew khat. In a previous study conducted on the prediction of cigarette smoking, attitude was the strongest predictor of intention to smoke. In a systematic review and meta-analysis done using the theory of planned behavior in predicting alcohol consumption, the attitude was more highly correlated with behavioral intention than the subjective norm, and the subjective norm was also more highly correlated with behavioral intention than perceived behavioral control (28, 30).

However, other previous studies show that attitude was the second and third predictor of behavioral intention to cigarette smoking and the second predictor of intention to alcohol drinking (29, 31, 32). The

possible reason for this difference might be the variation in behavior, the population in which the study generalizes results, situations, and circumstances under which the behavior is occurring, according to the theory of planned behavior perspective (24, 33). The implication is an attitude toward a specific behavior might be different in various settings, times, cultures, contexts, and societies based on the knowledge and feeling of specific behavior that occurred or formed in the various areas with different cultural, contextual, and societal make-ups and the changes over times or temporal stabilities of the attitude toward behavior.

As the multivariable analysis depicts, the standardized regression coefficient of the subjective norm was secondarily predicting the intention to chew. This indicates that youths' social pressures, family, peers, and significant others' pressure toward khat chewing have a great role in leading them to chew it. Previous studies conducted in Ethiopian settings focused on factors initiating khat chewing: peer pressure, social and psychological reasons, socialization issues, khat is considered a social and cultural construct of community, and having family members and friends who chew khat (1, 4, 5, 27, 34–36). This implies that individuals who matter and approve of their important persons' approval to them and socio-cultural conditions are influenced to perform the behavior. The implication is having direct relationships with referents who engage in a certain form of conduct, exposure to different sets of values and norms, balancing of expected and actual rewards and punishment, and the definition or judgment to behavior determine the intention and occurrence of the behavior.

In line with the study conducted and meta-analysis done on the prediction of cigarette smoking using the theory of planned behavior, the subjective norm was the second strongest predictor of intention to cigarette smoking (29, 30) and systematic review and meta-analysis done on the theory of planned behavior in predicting alcohol consumption, subjective norm was the second highly correlated to behavioral intention to alcohol drinking (28). In contrast to this, another study conducted to predict intention to alcohol consumption reveals that subjective norm was the strongest predictor of behavioral intention to alcohol consumption (31). This implies that behavior is attributable to the target population, type of actions, contexts, time, and other circumstances in which it occurs.

In line with the systematic review and meta-analysis done on predicting alcohol consumption using the TPB model (28), the present study depicts that perceived behavioral control was the third important and statistically significant predictor of intention to khat chewing. This indicates that youths with high confidence to chew khat are high with an intention to khat chewing. However, a previous study and meta-analysis did show that perceived behavioral control was the primary predictor of intention to cigarette smoking (29, 32) and in opposition to this, perceived behavioral control was an insignificant predictor of intention to alcohol drinking (31). It implies that predictors could

be similar and vary in different behaviors, circumstances, contexts, and population groups. The perceived likelihood of constraints and facilitators and the belief ability to start a new behavior determines behavior occurrence and variation could occur due to situations of the impeters and opportunities with their effect on behavior, and the variation settings, cultures, contexts, and the exposure to the behavior.

On regression analysis, indirect components of theory-planned behavior explained the variation of their respective direct components of theory-planned behavior. Indirect attitude, subjective norm, and perceived behavioral control toward khat chewing accounted for 67.7, 65.9, and 61.5% variation respective direct components of theory planned behavior attitude, subjective norm, and perceived behavioral control of khat chewing. This predictive power of indirect components to their respective direct component of theory planned behavior is higher than previous studies conducted using TPB supported by elicitation study (37, 38). The possible explanation related to this might be that there was a variation in the temporal stability of salient beliefs commonly held in the community and a correlation between indirect and corresponding direct measures of the theory of planned behavior.

Regarding the present study, the finding demonstrates the fact that all indirect measures of the theory of planned behavior had significant positive indirect influences on the intention to khat chewing through their corresponding direct measures theory of planned behavior. This finding is supported by the suggestion of the theory of planned behavior principles (24, 33). This finding implies that the commonly held beliefs about the behavior of khat chewing were well explored. Other possible reasons could be a strong correlation between indirect and respective direct components of the theory of planned behavior and the direct component of the theory of planned behavior with the intention to khat chewing as well.

## Strengths and limitations

### Strengths

The researchers did an elicitation study to explore salient beliefs to design a culturally appropriate survey instrument to measure TPB constructs. These salient beliefs are not observable characters and difficult to find the belief with other methods. The study included different variables except for the constructs of the theory of planned behavior. This made the study more comprehensive than the theory's constructs. The researchers also did cross-validation the final predictive model using the Stein's formula and data splitting at random.

### Limitations

Even though the study used the interviewer-administered questionnaire, it has the potential to introduce social desirability bias. In this study, face validity was done to check the validity of the data collection instrument which is affected by individual subjectivity. The relation between constructs of TPB was measured at the spot not in prospective time intervals.

## Conclusion

This study revealed that a considerable proportion of youths had an intention to chew khat in the next 6 months. Behavioral intention to khat

chewing was a function of attitude, subjective norm, and perceived behavioral control of khat chewing. Behavioral intention to khat chewing was primarily under the attitudinal influence. The indirect measures of TPB had influences on direct measures of TPB, so that intention to khat chewing will be increased. Increasing health literacy by transferring health messages in media outlets and giving particular emphasis on risk perceptions of khat chewing. A prospective study design is recommended to determine the relationships between constructs; measuring behavior at time intervals as human behavior cannot be always stable. It is better if construct validity is done for the data collection tool. Large-scale qualitative study is suggested by involving religious leaders, community leaders, farmers, agriculture personnel, and health professionals.

## Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/supplementary material.

## Ethics statement

The studies involving humans were approved by the Research and Ethics Committee (REC) of the School of Public Health, College of Health Sciences, Addis Ababa University (Ref: SPH/043/19). Before beginning the study, all participants were asked to provide verbal informed consent. For the participants aged less than 16 years, informed consent was obtained from their parents before the interview. The data collected from women, service providers, and experts was kept strictly confidential. All participant data was stored anonymously and per the 1964 Declaration of Helsinki. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

AA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. AM: Methodology, Supervision, Writing – original draft, Writing – review & editing, Conceptualization, Formal analysis, Visualization. BK: Data curation, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing, Conceptualization, Investigation. TG: Conceptualization, Supervision, Writing – original draft, Writing – review & editing, Formal analysis, Funding acquisition. HTG: Conceptualization, Supervision, Writing – original draft, Writing – review & editing, Data curation, Methodology, Project administration, Resources. EA: Conceptualization, Data curation, Formal analysis, Resources, Writing – original draft, Writing – review & editing. YA: Conceptualization, Data curation, Project administration, Visualization, Writing – original draft, Writing – review & editing. HG: Data curation, Funding acquisition, Investigation, Validation, Writing – original draft, Writing – review &

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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# Predicting online shopping addiction: a decision tree model analysis

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**Background:** Online shopping addiction has been identified as a detrimental behavioral pattern, necessitating the development of effective mitigation strategies.

**Objective:** This study aims to elucidate the psychological mechanisms underlying online shopping addiction through constructing and analyzing a C5.0 decision tree model, with the ultimate goal of facilitating more efficient intervention methods.

**Methodology:** A comprehensive survey was conducted among 457 university students in Sichuan, China, utilizing validated psychometric instruments, including the Online shopping addiction Scale, College Academic Self-Efficacy Scale, College Students' Sense of Life Meaning Scale, Negative Emotion Scale, Social Anxiety Scale, Sense of Place Scale, and Tuckman Procrastination Scale.

**Results:** The predictive model demonstrated an accuracy of 79.45%, identifying six key factors predictive of online shopping addiction: academic procrastination (49.0%), sense of place (26.1%), social anxiety (10.1%), college students' sense of life meaning (7.0%), negative emotions (7.0%), and college academic self-efficacy (0.9%).

**Conclusion:** This pioneering study in online shopping addictiononline shopping addiction prediction offers valuable tools and research support for identifying and understanding this behavioral addiction, potentially informing future intervention strategies and research directions. This study provides research support for improving people's understanding and management of behavioral addictions and promoting healthier online shopping habits.

## KEYWORDS

online shopping addiction, c5.0 decision tree model, predictive analysis, behavioral addiction, academic procrastination, social anxiety, self-efficacy, psychological mechanisms

## 1 Introduction

The ubiquity and efficiency of e-commerce platforms have been identified as pivotal factors contributing to the proliferation of online shopping behaviors. Empirical research by Salehi et al. (2012) and Childers et al. (2001) elucidated that the popularity of online shopping stems from its convenience, efficiency, and capacity to serve as a proxy for physical product inspection, thereby positioning it as a prevalent lifestyle choice. Corroborating these findings, Shanthi and Desti (2015) accentuated the convenience of online shopping, highlighting its facilitation of consumer decision-making processes and price comparison capabilities. In congruence with these perspectives, Noori (2019) and Kripesh et al. (2020) posited that the widespread adoption of online shopping is attributable to its convenience, efficiency, and the

extensive availability of products and services across geographical boundaries. Moreover, Katta and Patro (2016), as well as Duarte et al. (2018), underscored accessibility and convenience as critical drivers in the paradigm shift toward online purchasing behaviors, noting their particular relevance for consumers navigating time constraints and demanding lifestyles. Collectively, these scholarly works substantiate the hypothesis that the convenience and efficiency inherent in online shopping modalities have significantly contributed to their widespread integration into contemporary consumer practices and lifestyles. This body of literature suggests a robust correlation between the perceived utility of e-commerce platforms and their increasing prevalence in consumer behavior patterns. Notwithstanding the apparent benefits of online shopping, excessive engagement in this behavior has been associated with many adverse consequences spanning physical, academic, and social domains. Empirical investigations have established a strong correlation between deteriorating physical health and excessive online shopping behaviors (Ko et al., 2020; Nawodya and Kumara, 2022; Niedermoser et al., 2021; Trotzke et al., 2015). Moreover, the proliferation of e-commerce transactions and the pursuit of convenience among students have been observed to exert substantial influence on their academic trajectories. This phenomenon potentially culminates in overindulgence in online shopping activities, thereby impeding academic progress and performance (Chelvarayan et al., 2021; Muilenburg and Berge, 2005; Wang Q. et al., 2022). Further exacerbating these concerns, Lee and Park (2008) and Triningtyas and Margawati (2019) have elucidated the intricate relationship between social conformity psychology and excessive online shopping behaviors. Their research underscores how conformity psychology can precipitate impulsive consumer behaviors and highlights the deleterious consequences of unregulated online shopping practices. These patterns may manifest as impulsive and compulsive shopping behaviors, potentially leading to the development of behavioral addictions. In summation, a growing body of literature suggests that excessive online shopping can precipitate a cascade of negative outcomes, including but not limited to physical health deterioration, academic regression, and the onset of behavioral addictions (Cojocariu et al., 2021; Nawodya and Kumara, 2022; Ti et al., 2022). These findings underscore the critical need for further research into the mechanisms underlying excessive online shopping behaviors and the development of targeted interventions to mitigate their adverse effects.

The pervasive nature of online shopping and its potential for overuse have garnered significant scholarly attention globally, precipitating a diverse nomenclature in the extant literature. Contemporary research employs various terminologies to describe this phenomenon, including “compulsive online buying,” “online shopping addiction,” “excessive online consumption,” and “excessive online shopping” (Adamczyk, 2021; Dittmar et al., 2007; Duroy et al., 2014; Jain et al., 2018; Lee et al., 2012). For this study, the term “online shopping addiction” has been adopted, predicated on several key considerations. Firstly, “online shopping” explicitly underscores the digital context of the behavior, a crucial factor in its addictive potential. Conversely, the term “consumption” lacks this specificity and fails to convey the addictive nature of the behavior. Furthermore, the use of “addiction” implies a more severe and clinically significant level of impairment compared to the relatively milder connotation of “excessive,” thereby providing a more precise and apt descriptor for the

phenomenon under investigation. This terminological choice aligns with the study’s objective to examine the more severe end of the spectrum of online shopping behaviors and their associated psychological mechanisms.

Extant literature has identified several key factors influencing online shopping addiction, including academic procrastination, sense of place, and college academic self-efficacy (Geng et al., 2018). Additionally, social anxiety, college students’ sense of life meaning, and negative emotions have been recognized as significant contributors to this phenomenon (Li et al., 2022; Müller et al., 2019; Rose and Dhandayudham, 2014). Despite these findings, there remains a paucity of research exploring the combined effects of academic factors, sense of place, and negative emotions on online shopping addiction. From a methodological perspective, decision tree models, as sophisticated data mining algorithms within machine learning, offer high predictive accuracy and the ability to decompose complex decision-making processes into more interpretable components (Batra and Agrawal, 2018). However, the application of machine learning techniques, particularly decision tree models, in predicting online shopping addiction remains underexplored. This gap in the literature underscores the need for more comprehensive studies that integrate multiple predictive factors and leverage advanced analytical techniques to elucidate the complex interplay of variables contributing to online shopping addiction among college students. Such research has the potential to enhance our understanding of this behavioral phenomenon and inform the development of more effective intervention strategies.

This study adopts an objective-based approach with three specific research objectives, grounded in existing literature: (1) to develop and validate a decision tree model for predicting online shopping addiction among college students; (2) to identify and rank the relative importance of predictive factors; and (3) to examine the interactions among these factors in contributing to online shopping addiction.

The primary objective of this study is to investigate the efficacy of decision tree models in predicting online shopping addiction and to identify salient variables that serve as robust predictors of this behavioral phenomenon. By elucidating these predictive factors, this research aims to provide empirically-grounded guidance for developing and implementing targeted intervention and prevention strategies. The subsequent sections of this paper will present a comprehensive examination of the influencing factors, the conceptual framework of online shopping addiction, its underlying impact mechanisms, and the predictive models employed in this analysis. This multifaceted approach seeks to contribute to the existing body of knowledge by offering a nuanced understanding of online shopping addiction, thereby facilitating more effective and tailored approaches to mitigating its negative consequences among vulnerable populations. The integration of advanced statistical techniques with a thorough exploration of psychological and environmental factors promises to yield valuable insights into this increasingly prevalent form of behavioral addiction.

## 2 Literature review

This study’s theoretical foundation is built upon three established frameworks in behavioral addiction research. First, the Conceptual Model of Over-shopping (OSA) proposed by Rose and

Dhandayudham (2014) provides the foundational understanding of online shopping addiction through key components including self-esteem, self-regulation, affective states, and cognitive factors. Second, the Stress and Coping Model (SCM) by Cassidy and Adair (2021) establishes the theoretical link between psychological distress factors (loneliness, rejection sensitivity) and shopping addiction. Third, the study draws on the theoretical principles of the Machine Learning Model (MLP) framework (Nawodya and Kumara, 2022), which demonstrates how consumer motivations interact with environmental factors in developing addictive behaviors. These complementary theoretical perspectives provide a comprehensive foundation for examining the multiple pathways and predictors of online shopping addiction.

## 2.1 Online shopping addiction

Historically, the conceptualization of addiction and impulse control disorders was narrowly circumscribed, primarily encompassing substance-related addictions such as drug or alcohol dependence. However, contemporary research has expanded this paradigm to include non-substance addictions (Griffiths, 2000; Kwon et al., 2013). Within this broader framework, “behavioral addiction” has emerged as a distinct category of non-substance addiction, characterized by impulse control disorders centered on specific behaviors, such as excessive exercise or compulsive shopping (Grant et al., 2010). The “online shopping addiction” concept was first introduced in 1998, rapidly evolving into a novel research domain (Young, 2017). While there is a consensus among scholars that online shopping addiction refers to an uncontrollable urge to engage in online purchasing behaviors, influenced by the frequency of quotidian online shopping activities and digital experiences (Duong and Liaw, 2022), some researchers conceptualize it as a compulsive manifestation of otherwise routine activities (Jain et al., 2018). The etiology of online shopping addiction is multifaceted, potentially influenced by factors such as low self-esteem, poor self-regulation, negative affective states, hedonistic tendencies, gender, social anonymity, and cognitive overload (Rose and Dhandayudham, 2014). Moreover, internet addiction and increased accessibility to online shopping platforms may exacerbate impulsive and compulsive buying behaviors, thereby impacting self-control mechanisms and shopping patterns (Jain et al., 2018). For this study, online shopping addiction is operationally defined as compulsive, excessive, and uncontrollable online purchasing behavior that engenders negative consequences, mediated by factors including poor self-regulation, emotional distress, and digital experiences.

Recent research has highlighted the evolving nature of online shopping addiction within the broader context of behavioral addictions. Prodanova and Chopdar (2024) demonstrate how the acceleration of e-commerce has created new pathways to addictive behaviors, particularly examining how app characteristics and smartphone addiction interplay in mobile shopping behavior. Supporting this technological perspective, Duong and Liaw (2022) found that daily online shopping duration and frequency significantly predict addiction tendencies, emphasizing how the accessibility of digital retail platforms has transformed traditional shopping addiction patterns. This emergence of novel addiction vectors necessitates

updated theoretical frameworks that account for the rapidly changing digital retail landscape.

## 2.2 Measurement and models of online shopping addiction

Contemporary assessment of online shopping addiction predominantly relies on psychometric scale models. Researchers have developed specialized instruments to quantify online shopping addiction behaviors, such as the Compulsive Online Shopping Scale (COSS) introduced by Manchiraju et al. (2017). It is noteworthy, however, that Griffiths et al. (2016) elucidate that the COSS is not an entirely novel instrument but rather an adaptation of the original 28-item Bergen Shopping Addiction Scale (BSAS) developed by Andreassen et al. (2015). For this study, we employ the Online Shopping Addiction Scale (OSAS), designed by Zhao et al. (2017) and grounded in a generalized addiction model. The OSAS has demonstrated robust psychometric properties, with multiple studies confirming its sufficient internal consistency (Duong and Liaw, 2022; Gong et al., 2021; Tian et al., 2018). The selection of the OSAS as the primary measurement tool is based on its empirically validated reliability and its comprehensive approach to assessing the multifaceted nature of online shopping addiction. This enhances the validity and generalizability of our findings within the broader context of addiction research.

Extant literature has comprehensively examined the phenomenon of online shopping addiction, employing diverse methodological approaches to elucidate its manifestation in quotidian behavior. Researchers have utilized observational techniques and in-depth interviews to investigate this behavioral addiction. For instance, Paik et al. (2014) conducted a case study that revealed the potential for online addiction syndrome to precipitate transient psychotic symptoms during withdrawal periods, with antipsychotic medication demonstrating efficacy in rapidly ameliorating these symptoms. Further case-based research by Jiang et al. (2017) underscored the critical role of high levels of self-control in mitigating online shopping addiction among college students and attenuating attentional bias towards shopping-related stimuli. Augsburg et al. (2020) contributed to this body of knowledge by observing that shopping disorders are intricately linked to in-store and online purchasing behaviors, while highlighting that variations in diagnostic methodologies may impact the identification of previously overlooked high-risk groups, such as males and older adults. These empirical investigations collectively underscore the complex, multifaceted nature of online shopping addiction and emphasize the need for nuanced, demographically sensitive approaches to its diagnosis and treatment.

Contemporary research on online shopping addiction is underpinned by various theoretical frameworks, including the Conceptual Model of Over-shopping (OSA), Stress and Coping Model (SCM), Machine Learning Model (MLP), and Mediation Models. The OSA Conceptual Model, as elucidated by Rose and Dhandayudham (2014), encompasses multifaceted components such as low self-esteem, poor self-regulation, negative affective states, hedonistic pursuits, gender predisposition, social anonymity, and cognitive overload. This model posits that current internet shopping experiences may precipitate problematic behaviors along a continuum, with OSA representing its extreme manifestation (Jiang et al., 2017). The Stress

and Coping Model, as delineated by Cassidy and Adair (2021), demonstrates a robust positive correlation between feelings of loneliness, rejection sensitivity, and shopping addiction, suggesting that shopping addiction may be symptomatic of underlying emotional difficulties. The Machine Learning Model (MLP), with its impressive 90.90% accuracy rate, offers a novel approach to detecting online shopping addiction by analyzing consumer motivations within the context of attractive features and facilities provided by the online shopping environment (Nawodya and Kumara, 2022). Finally, the Mediation Model, as proposed by Wang Q. et al. (2022), elucidates the significant positive relationships among academic procrastination, online shopping addiction, and negative emotions, with online shopping addiction serving as a mediator between academic procrastination and negative affective states. This diverse array of theoretical frameworks underscores online shopping addiction's complex, multidimensional nature and highlights the need for interdisciplinary approaches in its study and treatment.

### 2.3 Predictive analysis methods for online shopping addiction

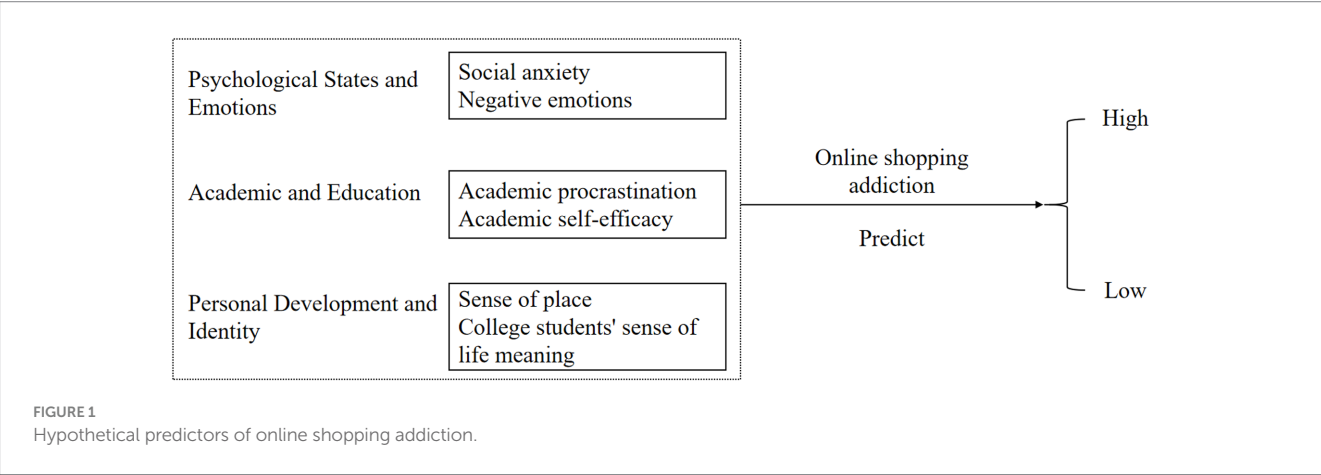
Extant literature on the prediction of online shopping addiction encompasses various methodological approaches and analytical techniques. Günüç and Keskin (2016) employed a multi-faceted analytical strategy, incorporating descriptive analysis, *t*-tests, analysis of variance, and a two-step cluster analysis to classify hedonic shopping scores, complemented by content analysis for qualitative data interpretation. This comprehensive approach facilitated an in-depth examination of qualitative and quantitative data on online shopping behaviors, elucidating factors contributing to online shopping addiction and related conceptual constructs. Duong and Liaw (2022) utilized hierarchical analysis to demonstrate a significant negative correlation between online experience and online shopping addiction while also identifying daily online shopping duration and frequency as significant predictors of addiction scores. Furthermore, Li et al. (2022) implemented a mediation analysis to reveal that elevated stress levels and insufficient social support heighten the susceptibility to online shopping addiction among university students, with social support serving as a protective factor against this behavioral addiction. Notwithstanding these valuable contributions,

there remains a notable paucity of research employing decision tree models for the prediction of online shopping addiction, highlighting a significant gap in the current literature and underscoring the potential for novel insights through the application of this advanced machine learning technique.

### 2.4 Predictive factors for online shopping addiction

In the extant literature, the application of decision tree models for predicting online shopping addiction remains relatively underexplored, particularly among university students. However, this approach offers several compelling advantages. Decision trees provide a transparent and easily interpretable structure, facilitating a nuanced analysis of addiction etiology. Their versatility in handling diverse data types, both numerical and categorical, renders them particularly suited to examining the multifaceted variables associated with online shopping behavior, such as personal income and shopping frequency (Kotsiantis, 2013; Sani et al., 2018; Loh, 2011). As a non-parametric method, decision trees circumvent assumptions about data distribution, making them adept at processing complex or irregular datasets (Ouyang et al., 2009). Moreover, these models excel in identifying salient variables influencing online shopping addiction, which is crucial for elucidating behavioral drivers and formulating preventative strategies. The adaptability of decision trees to new data and their robustness in managing missing data and outliers enhances their reliability in real-world applications (Khosravi et al., 2020). Given these attributes, the decision tree model emerges as a potent analytical tool for examining and forecasting online shopping addiction patterns among university students, underscoring the necessity of developing such a model based on established influential factors gleaned from the existing literature (see Figure 1).

This study posits College Academic Self-Efficacy, sense of place, and college students' sense of life meaning as potential predictors of online shopping addiction. College Academic Self-Efficacy, in particular, has garnered substantial attention and empirical support as a critical factor in online shopping addiction. Saleh (2019) identified a positive correlation between College Academic Self-Efficacy and internet addiction among university students, establishing it as a key predictive variable for online shopping addiction. Corroborating this



finding, Kuo and Belland (2019) demonstrated positive associations among computer self-efficacy, internet self-efficacy, and College Academic Self-Efficacy. Odacı (2013) further elucidated that College Academic Self-Efficacy in university students positively correlates with excessive internet use. Notably, research by Hassan et al. (2015), Keisidou et al. (2011), Milne et al. (2009), Ranganathan and Jha (2007), and Zamzuri et al. (2018) consistently emphasizes significant positive correlations between self-efficacy, internet self-efficacy, online shopping self-efficacy, and the propensity for online shopping behavior. These cumulative findings underscore the potential significance of College Academic Self-Efficacy in comprehending and addressing online shopping addiction among university students, thereby providing a robust theoretical foundation for developing targeted intervention strategies.

In examining the role of sense of place as a predictor of online shopping addiction behaviors, this study underscores its pivotal influence on consumer behavior, positing that it may even surpass the impact of consumers' evaluations of shopping area characteristics. This finding accentuates the critical role of retail environments in fostering and stimulating a sense of place, thereby significantly shaping consumer behaviors (Van den Berg et al., 2021). Further empirical evidence suggests that consumers' motivations, driven by the alluring features and facilities inherent in the online shopping experience, can serve as robust predictors of online shopping addiction (Nawodya and Kumara, 2022). These digital amenities may potentially enhance consumers' sense of place within the virtual retail environment, consequently influencing their shopping behaviors and addiction propensities. Thus, a comprehensive understanding and strategic application of the sense of place concept emerge as crucial elements in the prevention and management of online shopping addiction, offering valuable insights for both researchers and practitioners in consumer psychology and digital retail management.

In examining the role of college students' sense of life meaning as a predictor of online shopping addiction, extant research provides compelling insights. Zhang et al. (2015) demonstrate that for individuals with high impulsivity, both life meaning and self-esteem serve as adequate buffers against internet addiction. Otero-López et al. (2011) elucidate the mediating role of life satisfaction in the relationship between materialism and addictive buying behaviors, highlighting the importance of acquisition on female addictive buying tendencies. Further empirical analysis by Simmons (1980) reveals that the sense of life meaning is intricately linked to self-worth valuation, current and anticipated future satisfaction, and an emphasis on responsible self-control. These findings collectively underscore the complex interplay between life meaning, personal values, and addictive behaviors, offering a nuanced perspective on the potential protective factors against online shopping addiction among college students and providing valuable insights for developing targeted intervention strategies.

Empirical evidence suggests a nuanced relationship between personal values and online shopping behaviors among Chinese consumers. Wu et al. (2011) demonstrate that values oriented toward openness to change and self-enhancement positively influence online shopping behaviors, while conservation and self-transcendence values do not exert significant effects. Furthermore, Shahnaz and Karim (2014) elucidate the substantial impact of internet addiction on young individuals' life satisfaction and engagement, with frequent users of social networking platforms exhibiting higher scores. Jiang et al.

(2017) underscore the critical role of self-control in modulating attentional bias among individuals with online shopping addiction and high levels of attention concentration. These findings collectively emphasize the importance of integrating the sense of life meaning into prevention and intervention strategies for online shopping addiction among university students. Additionally, this study incorporates academic procrastination, social anxiety, and negative emotions as potential predictive factors for online shopping addiction, further expanding the multifaceted approach to understanding and addressing this phenomenon within the academic context.

Empirical investigations into academic procrastination as a predictive factor for online shopping addiction yield compelling results. Tras and Gökçen (2020) demonstrate a significant positive correlation between internet addiction in adolescents, academic procrastination, and social anxiety, with academic procrastination emerging as the most robust predictor. Specifically, a notable positive association between academic procrastination and online shopping addiction has been established. Moreover, Wang Q. et al. (2022) elucidate that online shopping addiction significantly predicts the generation of negative emotions. Further analysis by Nwosu et al. (2020) reveals internet addiction as the most salient predictor of academic procrastination among undergraduate students. Interestingly, while social media usage does not directly impact academic procrastination, it indirectly predicts its occurrence through the mediating effect of internet addiction. These findings collectively underscore the importance of considering academic procrastination as a key factor in comprehending and mitigating online shopping addiction among university students, offering valuable insights for developing targeted intervention strategies within the academic context.

Extant research suggests a significant relationship between social anxiety and online shopping addiction among university students. Li et al. (2022) demonstrates that students experiencing elevated stress levels and inadequate social support are substantially more susceptible to developing online shopping addiction. Conversely, social support emerges as a crucial protective factor, mitigating the onset of such addictive behaviors. Liu et al. (2022) further posit that implementing social sensing solutions may positively contribute to reducing shopping addiction. Concurrently, Madu (2020) elucidates that internet addiction is influenced by a complex interplay of neural plasticity, physiological, psychological, and social factors, underscoring the critical role of educational interventions in mitigating the deleterious effects of internet addiction on learning and social interaction. These findings collectively emphasize the imperative of addressing social anxiety and bolstering social support mechanisms in the prevention and management of online shopping addiction among university students, offering valuable insights for developing comprehensive intervention strategies within the academic milieu.

Current research on negative emotions as predictors of online shopping addiction reveals a complex interplay of psychological and social factors. Rose and Dhandayudham (2014) identify low self-esteem, poor self-regulation, negative emotional states, the pursuit of pleasure, female gender identity, social anonymity, and cognitive overload as correlates of online shopping addiction. Sun and Wu (2011) posit that emotional instability and lack of responsibility are predictive factors for internet addiction, which is closely associated with impulsive buying behaviors. Li et al. (2022) elucidates that academic distress, personal issues, and negative life events serve as

triggers for Online Shopping Addiction Tendency (OSAT) among university students, while social support acts as a protective factor. Yao et al. (2013) demonstrate that psychological health symptoms and adjustment issues during the first year significantly predict internet addiction among Chinese male college students. Gupta et al. (2018) further establishes depression, anxiety, and stress as independent predictors of internet addiction in university populations. Brunelle and Grossman (2022) highlight the predictive role of high impulsivity, anxiety sensitivity, and lower levels of mindfulness in online compulsive buying behavior, suggesting the potential efficacy of mindfulness interventions. These findings collectively underscore the critical importance of addressing negative emotional factors in the prevention and management of online shopping addiction. Consequently, this study proposes several predictive factors for online shopping addiction among college students, including College Academic Self-Efficacy, sense of place, sense of life meaning, academic procrastination, social anxiety, and negative emotions, offering a comprehensive framework for understanding and addressing this multifaceted phenomenon.

## 3 Materials and methods

### 3.1 Participants

This investigation was conducted at a tertiary university in Sichuan Province, China. Prior to finalizing the research design, the investigators undertook exploratory focus interviews with a cohort of five volunteer participants to elucidate potential predictive factors of online shopping addiction. Prior to finalizing the research design, the investigators conducted exploratory focus interviews with five volunteer participants to inform the selection of potential predictive factors. These preliminary discussions identified three primary domains of interest: sense of life meaning among college students, negative emotional states, and academic procrastination tendencies. These qualitative insights helped refine our quantitative research framework and variable selection, enhancing the ecological validity and contextual relevance of the study within the specific sociocultural milieu of Chinese higher education.

This study employed a convenience sampling method to recruit participants, resulting in a total of 457 students completing the questionnaire. The sample comprised 229 s-year and 228 third-year students. Following data collection, researchers meticulously evaluated the validity of questionnaire responses, yielding 457 valid submissions. The gender distribution of participants reflected 114 males (24.9%) and 343 females (75.1%). This notable gender disparity is consistent with the predominantly female composition of teacher training colleges in China. The sample's geographical representation included 329 rural students (72.0%) and 128 urban students (28.0%), a distribution that aligns with the prevalence of rural-origin students in Western Chinese universities. The age distribution of participants was as follows: 16 participants aged 18 or below (3.5%), 109 aged 19 (23.9%), 160 aged 20 (35.0%), 120 aged 21 (26.3%), 35 aged 22 (7.7%), and 17 aged 23 or above (3.7%). Research participants were recruited on a voluntary basis to complete anonymized questionnaires. This investigation was conducted in strict adherence to the ethical principles outlined in the Declaration of Helsinki and the American Psychological Association (APA) Code of Ethics, and the study

received ethical approval from the Academic Ethics Committee of the School of Chemistry and Life Sciences at [Blinded] University. As a newly established undergraduate institution, the faculty-level committee was authorized for ethical review during the university-level committee's formation period. All participants were university students aged 18–23. Informed consent was obtained from participants and their legal guardians. All data were anonymized to ensure confidentiality. Participation was voluntary, and withdrawal was allowed at any time without consequences. Special care was taken to protect minors, and interactions were conducted in a safe environment. Furthermore, all participants granted permission for the publication of the research findings. This demographic profile provides a comprehensive representation of the target population, facilitating a nuanced analysis of online shopping addiction predictors within the context of Chinese higher education.

### 3.2 Data collection and instruments

This research utilized a targeted design scheme and implemented data collection through an online questionnaire survey from September 2 to September 7, 2023. During class meetings, instructors presented students with a Quick Response (QR) code for the questionnaire as a learning task. The QR code, a machine-readable barcode containing substantial information, could be scanned using smartphones or tablets, redirecting students to the specific questionnaire link. In China, QR codes are ubiquitous, employed not only for accessing specific interfaces but also extensively utilized in financial transactions, identity verification, information retrieval, and various other applications. The QR code was linked to a webpage hosting the questionnaire for this study. To ensure the cross-cultural validity and accuracy of the questionnaire items, this study employed the back-translation method. The first researcher translated the scales from English to Chinese, followed by a second researcher who translated the text back to English. A third researcher then compared the original, translated, and back-translated versions to ensure both accuracy and consistency. Notably, prior to code distribution, class instructors comprehensively elucidated the study's objectives and ensured voluntary participation from all students, a crucial step in maintaining research integrity and validity. This methodological approach underscores the study's commitment to upholding ethical standards by prioritizing participants' voluntary and informed consent throughout the data collection process, thereby enhancing the robustness and credibility of the research findings.

### 3.3 Materials

This study employed a comprehensive questionnaire comprising six sections with 94 items each, encompassing demographic information and multiple psychometric scales: the Online Shopping Addiction Scale, Tuckman Academic Procrastination Scale, Sense of Place Scale, Social Anxiety Scale, College Students' Sense of Life Meaning Scale, Negative Emotion Scale, and College Academic Self-Efficacy Scale. Demographic data collected included gender, age, and urban or rural origin. Originally developed in English, these scales underwent a rigorous translation process for this study. The researchers implemented Brislin (1970) back-translation method to

ensure translation quality and cross-cultural validity. This process involved the first researcher's initial translation from English to Chinese, followed by a back-translation to English by a second researcher. Subsequently, a third researcher compared the original text, Chinese translation, and back-translated English version to assess translation accuracy. The translation underwent iterative refinement and optimization to ensure conceptual and linguistic equivalence across versions, thereby maintaining the psychometric integrity of the scales in the target language and cultural context.

### 3.3.1 Online shopping addiction scale

This study utilized the Online Shopping Addiction Scale developed by Zhao et al. (2017), which comprises 18 items designed to assess compulsive online shopping behaviors. Exemplar items include "When I'm not shopping online, I'm always thinking about it," "I often think about how to free up more time or money for online shopping," and "Online shopping is significant to me." The scale employs a 5-point Likert-type response format, ranging from 1 (strongly disagree) to 5 (strongly agree), yielding potential composite scores between 18 and 90. The scale demonstrated excellent internal consistency in the present investigation, with a Cronbach's alpha coefficient of 0.959. This high reliability coefficient underscores the scale's robust psychometric properties and its suitability for assessing online shopping addiction within the context of this study's target population, thereby enhancing the validity and interpretability of the research findings.

### 3.3.2 Tuckman academic procrastination scale

This study employed the Tuckman Academic Procrastination Scale (Tuckman, 1991) to assess participants' propensity for academic procrastination. The scale comprises 16 items, including exemplars such as "Even when I know studying is important, I still procrastinate," "I delay doing things I do not like to do," and "When tasks have a deadline, I wait until the last minute before I complete them." To maintain consistency with other measures in the study, the original 6-point response format was modified to a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree). This adaptation resulted in potential composite scores ranging from 16 to 80. The scale demonstrated strong internal consistency in the current investigation, with a Cronbach's alpha coefficient of 0.870. This robust reliability coefficient underscores the scale's psychometric integrity and its appropriateness for assessing academic procrastination tendencies within the study's target population, thereby enhancing the validity and interpretability of the research findings.

### 3.3.3 Sense of place scale

This investigation utilized the Sense of Place Scale developed by Jorgensen and Stedman (2001) to assess participants' place attachment and identity. The scale comprises 12 items, including exemplars such as "This place is related to me and reflects my existence," "This place is closely related to me but cannot truly define my identity," and "This place is closely related, and I can be my true self here." Responses were recorded on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree), yielding potential composite scores between 12 and 60. The scale demonstrated acceptable internal consistency in the present study, with a Cronbach's alpha coefficient of 0.716. While this reliability coefficient is lower than those of some other measures employed in the study, it still falls within the acceptable

range for social science research. This psychometric property suggests that the scale provides a reasonably cohesive measure of sense of place within the context of this study's target population, contributing valuable insights to the multifaceted exploration of factors influencing online shopping addiction among college students.

### 3.3.4 Social anxiety scale

This study employed the Social Anxiety Subscale of the Self-Consciousness Scale (SASS-CS), initially developed by Fenigstein et al. (1975) and subsequently refined by Scheier and Carver (1985) to enhance clarity and accessibility. The scale comprises six items designed to assess social anxiety, including exemplars such as "In unfamiliar situations, I need a lot of time to overcome my shyness," "When everyone is looking at me, I tend to mess things up," and "I am easily embarrassed." Responses were recorded on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree), yielding potential composite scores between 6 and 30. The scale demonstrated satisfactory internal consistency in the present investigation, with a Cronbach's alpha coefficient of 0.775. This reliability coefficient indicates a robust level of inter-item consistency, supporting the scale's utility in assessing social anxiety within the context of this study's target population. The psychometric properties of the SASS-CS contribute to the overall validity and interpretability of the research findings, particularly in elucidating the relationship between social anxiety and online shopping addiction among college students.

### 3.3.5 College students' sense of life meaning scale

In the present study, we employed the Chinese version of the Meaning in Life Questionnaire (MLQ), as translated and adapted by Liu and Gan (2010), to assess participants' sense of life meaning. This validated instrument comprises nine items (e.g., "I am searching for a purpose or mission in my life," "My life lacks a clear purpose," "I am seeking the meaning of my life") and is structured along two dimensions: "Presence of Meaning in Life" and "Search for Meaning in Life." To ensure methodological consistency, we modified the original 7-point Likert scale to a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree), yielding a potential score range of 9 to 45 for each participant. The scale's psychometric properties were robust, with an internal consistency coefficient (Cronbach's alpha) of 0.940 in the current study, indicating high reliability. This adaptation of the MLQ provides a culturally appropriate and psychometrically sound measure for assessing the construct of life meaning within our target population, facilitating a nuanced exploration of its relationship with online shopping addiction and other variables of interest.

### 3.3.6 Negative emotion scale

In the current study, we utilized the Negative Emotion Scale, as revised by Antony et al. (1998), to assess participants' negative emotional states. This psychometrically validated instrument comprises 21 items distributed across three distinct dimensions, encompassing various aspects of negative affect (e.g., "I do not seem to feel any pleasure or satisfaction at all," "I feel my mouth is dry," and "I find it difficult to calm down"). To ensure methodological consistency across our battery of measures, we adapted the original 4-point Likert scale to a 5-point scale, ranging from 1 (strongly

disagree) to 5 (strongly agree). This modification resulted in a potential score range of 21–105 for each participant. The scale demonstrated excellent psychometric properties in our sample, with an internal consistency coefficient (Cronbach's alpha) of 0.970, indicating high reliability. This robust measure of negative emotions provides a comprehensive assessment of affective states, facilitating a nuanced examination of their relationship with online shopping addiction and other variables of interest in our study.

### 3.3.7 College academic self-efficacy scale

In the present study, we employed the College Academic Self-Efficacy Scale (CASES), developed by Owen and Froman (1988), to assess participants' self-efficacy within academic contexts. This psychometrically validated instrument comprises nine items (e.g., "Compared to other students in my class, I want to have a better performance," "I am confident that I can understand the teacher," and "I want to have good performance in class") designed to capture various dimensions of academic self-efficacy. Responses are recorded on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), yielding a potential score range of 9–45 for each participant. The scale demonstrated robust psychometric properties in our sample, with an internal consistency coefficient (Cronbach's alpha) of 0.905, indicating high reliability. This well-established measure of academic self-efficacy provides a comprehensive assessment of students' beliefs in their academic capabilities, facilitating a nuanced examination of its relationship with online shopping addiction and other variables of interest in our study. The utilization of CASES enhances the validity and reliability of our findings within the context of academic performance and behavioral addictions among college students.

## 3.4 Design

This quantitative investigation aims to elucidate the underlying mechanisms of online shopping addiction. To achieve this objective, we utilized a questionnaire survey to collect data on students' behaviors related to online shopping addiction and six predictive factors. We submitted the questionnaire materials and a comprehensive explanation of our survey design to the Ethics Review Committee of Chengdu Normal University and the principals of the participating schools. Separate meetings were convened to address research ethics and survey prerequisites. Upon receiving approval, we administered the questionnaire survey and collected responses from the student participants.

To process the survey data, we employed data mining methodologies, which possess the capability to reveal patterns of online shopping addiction. Within the humanities and social sciences domain, commonly utilized machine learning algorithms such as decision trees, k-nearest neighbors, neural networks, naive Bayes, and support vector machines have demonstrated efficacy in predicting students' online shopping addiction tendencies. The decision tree algorithm was selected due to its transparent decision-making process, ability to handle non-linear relationships among psychological variables, and excellent tolerance for mixed data types. While other algorithms could be considered, decision trees' interpretable nature makes them particularly valuable for counseling applications where understanding the reasoning process is essential.

Our selection of the decision tree method for this study was primarily predicated on the following considerations: (1) Decision tree models have been extensively applied in predicting students' online shopping addiction propensities, and (2) they generate easily interpretable rules. Specifically, decision trees establish classification rules through sample training, producing a top-down chart that facilitates comprehension (Mining, 2006). In this hierarchical structure, the decision tree comprises a root node, several internal nodes, and multiple leaf nodes. The root node and internal nodes represent respective testing conditions (i.e., classification criteria), while the leaf nodes denote the final output. Rules can be inferred based on the tree structure formed by each node (Mitchell and Learning, 1997). (3) Furthermore, decision tree algorithms exhibit robust tolerance for multicollinearity and can effectively handle complex relationships among predictor variables. A classification decision tree is employed when predictor variables are categorical, whereas a regression decision tree is appropriate for continuous predictor variables (Miguéis et al., 2018). Given that our study aims to determine whether students exhibit high or low levels of online shopping addiction, we implemented the classification decision tree algorithm to construct the predictive model and analyze the influence of each factor in predicting online shopping addiction behaviors.

## 3.5 Construction of the decision tree

The optimal splitting variables and thresholds for the decision tree were determined based on the information entropy reduction rate criterion. Information entropy, a measure of the degree of impurity in a dataset, is defined as Equation 1 (Mitchell and Learning, 1997):

$$Entropy(D) = -\sum_{k=1}^m P_k \log_2 P_k \quad (1)$$

Where  $D$  is the training dataset with a sample size of  $m$ , and  $P_k$  is the probability of each class of samples. The information gain ratio is used to assess the difference in information entropy of the dataset under different classification methods. If the variable  $C$  is chosen to divide the dataset  $D$  into  $n$  subsets, then the information gain ratio is defined as Equation 2 (Quinlan, 1997):

$$Gain\ ratio(D, C) = \frac{Entropy(D) - Entropy(D|C)}{Entropy(C)} \quad (2)$$

The C5.0 algorithm selects attributes with the highest information gain ratio as splitting points and then creates multiple branches based on the values of that attribute, resulting in the generation of multiple subsets. This selection process is repeated until the last subset contains data of only the same category, thus achieving inductive classification of the data (Che et al., 2011). This methodological approach enables constructing a decision tree model that optimally classifies the dataset based on the most informative attributes, providing a robust framework for analyzing and predicting online shopping addiction behaviors among the study participants.

### 3.5.1 Pruning of the decision tree

We implemented a post-pruning strategy by iteratively pruning the leaf nodes. Following the initial construction of the decision tree, we recursively traversed the dataset to each leaf node and computed the mean squared error for datasets both with and without the leaf nodes. The pruning decision was based on a comparative analysis of these error rates; if the mean squared error decreased after pruning, the node was eliminated, whereas it was retained if no improvement was observed (Quinlan, 1986). This pruning process serves to enhance the model's generalizability and mitigate overfitting.

### 3.5.2 Evaluation of the decision tree

We employed a data partitioning approach to assess our model's robustness and predictive capability. We randomly selected 68% of the sample data ( $n = 311$ ) as the training set, reserving the remaining 32% ( $n = 146$ ) as the test set. The quality of the model was evaluated using three key metrics: accuracy, precision, and recall (Han et al., 2019). Accuracy is defined as the proportion of correctly classified samples relative to the total number of samples. Precision quantifies the proportion of accurate positive samples among the positive predictions in the results, providing insight into the model's ability to avoid false positives. Recall, also known as sensitivity, gauges the proportion of actual positive samples accurately predicted by the model, indicating its effectiveness in identifying true positives. These metrics collectively provide a comprehensive assessment of the decision tree's performance and predictive power in classifying online shopping addiction behaviors.

## 3.6 Data analysis and data encoding

We conducted comprehensive statistical analyses using SPSS 22.0 for descriptive statistics and IBM SPSS Modeler 18.0 for decision tree modeling. Initially, descriptive statistical analysis was employed to

elucidate the frequency and principal characteristics of students' online shopping addiction behaviors and associated predictor variables. Subsequently, we implemented decision tree analysis utilizing the C5.0 algorithm, representing a significant advancement over its predecessors, the ID3 and C4.5 algorithms introduced by Quinlan (1986) and Witten and Frank (2002). The C5.0 algorithm is renowned for its efficacy in handling large datasets, superior processing speed, and enhanced predictive accuracy (Xiong, 2011), marking it as a notable development in machine learning.

To facilitate the decision tree analysis, we categorized the sample into high and low online shopping addiction groups based on a 60% threshold. The predictor variables, including college student ethnic identity, negative emotions, and other nominal or continuous variables, were transformed into binary variables according to predetermined criteria (see Table 1). This binary encoding process optimizes the decision tree's ability to discern meaningful patterns and relationships within the dataset, thereby enhancing the model's predictive capabilities and interpretability. This methodological approach enables a nuanced examination of the factors contributing to online shopping addiction among college students, leveraging advanced statistical techniques to uncover complex relationships and predictive patterns within the data.

## 4 Results

### 4.1 Descriptive statistics

We conducted descriptive statistical analysis on this study's continuous and ordinal variables, with the results presented in Table 2. Students exhibited a high level of online shopping addiction behavior, with a mean score of 3.11 (standard deviation = 0.923), exceeding 60% of the maximum score. This suggests that the majority of students experienced a high level of online shopping addiction. A threshold of 60% of the maximum score was utilized as the coding criterion for each variable.

TABLE 1 Variable encoding and descriptive statistics.

Variable	Encoding	Count	Percentage
Online shopping addiction	0 = low	324	70.59%
	1 = high	133	29.10%
Tuckman academic procrastination	0 = low	344	75.27%
	1 = high	113	24.73%
Sense of place	0 = low	276	60.39%
	1 = high	181	39.61%
Social anxiety	0 = low	168	36.76%
	1 = high	289	63.24%
College students' sense of life meaning	0 = low	69	15.10%
	1 = high	388	84.90%
Negative emotion	0 = low	381	83.37%
	1 = high	76	16.63%
College academic self-efficacy	0 = low	198	43.33%
	1 = high	259	56.67%

TABLE 2 Descriptive statistics

Variable	Full score	Mean value	Standard deviation	60% of the full score
Tuckman academic procrastination	5	2.9884	0.6526	3
Sense of place	5	3.30999	0.4670	3
Social anxiety	5	3.6163	0.7302	3
College students' sense of life meaning	5	4.2188	0.6765	3
Negative emotion	5	2.5638	0.9662	3
College academic self-efficacy	5	3.6676	0.6589	3
Online shopping addiction	5	3.1129	0.9226	3

TABLE 3 Pearson's *r* of the variables.

	TAP	SP	SA	CSSLM	NE	CASE	OSA
TAP	1						
SP	0.039	1					
SA	0.314	0.141	1				
CSSLM	−0.145	0.267	0.016	1			
NE	0.502	0.108	0.343	−0.082	1		
CASE	−0.056	0.393	−0.011	0.299	0.069	1	
OSA	0.488	0.308	0.464	0.221	0.426	0.196	1

TAP, Tuckman academic procrastination; SP, sense of place; SA, social anxiety; CSSLM, college students' sense of life meaning; NE, negative emotion; CASE, college academic self-efficacy; OSA, online shopping addiction. \**p* < 0.05, \*\**p* < 0.01.

The associations among variables were evaluated using [Pearson \(1897\)](#) product–moment correlation coefficient, with the results presented in [Table 3](#). Tuckman academic procrastination, sense of place, social anxiety, college student life meaning, negative emotions, and College Academic Self-Efficacy demonstrated statistically significant positive correlations with online shopping addiction. These findings provide preliminary evidence for the interrelationships among the examined variables and their potential influence on online shopping addiction behaviors.

## 4.2 Predictive analysis of online shopping addiction

The decision tree model for predicting online shopping addiction, illustrated in [Figure 2](#), reveals a hierarchical structure of predictive factors. Academic procrastination emerges as the primary predictor, with students exhibiting high levels subsequently assessed based on their sense of place. This secondary predictor demonstrates high classification accuracy (85.11%) when elevated, whereas a low sense of place correlates with reduced online shopping addiction tendencies (34.48%). For students displaying low levels of academic procrastination, the model bifurcates into two branches predicated on social anxiety levels.

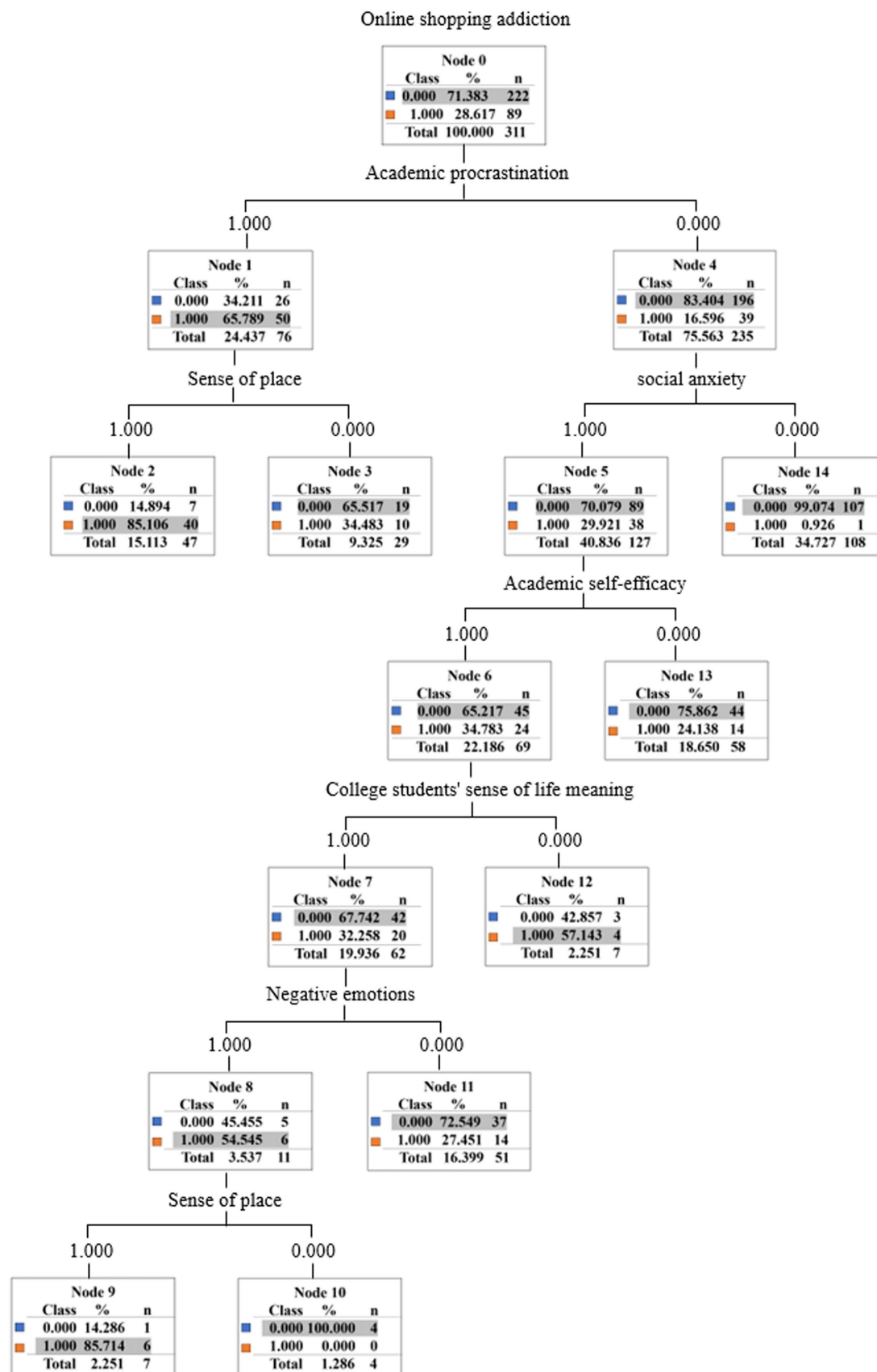
Social anxiety serves as the tertiary predictor, with high social anxiety necessitating further evaluation through four additional predictors. Among students with a low sense of life meaning, online shopping addiction prevalence is notably higher (57.14%). The model incorporates negative emotions as a discriminating factor for those with a high sense of life meaning. Low negative emotions correspond

to low online shopping addiction (27.45%), while high negative emotions prompt further assessment based on a sense of place. A high sense of place in this context indicates online shopping addiction with considerable accuracy (85.71%), whereas a low sense of place suggests an absence of addiction (0%). Conversely, students exhibiting low social anxiety levels tend to demonstrate low online shopping addiction propensity (9.26%). This multi-tiered decision tree model elucidates the complex interplay of psychological and environmental factors contributing to online shopping addiction among college students, offering valuable insights for targeted intervention strategies.

[Figure 3](#) illustrates the relative importance of predictor variables in the model, quantifying their respective contributions to predicting online shopping addiction. Academic procrastination emerges as the most significant predictor, followed by orientation attachment and social anxiety in the second and third positions. Among college students, sense of meaning in life and negative emotions occupy the fourth and fifth ranks of importance. Notably, College Academic Self-Efficacy demonstrates comparatively lower predictive significance within this model. This hierarchy of predictor variables provides valuable insights into the multifaceted nature of online shopping addiction among college students, potentially informing targeted intervention strategies.

## 4.3 Evaluation of the model

[Tables 4, 5](#) present the model's confusion matrix and classification accuracy, respectively. The model demonstrates an accuracy of 79.45% on the test dataset. Further evaluation metrics reveal a precision of 71.88% and a recall of 52.27% on the test dataset, calculated according



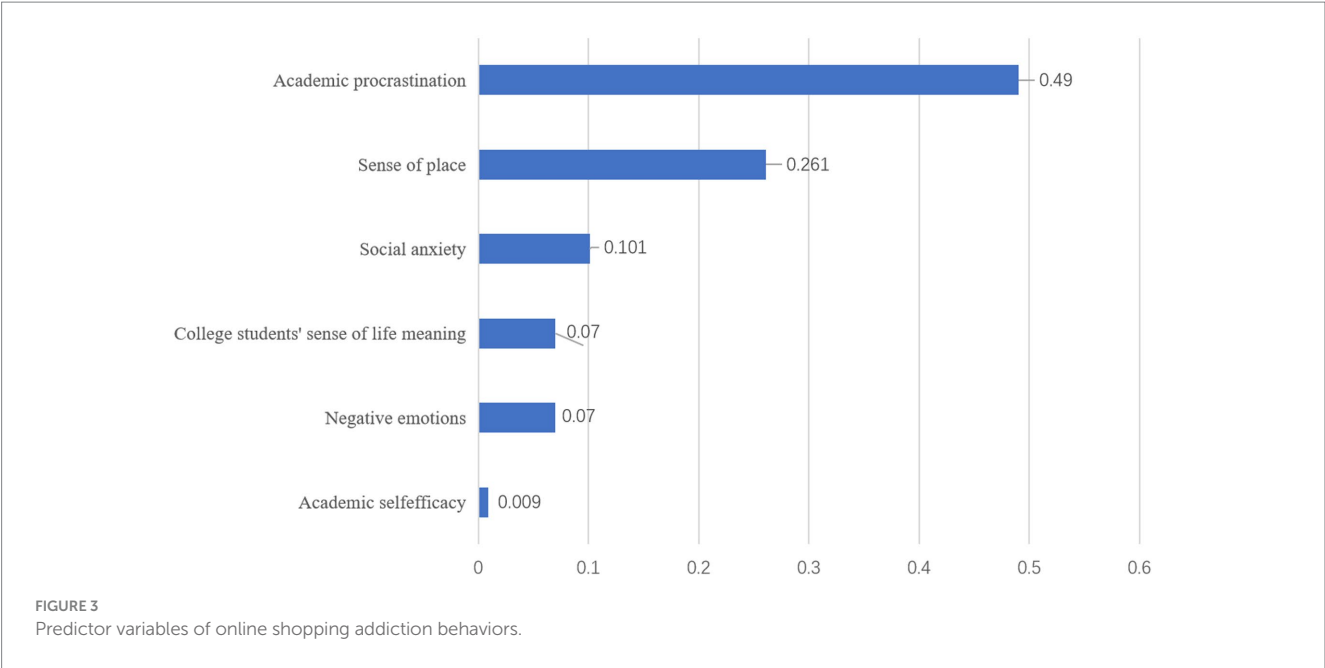


TABLE 4 Confusion matrix.

		Predicted class	
		Class = Low	Class = High
Actual class of training data	Class = Low	211	11
	Class = High	39	50
Actual class of testing data	Class = Low	93	9
	Class = High	21	23

Accuracy refers to the proportion of correctly classified samples out of all samples. That is,  $\text{Accuracy} = (93 + 23)/(93 + 9 + 21 + 23)$ . 79.45%. Precision measures how many of the predicted positive samples are truly positive.  $\text{Precision} = 23/(9 + 23)$ . 71.88%. Recall represents how many of the actual positive samples were correctly predicted.  $\text{Recall} = 23/(21 + 23)$ . 52.27%.

TABLE 5 Classification accuracy.

Title 1	Title 2	Number	Proportion
Training data	Correct	261	83.92%
	Wrong	50	16.08%
	Total	311	
Testing data	Correct	116	79.45%
	Wrong	30	20.55%
	Total	146	

to standard definitions. Collectively, these three-evaluation metrics indicate robust performance of the predictive model, underscoring its utility in identifying online shopping addiction among college students.

5 Discussion

5.1 Discussion of results

This study extends beyond previous research by revealing the hierarchical relationship between multiple psychological predictors of online shopping addiction. While previous studies examined online

shopping addiction through limited pathways—such as Wang Q. et al. (2022) and Wang X. et al. (2022) investigating its mediating role between academic procrastination and negative emotions, and Luo et al. (2018) focusing on the mediating effects of self-control and negative emotions on compulsive buying behavior—our findings demonstrate how academic procrastination interacts with sense of place and social anxiety to create distinct pathways to addiction. These insights enable development of more nuanced, personalized intervention strategies targeting specific predictor combinations.

Employing the C5.0 algorithm decision tree model, this study developed a six-factor predictive model for online shopping addiction behaviors and examined the contributions of these factors. The findings reveal: (1) Academic procrastination, sense of place, social

anxiety, college students' sense of meaning in life, negative emotions, and College Academic Self-Efficacy significantly contribute to predicting online shopping addiction. (2) The importance of these six factors follows the order: academic procrastination, sense of place, social anxiety, college students' sense of meaning in life, negative emotions, and College Academic Self-Efficacy. (3) The evaluation results indicate that the predictive model demonstrates satisfactory predictive performance, with an accuracy of 79.45% and precision of 71.88%, which are considered good performance metrics in behavioral prediction models. Additionally, the model's AUC value of 0.657 surpasses 0.5, demonstrating its superiority over random guessing (Fawcett, 2006).

This study identifies academic procrastination as the most crucial among the six variables in the decision tree model, aligning with findings from Tras and Gökçen (2020), Wang Q. et al. (2022), Ti et al. (2022), and Cerniglia (2019). These studies have established that academic procrastination positively predicts internet addiction. As a subtype of internet addiction, online shopping addiction's predictive factors, including academic procrastination, corroborate previous research findings. One potential explanation for this phenomenon is that procrastinators may be less inclined to discontinue engaging in pleasurable activities, whether online, such as online shopping, or offline pursuits seeking gratification. Individuals with smartphone addiction may find it particularly challenging to cease device usage or manage interruptions (Zhang and Wu, 2020). Moreover, procrastination, including academic procrastination, is a personality trait that may constitute a risk factor for online shopping addiction. Procrastinators typically exhibit weak self-control and a preference for short-term rewards, rendering them more susceptible to internet addiction (Shi, 2018; Ti et al., 2022). Consequently, it is reasonable to consider academic procrastination a significant factor in predicting online shopping addiction. Recent research further supports our findings regarding the predictive power of academic procrastination and social anxiety. A longitudinal study by Hong et al. (2021) found that academic procrastination significantly predicts problematic mobile phone use among Chinese adolescents through distraction cognitions. Similarly, Rose and Dhandayudham (2014) revealed that social anxiety and negative emotional states were strongly associated with increased online shopping addiction tendencies, corroborating our model's identification of social anxiety as a key predictor.

Furthermore, the sense of place emerges as the second most important predictor in the model. Chemnad et al. (2023) identified the school environment as a significant negative predictor of adolescent online shopping addiction. The school environment represents a relatively stable attribute shaping students' behavior, contingent upon their perception of school conduct (Li et al., 2016). For college students, emotional attachment and degree of identification with the school can be considered manifestations of a sense of place. Typically, the absence of a sense of place may lead to dissatisfaction with real life and feelings of loneliness, prompting individuals to seek satisfaction and belonging in the virtual world. When college students experience loneliness, they become more susceptible to developing addiction to the internet's virtual realm, indulging in gaming, or engaging in online shopping (Yu et al., 2019). A plausible explanation for this phenomenon is that the lack of real-world social interaction and sense of belonging may drive them to become addicted to virtual activities like online shopping to fill psychological voids and alleviate anxiety.

Additionally, social anxiety emerges as the third most important factor. Previous research has demonstrated that social anxiety significantly and positively impacts smartphone addiction (Xiao and Huang, 2022; Zhou et al., 2021). This is attributed to social anxiety making students reluctant to face real social situations. Online shopping offers a virtual environment where individuals can fulfill their shopping desires without encountering others. Those grappling with social anxiety often find it challenging to regulate their emotions through conventional social interactions and may struggle to alleviate anxiety and negative emotions effectively (Hou et al., 2021). Shopping can serve as a temporary outlet for relieving anxiety and facilitating emotional regulation, rendering online shopping an avenue for escaping social anxiety. Furthermore, individuals with social anxiety frequently experience diminished subjective well-being during social interactions, whereas online shopping provides a relatively secluded environment that enables them to evade social pressures and enhance their subjective well-being momentarily. This method of circumventing real social pressures may heighten individuals' susceptibility to developing an addiction to online shopping to attain temporary psychological solace and gratification (Taş and Güneş, 2019), thereby escalating the risk of online shopping addiction.

Furthermore, the sense of life meaning among university students emerges as the fourth most important factor in this study. Research by Uzarska et al. (2021) suggests that shopping addiction is often driven by individual focus values such as self-enhancement and openness to change. To some extent, shopping addiction can be perceived as a pursuit in which individuals seek to attain an ideal lifestyle with minimal exertion while maintaining positive and healthy social connections. Particularly within the university student population, online shopping addiction, as a subtype of shopping addiction, may be driven by its ability to satisfy symbolic, experiential, and functional needs, thereby promoting self-identity through an ongoing process (Hou and Yang, 2021). Similarly, Dittmar et al. (2007) revealed that individuals who pursue emotional and identity enhancement through materialism are predisposed to display pronounced compulsive buying tendencies. Additionally, research by Wang X. et al. (2022) suggests that various hedonic motives, such as the pursuit of gratification and engaging in creative shopping, act as significant drivers for compulsive online shopping behavior. For instance, Yoo (2007) uncovered that Korean housewives perceive shopping as entertainment and a responsibility, viewing it as a way to enhance their quality of life. To and Sung (2014) proposed that online shoppers value privacy and a sense of achievement, with their greatest hedonic value being the ability to interact with others while shopping. Therefore, university students with a higher sense of life meaning may be more prone to developing online shopping addiction, reflecting a positive correlation between the sense of life meaning and online shopping addiction. This relationship highlights the role of personal values, efforts to maintain social relationships, and the pursuit of an ideal lifestyle in behavioral choices.

Moreover, negative emotions represent the fifth factor of relative importance. Research has found that negative emotions predict smartphone addiction (Gao et al., 2022; Meng et al., 2023). As a subtype of smartphone addiction, the predictive factors displayed in online shopping addiction also include negative emotions, corroborating previous research (Nawodya and Kumara, 2022; Rose and Dhandayudham, 2014; Wang Q. et al., 2022). Building on prior research, it can be inferred that under the influence of negative

emotions, individuals may be more inclined to seek immediate psychological comfort through activities like online shopping, thereby exacerbating their dependence and addiction to online shopping. Additionally, negative emotions may impact individual executive functions, including decision-making, self-control, and impulse control. Anxiety, in comparison to neutral emotions, significantly impairs executive functions, which may consequently affect an individual's ability to exercise self-control, potentially leading to addictive behaviors such as online shopping addiction (Shields et al., 2016).

Academic self-efficacy emerges as the sixth predictive factor. Saleh (2019) identified a positive correlation between students' internet addiction and College Academic Self-Efficacy. Given that online shopping addiction falls under the umbrella of internet addiction, it is plausible that there exists a predictive relationship between online shopping addiction and College Academic Self-Efficacy. This is supported by Hassan et al. (2015), who found that College Academic Self-Efficacy positively predicts online shopping addiction. Delafrooz et al. (2011) observed a positive correlation between self-efficacy, trust, security, and online purchase intention. One possible explanation for this phenomenon is that self-efficacy positively influences trust in online vendors, subsequently affecting the willingness to engage in online transactions (Kim and Kim, 2005). Consequently, College Academic Self-Efficacy fosters trust in social media or shopping platforms, heightens the propensity to make online purchases and exerts a positive influence on online shopping addiction (Dash and Saji, 2008).

## 5.2 Significance

This study provides valuable insights into online shopping addiction among college students, holding both theoretical and practical significance. From a theoretical perspective, the decision tree model reveals predictive factors of online shopping addiction, thus offering avenues for a deeper understanding of addictive behaviors. This contributes to a more comprehensive understanding of the etiology and associations of various addictive behaviors within the field of psychology. These findings align with broader psychological theories of behavioral addiction, where Kuftyak (2022) suggests that academic procrastination serves as a significant stress factor impacting student behavior and academic performance. The prominent role of sense of place in our model supports Estévez et al. (2017) theory that attachment patterns significantly influence non-substance addictive behaviors. For university counseling services, this suggests the need for integrated intervention approaches combining time management training with environmental adaptation support. Furthermore, the model serves as a foundation for future research. Based on these identified factors, researchers can further explore the complex relationships between online shopping addiction and academic procrastination, sense of place, and social anxiety, potentially leading to more precise intervention measures in the field of mental health.

In practical terms, this study offers several significant applications. Firstly, by utilizing predictive factors such as academic procrastination, sense of place, and social anxiety, early detection of online shopping addiction risk becomes feasible. This enables targeted interventions, the promotion of healthy online habits, and the mitigation of addiction likelihood. Furthermore, educational

institutions, mental health organizations, and parents can provide tailored support based on students' addiction risk profiles. This may include time management and geographic adaptation training for students exhibiting high academic procrastination and low sense of place, as well as social skills training and psychological support for those with high social anxiety. Moreover, targeted strategies in public awareness campaigns and parental guidance can enhance community understanding of online shopping addiction issues and contribute to reducing its prevalence.

## 5.3 Limitations and future directions

This study acknowledges three primary limitations. First, its cross-sectional design only captures patterns of online shopping addiction prediction at a specific point in time. Second, the sample ( $n = 457$ ) is drawn from a single university in China, potentially limiting the generalizability of the findings and necessitating further testing of the predictive model's robustness in diverse regional contexts. Future research could address this by collecting data from multiple institutions using a longitudinal approach. Although our decision tree model demonstrates satisfactory predictive performance, its reliability requires further validation. The relatively small sample size ( $n = 457$ ) may limit the model's statistical power and stability across different subgroups. Future studies should employ k-fold cross-validation with larger samples and conduct sensitivity analyses to establish the model's robustness. Additionally, comparing the decision tree's performance with other machine learning approaches would help validate our methodological choice. Third, the study's scope is constrained by the inclusion of only six factors influencing online shopping addiction, suggesting room for model refinement. Future investigations could enhance the predictive model by employing dynamic tracking methodologies, expanding sample size and diversity, and incorporating additional predictive factors to provide a more comprehensive understanding of online shopping addiction among college students.

The research findings propose a series of recommendations for preventing online shopping addiction among college students. Firstly, educational institutions and families are encouraged to monitor students' academic procrastination tendencies, sense of place, and social anxiety levels. Secondly, for students exhibiting high levels of academic procrastination, it is advisable to cultivate practical time management skills. Thirdly, adaptive support should be extended to students with a low sense of place to enhance their connection to their academic environment. Fourthly, students experiencing high levels of social anxiety may benefit from targeted social skills training and psychological support interventions. Finally, institutions can implement personalized counseling programs, promote multicultural exchange opportunities, and enhance students' overall life satisfaction to mitigate the risk of online shopping addiction.

## 6 Conclusion

This study established a six-factor predictive model for online shopping addiction using the decision tree algorithm. The results demonstrate that this model can effectively assess and predict students' online shopping addiction behaviors, with an accuracy

rate of 79.45%. The predictive model reveals three critical predictors of online shopping addiction: academic procrastination, sense of place, and social anxiety. Additionally, the sense of life meaning, negative emotions, and College Academic Self-Efficacy among college students also possess predictive value for online shopping addiction, albeit to a lesser extent. These findings contribute to a more nuanced understanding of the complex factors influencing online shopping addiction among college students and provide a foundation for developing targeted prevention and intervention strategies.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by the Academic Ethics Committee of the School of Chemistry and Life Sciences, Chengdu Normal University. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

## Author contributions

XW: Writing – original draft, Writing – review & editing. JZ: Writing – original draft, Data curation, Formal analysis. LZ: Writing – original draft, Data curation, Formal analysis.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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