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Social cognition and mental health among children and youth

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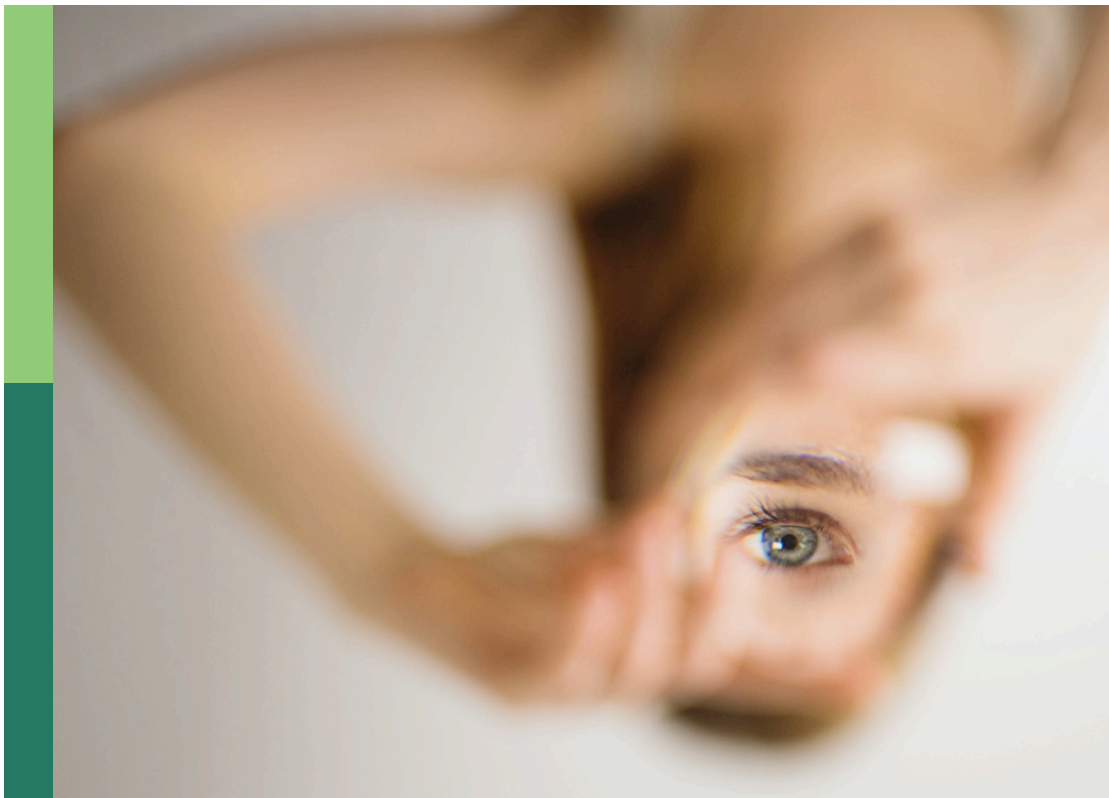

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Social cognition and mental health among children and youth

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Editorial: Social cognition and mental health among children and youth

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Editorial on the Research Topic
Social cognition and mental health among children and youth

This editorial comment on "*Social cognition and mental health among children and youth*" aims to provide a forum to improve research in this field and its contribution to health psychology, the understanding of risk and protective factors, and the exploration of innovative psychosocial interventions to benefit children and youth's health and wellbeing. People's feelings and social experiences are very influenced by their social, cultural, educational and autobiographical contexts.

Long-term effects of stress, such as COVID-19, have the potential to seriously endanger developing children's and youth's social cognition and mental health (Marques de Miranda et al., 2020; Theberath et al., 2022). Given the sanitary precautions requiring social isolation, school closures, and online lessons at home during the COVID-19 pandemic, which lasted for over 3 years, the risk of anxiety and depression disorders among children and adolescents rose (Senft et al., 2022). Young people's social cognition (such as beliefs, desires, self-concept, emotions, and academic achievement) and negative mental health outcomes (such as social isolation, sleep deprivation, smartphone addiction, impulse buying, and aggressive behavior) were likely significantly impacted by these restrictions.

Studies on the negative impact of the pandemic on young people have concentrated on mental health symptoms like anxiety, depression, distress, and subpar academic performance, among others (Elharake et al., 2023). Scientific societies have looked for effective post-pandemic recovery, preventive and intervention measures. Focusing on young people's physical health, psychological wellbeing, resilience, and social capital, some researchers contend that the COVID-19 crisis may also provide a chance for intergenerational family solidarity and personal growth (Moss et al., 2023). The pandemic has therefore need for deeper knowledge of social cognition and mental health among children and young people.

The present 18 academic papers focused on children, adolescents, and emerging adults, mainly from China, and included one study from Netherlands. Published in different article formats—namely Hypothesis and Theory, and empirical papers of varying research designs (such as cross-sectional, longitudinal, and intervention studies), the 18 articles on this Research Topic highlight the individual and contextual factors that can affect the mental health and psychological wellbeing of these age-groups. In this section, we refer briefly to the themes and novel contributions of these 18 articles.

Zeng et al. characterized post-traumatic growth and academic burnout and "the moderating role of core belief challenge among adolescents in an ethnic minority area in China during the COVID-19 pandemic" (p. 1). Fang et al. explored an audience's emotional experience and sharing of audio-visual artistic works during the COVID-19 pandemic. In a sample of college students, Chen S. et al. "explored the mediation and moderation effects on the relationship between different social media usage patterns, emotional responses, and consumer impulse buying during the COVID-19 pandemic" (p. 1). Lin et al. surveyed a large sample of Chinese adolescents and, based on health-related correlates, revealed the important role of negative problem orientation. Feng and Zhang explored "the effect of perceived teacher support and peer relationships on the mental health of Chinese university students, examining the mediating effects of reality and Internet altruistic behaviors on these relationships" (p. 1). Yue et al. explored the influence of peer actual appraisals on moral self-representations through peers' reflected appraisals among Chinese adolescents aged 12–14. Li M. et al. examined the relationship between empathy and altruistic behavior and their underlying mechanisms in Chinese undergraduate and graduate students. Yan et al. offered a theoretical model of how perceived control and sense of power affect adolescents' acceptance intention of intelligent online services through their perceived usefulness. Zhu et al. conducted behavioral and event-related potential experiments in China to illustrate "how young females with facial dissatisfaction process different levels of facial attractiveness" (p. 1). Chen X. et al. "revealed the effect of family cohesion on adolescents' engagement in school bullying and its mechanism of action, providing a theoretical basis for preventing and reducing the occurrence of school bullying incidents" (p. 1). Li A. et al. examined how a father's presence affects an adolescent's social responsibility, and their quality of interpersonal relationships. Li T. et al. "constructed a moderated chain mediation model to investigate the influence of childhood psychological abuse on relational aggression among Chinese adolescents" (p. 1). Zhang et al. demonstrated that photographic intervention could effectively improve positive affect and mitigate negative affect of college students during the COVID-19 pandemic. Wang et al. "showed that subjective wellbeing was positively correlated with social trust, trust in people, self-compassion, and social empathy" (p. 1), in a sample of first-generation Chinese college students. Hua and Zhou examined the relationship between personality assessment and mental health, via sequential mediation path involving the Barnum effect and ego identity. Liu et al. used a multi-methods approach "to analyze the mediating effects of social comparison and body image on social media selfie behavior and social anxiety in Chinese youth group" (p. 1). Fan et al. explored how relationship-maintenance strategies affect burnout in adolescent athletes, "including the potential mediating effects of the coach–athlete relationship and basic psychological needs satisfaction" (p. 1). Lastly, van Grieken et al. evaluated the longitudinal association between life events occurring before the second year and the risk of psychosocial problems at 3 years of age in Netherlands.

The papers on this Research Topic show how understanding the fundamental cognitive/social processes and the applied/clinical situations may help unify and expand our knowledge of Social Cognition and Mental Health throughout childhood and adolescence. However, the research herein is not exhaustive, and results must be weighed against the many conceptual and methodological constraints indicated in the publications. There are also geographic and cultural limits since most of the investigations were done in China. However, we believe that by offering an overview of the topic and emphasizing the most recent achievements, this Research Topic/eBook will be useful to both beginners and specialists toward improving the mental health of disadvantaged children and youth around the globe.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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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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Influence of peers' actual appraisals on moral self-representations of Chinese adolescents

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Adolescence is a vital period of developing a moral self. As individuals enter adolescence, peers become increasingly important to them. This study aimed to explore the influence of peers' actual appraisals on moral self-representations. Based on Looking Glass Self Hypothesis, peers' reflected appraisals usually have a mediating effect on peers' actual appraisals and self-appraisals. This study used the *Chinese Moral Trait Words Rating Scale* to investigate 160 dyads of Chinese adolescents (12–14 years old). The participants filled in the Self-Appraisals Questionnaire, Peers' Reflected Appraisals Questionnaire, and Peers' Actual Appraisals Questionnaire, respectively. The results showed that: (a) peers' actual appraisals indirectly affected self-appraisals through peers' reflected appraisals in the process of forming the moral self of early Chinese adolescents; (b) Chinese adolescents had a certain accuracy in peers' actual appraisals, but often underestimated their peers' actual appraisals of them. This study was conducive to understanding the influence of peers on forming adolescents' moral self in the context of collectivistic culture.

KEYWORDS

adolescents, moral self, self-representation, reflected appraisals, peers' actual appraisals

Introduction

Developmental psychologists think that as individuals enter adolescence, self-differentiation is intensified, self-content changes accordingly, and self-coherence is challenged. Therefore, searching for coherent self-awareness is an important developmental task in adolescence (Becht et al., 2016; Van Doeselaar et al., 2018). The moral self refers to the self-concept organized around a series of moral characteristics (Aquino and Reed, 2002), and as the core meaning of a person (Solomon, 1992; Blasi, 1993; Narvaez and Lapsley, 2009), it is an important part of self-knowledge. Understanding the formation of adolescent moral self helps construct adolescent self-identity, develop prosocial behavior, and shape positive personality.

Moral Self Theory (Aquino and Reed, 2002; Jennings et al., 2014) holds that the research on the moral self should focus on two aspects: the one is about the "having" of the moral self, mainly discussing how morality is internalized into an individual's self-awareness. The other is about the "doing" of the moral self, mainly discussing how internalized morality affects the cognitive and emotional self-regulation abilities that govern decision-making and behavior (Jennings et al., 2014). Researchers generally suggested that the "owning" of the moral self is both cognitive and socially constructed (Bandura, 1991; Harter, 2015). Classical symbolic interactionism thinks that people certainly would not have self-concepts if there is no interaction with others (Mead and Schubert, 1934; Swann and Bosson, 2010). Similarly, the social construction of the moral self is embedded through an individual's role, practice, and interpersonal interaction in a social moral environment, such as family, community, or organization (Hunter, 2000); its cognitive construction is generated on the basis of social interaction through the individual self-concept (Bollich et al., 2011; Srivastava, 2012), and social interaction gives meaning to their experiences. In general, when the social and cognitive constructions are based on morality, an individual is regarded as "having" moral self.

Referring to the influencing factors of the moral self, the researchers focused on personal characteristics and social factors. On the influence of personality traits on the moral self, the researchers discussed an individual's past experiences, personality characteristics, gender, etc. For example, some studies have found that the emotions of an individual's past actions and experiences have more influence on the "doing" of moral self than on the "owning" (Jordan et al., 2011); children with agreeable disposition are more likely to show concern for others (Hastings et al., 2006). In addition to individual characteristics, the researchers also explored the influence of different people, such as parents and peers, on individuals' moral self. For example, some studies have found that a supportive and warm parent-child relationship can help promote children's prosocial development (Hastings et al., 2007), while overly strict parents may undermine children's prosocial behavior; adolescents who get well along with their peers also have higher levels of prosocial behavior (Carlo et al., 2011).

How do people internalize morality as self-representations in real society? According to Looking Glass Self Hypothesis, others' actual appraisals of our moral behavior and our perceived others' actual appraisals play an important role in the formation of the moral self. Looking Glass Self Hypothesis holds that in interpersonal interactions, we are judged by others (others' actual appraisals), and we can perceive others' actual appraisals of us (others' reflected appraisals), and then we will internalize perceived others' actual appraisals into self-views (self-appraisals) (Kinch, 1963; Stets et al., 2020). The basic viewpoints of Looking Glass Self Hypothesis have been verified in different fields, for example, the influence of parents and teachers on the academic ability of middle-school students (Nurra and Pansu, 2009; Tomasetto et al., 2015), of parents, coaches, and teammates on adolescents' sports ability (Amorose, 2003; Bois et al., 2005), of parents or peers on criminal behaviors (Brownfield and Thompson, 2005; Walters, 2016), of social environments on racial identity (Khanna, 2010; Sims, 2016), of classmates in college on the teaching ability of normal university students (Hu et al., 2014), and of peers on personality formation of college students (Yue et al., 2021).

In the real world, we are in different social roles and interact with different others, and different types of others have different influences on individual self-concept. In general, if the other person is important, relevant, valued, or expected (such as a parent, or good friend), that person's perceptions or appraisals of an individual are more likely to be internalized into self-representations (Sinclair et al., 2005; Wallace and Tice, 2012). When individuals enter adolescence, adolescents take significantly less time with their parents but more time with their peers (Jankowski et al., 2014) and become more sensitive to peer acceptance or rejection of information (Pfeifer and Peake, 2012). Teenagers increasingly challenge the legitimacy of parental control over matters, such as personal appearance and cleaning the house (Smetana, 2005), and tend not to disclose to their parents what they consider to be a personal domain (Smetana et al., 2009). This means that peers are becoming increasingly important and have a growing influence on self-representations (Borghuis et al., 2017; Luan and Bleidorn, 2019; Crone and Fuligni, 2020).

From the perspective of individual development, adolescents have not yet formed a stable self-concept, and the main development task at this stage is identity exploration (Erikson, 1963; Veroude et al., 2014). With the development of individual cognitive ability and the change in the living environment in adolescence, adolescents have formed increasingly abstract self-concepts (Harter, 2015), and their self-representations have also attached growing importance to interpersonal or social characteristics (Lu, 1990). Meanwhile, adolescence is an important period of urgent integration between the individual self and morality (Damon, 1996; Blasi, 2004). For example, studies on adolescents' moral judgments have found a closer relationship between moral emotions self-attribution, and confidence in moral judgments (Krettenauer and Eichler, 2006). In addition, adolescents can reconcile their own and others' views in dealing with conflicting value information, allowing more mixed and nuanced moral appraisals, which suggested that the ability to consider their own and others' views, intentions, and emotions help individuals develop their understanding of moral experience (Wainryb et al., 2005).

As an individual meaning system constructed by individuals in social interactions (Valsiner, 2000), culture naturally affects people's moral life in a specific cultural environment. The researchers usually divide culture into two cultural types: individualism and collectivism. According to the basic view of

cultural psychology, culture with an individualistic orientation (such as western societies) constructs social experience around autonomous people, is relatively detached from their communities and relationships, and is motivated to achieve freedom and personal goals. Culture with collectivism as its core (such as eastern Asian societies) constructs social experience around collectivities such as families and communities. Thus, individuals in the collectivistic culture are defined to a large extent by their interdependent roles and responsibilities prescribed by social institutions (Kitayatna et al., 2007; Triandis, 2007). Individualism and collectivism are also considered to maintain different moral concepts (Miller, 2007). Morality in individualistic culture pays more attention to individual independence and choice; while collectivistic culture is regarded as an interdependent and responsive-based morality, which mainly refers to the expectations, regulations, and responsibilities arising from individuals' roles in the social system. Previous studies have found that individuals under collectivism have higher levels of cooperation and prosociety compared with the individualistic society (Mosier and Rogoff, 2003).

The Chinese culture, which is characterized by collectivism, places more emphasis on human morality, human obligations, fulfilling social roles, maintaining social orders, and promoting social harmony. For example, some studies have found that compared with American adolescents, Chinese adolescents are more inclined to lie due to humble service, to divert their attention from individuals, and promote harmonious groups relations (Genyue et al., 2011); on children's blue lies (unconscious lies), children aged 7–11 years were presented with moral dilemmas, in which the characters either lied to help their partners or told the truth to help their community (such as school), or vice versa. Chinese children think that lies help the groups but hurt the individual less than the opposite; in addition, they suggested that telling the truth is helpful for individuals, but is harmful to the groups, so they would rather say the opposite answers (Fu et al., 2010). Based on this, we adopted the *Chinese Moral Trait Words Appraisal Scale* in line with the Chinese cultural model for research (Guo et al., 2011). According to the Chinese cultural characteristics, the scale consists of seven dimensions, namely, sympathy, agreeableness, independence, conscientiousness, extraversion, sophistication, and ambition. Sympathy refers to an individual's attitude of likes and dislikes toward others and recognition of their own beliefs in the moral context. Agreeableness refers to an individual's cooperation, selflessness, gentleness, comity, and tolerance in interpersonal communication. Independence refers to the will trait of moral behavior and is the behavior response that individuals may make in the moral context, such as strength, capability, and ratio. Conscientiousness refers to people's traits in their lifestyle and work, such as self-discipline, concentration, and seriousness. Extraversion refers to the traits of being active and positive in an interpersonal context. Sophistication refers to the basic attitudes and behavior traits of individuals to safeguard interests or achieve goals when they face complex contexts of justice and interest in society. Ambition refers to an individual's attitude and motivation toward authority and tradition.

Culture affects not only people's moral lives but also their self-representations and interpersonal interaction. The individualistic culture emphasizes the independence and uniqueness of individuals, while the collectivistic culture attaches more importance to interpersonal relations and interdependence (Triandis, 1995), thus forming independent and interdependent self-constructs, respectively (Markus and Kitayama, 1991). For individuals with individualistic tendencies, their self-representations are more likely to be constructed in a general way, while for those with collectivistic tendencies, their self-representations are more likely in a context way (Zhou and Cacioppo, 2010). Compared with American participants, Chinese participants were better at perspective-taking (Wu and Keysar, 2007); others' views often become the default position of east Asians' self (Suh, 2007). These studies meant that others' views had a greater influence on individual self-concept in a collectivistic culture.

Based on the above, this study took Chinese adolescents as the participants and focused on the domain of moral self that has core significance for individuals. Due to the increasing importance of peers in adolescence and the relatively unstable self-representations of adolescents, this study aims to explore the influence of peers on the moral self-representations of Chinese adolescents. According to Looking Glass Self Hypothesis, it is predicted that peers' actual appraisals indirectly affect adolescents' moral self-representations through peers' reflected appraisals, namely, peers' reflected appraisals have a mediating effect between peers' actual appraisals and adolescents' self- appraisals.

Methods

Participants

This study adopted the convenient sampling method to select a middle school in Guizhou Province. After obtaining the authorization from the school, we randomly selected 167 participants from the first grade and the second grade and asked each of them to select a partner who they were familiar with in their own class. Participants were 334 middle-school students (167 dyads). During parent-teacher meetings at the school, we introduced the study to parents in detail and conducted the questionnaire research for adolescents after obtaining their guardians' written consent. Before the questionnaire, adolescents were told that the focus of this study was to understand their appraisals of themselves and their partners, their participation was voluntary, and if they would not like to participate, they have the right to refuse. It was told

them that their information would only be used for research purposes and be kept confidential. Each participant filled in three types of questionnaires: Self-Appraisals Questionnaire, Peers' Reflected Appraisals Questionnaire, and Peers' Actual Appraisals Questionnaire. Since 7 participants did not complete the questionnaires, this study collected 320 (160 dyads) of valid data. A total of 320 adolescents were 12–14 years old ($M = 12.91$, $SD = 0.49$), including 164 boys and 156 girls. This study was approved by the Ethics Committee of Guizhou Minzu University.

Measures

Self-representations

We used the *Chinese Moral Trait Words Rating Scale* (CMTWRS, Guo et al., 2011) to measure the moral self-representations of adolescents. The scale has been shown to be suitable for measuring moral personality in the context of Chinese culture and comprises seven factors, namely, sympathy, ambition, independence, extraversion, conscientiousness, agreeableness, and sophistication. The scale with 59 items was assessed using a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). In this study, the Cronbach's alpha coefficient in the Self-Appraisals Questionnaire of the CMTWRS was 0.94.

Peers' reflected appraisals

To measure peers' reflected appraisal of adolescents, adolescents were asked to infer to what extent their peers thought that the trait words of the CMTWRS described themselves (adolescents). The 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) was used for assessment. According to previous studies (Hu et al., 2014; Silva et al., 2020), "I am..." was changed into "My partner thinks I am..." in the CMTWRS. In this study, the Cronbach's alpha coefficient in the Peers' Reflected Appraisals Questionnaire of the CMTWRS was 0.96.

Peers' actual appraisals

To measure peers' actual appraisals, adolescents' peers were asked to fill in this questionnaire and to judge to what extent the trait words of the CMTWRS described them. The 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) was used for assessment. "I am …" was changed into "My partner is …" in the CMTWRS. In this study, the Cronbach's alpha coefficient in the Peers' Actual Appraisals Questionnaire of the CMTWRS was 0.95.

IOS scale

To measure the closeness between participants and their peers, the participants were asked to fill in the "Inclusion of Other in the Self" (IOS) Scale (Aron et al., 1991). IOS was used to measure the degree of interpersonal closeness. The IOS scale consists of seven pairs of overlapping circles, with each pair overlapping slightly more than the preceding pair. The participants were asked to select the pair of circles that best portrays their relationship with their partners.

Procedures

A total of 160 dyads of adolescents participated in this study (conducted from October to November 2018), and each dyad was composed of two participants who were familiar with each other well (the IOS score filled by 160 dyads of participants was: $M_{self} = 4.93$, $SD = 1.92$; $M_{peers} = 5.00$, $SD = 1.84$; the correlation coefficient of the IOS score filled by self-peer $r = 0.56$).

Two participants of each dyad came together to the lab, where each participant sat at a desk with a partition and two desks kept at a distance. The way was to prevent the two participants from communicating with each other while filling in the questionnaires. Each participant first filled in the Self-Appraisal Questionnaire.

Second, the participants filled in the Peers' Reflected Appraisal Questionnaire. Before filling in the questionnaire, they were asked to write their own names on the questionnaire and the names of their partners. Then, they filled in the IOS Questionnaire and were reminded what they filled in was the close relationship with the partner, and asked them to judge how the partner viewed them.

Finally, the participants filled in the Peers' Actual Appraisals Questionnaire. Before filling in the questionnaire, they were asked to write their own names on the questionnaire and the names of their partners and were reminded that the next step was to make trait words judgment on the partner.

Each dyad of participants filled in the three types of questionnaires. The Self-Appraisals Questionnaire, Peers' Reflected Appraisals Questionnaire, and Peers' Actual Appraisals Questionnaire of each dyad of participants were conducted with one-to-one correspondence. This study received 320 sets of data.

Data analyses

The SPSS 23.0 software was adopted to process and analyze 320 sets of data, calculating descriptive statistics (*M, SD*) and Pearson correlation. Subsequently, the SPSS

TABLE 1 Descriptive statistics among the three types of appraisals.

	SA *M(SD)*	RA *M(SD)*	AA *M(SD)*	RA-SA *M(SD)*	$t_{(RA-SA)}$	AA-SA *M(SD)*	$t_{(AA-SA)}$	AA-RA *M(SD)*	$t_{(AA-RA)}$
Sympathy	5.28 (0.93)	5.23 (1.10)	5.37 (1.08)	−0.05 (0.69)	−1.18	0.09 (1.25)	1.25	0.13 (1.32)	1.81^{y}
Ambition	4.01 (1.17)	3.61 (1.28)	3.72 (1.28)	−0.40 (1.09)	−6.58***	−0.30 (1.61)	−3.30***	0.10 (1.68)	1.11
Independence	4.76 (0.99)	4.83 (1.10)	5.08 (1.07)	0.08 (0.85)	1.60	0.32 (1.28)	4.50***	0.25 (1.37)	3.21***
Extraversion	5.19 (0.96)	5.18 (0.96)	5.40 (1.00)	−0.01 (0.76)	−0.18	0.20 (1.21)	3.04***	0.21 (1.16)	3.29***
Conscientiousness	5.15 (1.03)	5.19 (1.16)	5.35 (1.20)	0.04 (0.82)	0.80	0.20 (1.41)	2.57*	0.17 (1.48)	2.00*
Agreeableness	5.00 (0.88)	5.00 (1.02)	5.12 (1.08)	−0.00 (0.71)	−0.04	0.12 (1.20)	1.83^{y}	0.12 (1.26)	1.77^{y}
Sophistication	2.95 (0.95)	2.95 (1.11)	3.04 (1.17)	0.00 (0.97)	0.03	0.09 (1.44)	1.11	0.09 (1.50)	1.05
Total score	4.62 (0.70)	4.57 (0.79)	4.73 (0.73)	−0.05 (0.55)	−1.58	0.10 (0.88)	2.12*	0.15 (0.93)	2.96***

SA, self-appraisals; AA, peers' actual appraisals; RA, peers' reflected appraisals; RA-SA, reflected-minus-self; AA-SA, actual-minus-self; AA-RA, actual-minus-reflected; $^{y}p < 0.1$, $^{*}p < 0.05$, $^{***}p < 0.001$.

TABLE 2 Correlations among the three types of appraisals.

	SA-AA	AA-RA	SA-RA
Sympathy	0.24**	0.27**	0.78**
Ambition	0.14*	0.14*	0.61**
Independence	0.23**	0.21**	0.67**
Extraversion	0.25**	0.31**	0.68**
Conscientiousness	0.21**	0.21**	0.72**
Agreeableness	0.26**	0.28**	0.73**
Sophistication	0.09	0.14*	0.57**
Total score	0.24**	0.26**	0.73**

SA-AA, the relationship between SA and AA; AA-RA, the relationship between AA and RA; SA-RA, the relationship between SA and RA.

macro PROCESS Model 4 (Hayes and Preacher, 2013) was adopted for the mediation analyses, taking self-appraisals as the independent variable, peers' reflected appraisals as the mediator, and the peers' actual appraisals as the outcome variable; bootstrap = 5,000 resampling and 95% bias-corrected confidence intervals (*CIs*) were used. Mediation was deemed to be statistically significant if the *CIs* did not include zero.

Results

The test of common method variance

It is considered a thorny issue that tests the data collected from a single source and whether there are differences in common method variance (Avolio et al., 1991). This study used Harman's one-factor test (Podsakoff and Organ, 1986) to analyze common method bias (Livingstone et al., 1997). The underlying assumption of this technique is if there is a large quantity of method variations, a single factor will be isolated in factor analysis, or a common factor will be used to account for most of the variations (Fuller et al., 2016). A total of 38 factors with unrotated eigenvalues in this study were greater than 1, and the explanatory rate of variation of the first factor was 22.47%, which was lower than the critical standard of 40%, and then the results showed that the common method bias was not significant.

Comparison of differences among self-appraisals, peers' reflected appraisals, and peers' actual appraisals

To compare the differences among self-appraisals (SAs), peers' reflected appraisals (RAs), and peers' actual appraisals (AAs), this study calculated the differences between the two types of appraisals (e.g., reflected-minus-actual) and conducted one-sample *t*-test for the difference value, with the results shown in Table 1. The results showed that RAs were significantly lower than AA in sympathy, independence, extraversion, conscientiousness, agreeableness, and moral total score; SAs were significantly lower than AAs in ambition, independence, extraversion, conscientiousness, agreeableness, and moral total score. In general, the results indicated that Chinese adolescents would underestimate peers' moral appraisals of themselves.

Correlation analyses among self-appraisals, peers' reflected appraisals, and peers' actual appraisals

The results of correlation analyses among adolescents' moral self-appraisals, peers' reflected appraisals, and peers' actual appraisals are shown in Table 2. The results indicated that SA-RA had high correlations ($r = 0.57$–0.78) in sympathy, ambition, independence, extraversion, conscientiousness,

agreeableness, sophistication, and the total score. In addition, AA-RA had low correlations (r = 0.14–0.28) in sympathy, ambition, independence, extraversion, conscientiousness, agreeableness, sophistication, and the total score; SA-AA had low correlations (r = 0.14–0.26) in sympathy, ambition, independence, extraversion, conscientiousness, agreeableness, and the total score.

The mediating analyses

This study adopted Model 4 of the SPSS Macro-process (Hayes and Preacher, 2013) to test the mediating effect of RA on AA and SA.

The results showed that RA had a predictive effect on SA (sympathy, $\beta = 0.65$, $p < 0.001$; ambition, $\beta = 0.54$, $p < 0.001$; independence, $\beta = 0.59$, $p < 0.001$; extraversion, $\beta = 0.59$, $p < 0.001$; conscientiousness, $\beta = 0.63$, $p < 0.001$; agreeableness, $\beta = 0.64$, $p < 0.001$; sophistication, $\beta = 0.48$, $p < 0.001$; total score, $\beta = 0.78$, $p < 0.001$). Further analyses of bootstrap showed that RA had a significant mediating effect on AA and SA in moral personality traits (refer to Table 3; Figure 1). The mediating effects are as follows: sympathy [ab (mediating effect) = 0.21, SE (standard error) = 0.05, 95% CI = 0.12–0.30], ambition (ab = 0.08, SE = 0.03, 95%CI = 0.02–0.15), independence [ab = 0.14, SE = 0.04, 95%CI = 0.06–0.21], extraversion (ab = 0.21, SE = 0.04, 95%CI = 0.13-0.28), conscientiousness (ab = 0.15, SE = 0.04, 95%CI = 0.07–0.24), agreeableness (ab = 0.20, SE = 0.04, 95%CI = 0.12–0.28), sophistication (ab = 0.08, SE = 0.03, 95%CI = 0.01–0.14), and total score (ab = 0.20, SE = 0.04, 95%CI = 0.12–0.29).

TABLE 3 Mediating effect, direct effect, and total effect among the variables.

	Effect	Boot SE	Boot LL CI	Boot UL CI
Sympathy				
Mediating effect	0.21	0.05	0.12	0.30
Direct effect	0.02	0.03	−0.04	0.09
Total effect	0.21	0.05	0.11	0.30
Ambition				
Mediating effect	0.08	0.03	0.02	0.15
Direct effect	0.05	0.04	−0.03	0.14
Total effect	0.13	0.05	0.03	0.24
Independence				
Mediating effect	0.14	0.04	0.06	0.21
Direct effect	0.09	0.04	0.01	0.17
Total effect	0.21	0.05	0.11	0.32
Extraversion				
Mediating effect	0.21	0.04	0.13	0.28
Direct effect	0.04	0.04	−0.04	0.12
Total effect	0.24	0.05	0.14	0.34
Conscientiousness				
Mediating effect	0.15	0.04	0.07	0.24
Direct effect	0.05	0.04	−0.02	0.12
Total effect	0.18	0.05	0.09	0.27
Agreeableness				
Mediating effect	0.20	0.04	0.12	0.28
Direct effect	0.05	0.04	−0.02	0.13
Total effect	0.22	0.05	0.13	0.31
Sophistication				
Mediating effect	0.08	0.03	0.01	0.14
Direct effect	0.01	0.04	−0.07	0.08
Total effect	0.07	0.05	−0.02	0.16
Total score				
Mediating effect	0.20	0.04	0.12	0.29
Direct effect	0.03	0.03	−0.03	0.10
Total effect	0.19	0.04	0.10	0.28

Bootstrap sample size = 5,000; SE, standard error; LL, low limit; UL, upper limit; CI, confidence interval.

Discussion

This study mainly discussed the influence of peers on early adolescents' moral self-representations in the context of Chinese culture. The results verified the basic view of Looking Glass Self Hypothesis and found that peers' reflected appraisals had a mediating effect on peers' actual appraisals and adolescents' moral self-perception. This study also found that there was a significant correlation between peers' reflected appraisals and peers' actual appraisals of Chinese adolescents, while the score of peers' reflected appraisals was lower than that of peers' actual appraisals, which showed that adolescents' inferences about peers' moral appraisals on themselves were accurate to a certain extent, but they often underestimated peers' actual appraisals.

This study found that peers' actual appraisals indirectly affected the moral self-representations of early through peers' reflected appraisals, which indicated that adolescent perceived peers' views were vital in the influence of others' views on their self-representations while interacting with others. This study extended the effectiveness of Looking Glass Self Hypothesis on early Chinese adolescents. The results were similar to those of previous studies taking adolescents as the participants (Silva et al., 2020; Yue et al., 2021) but different from those taking Chinese adults as the participants (Yue, 2019). Based on these research results, it was found that the influence of others' views on individuals' self-representations depended on the development stages of the individuals. This study selected early Chinese adolescents, whose self-concept was relatively unstable and whose main task was self-exploration, to form unified and complete self-representations (Van Doeselaar et al., 2018), they

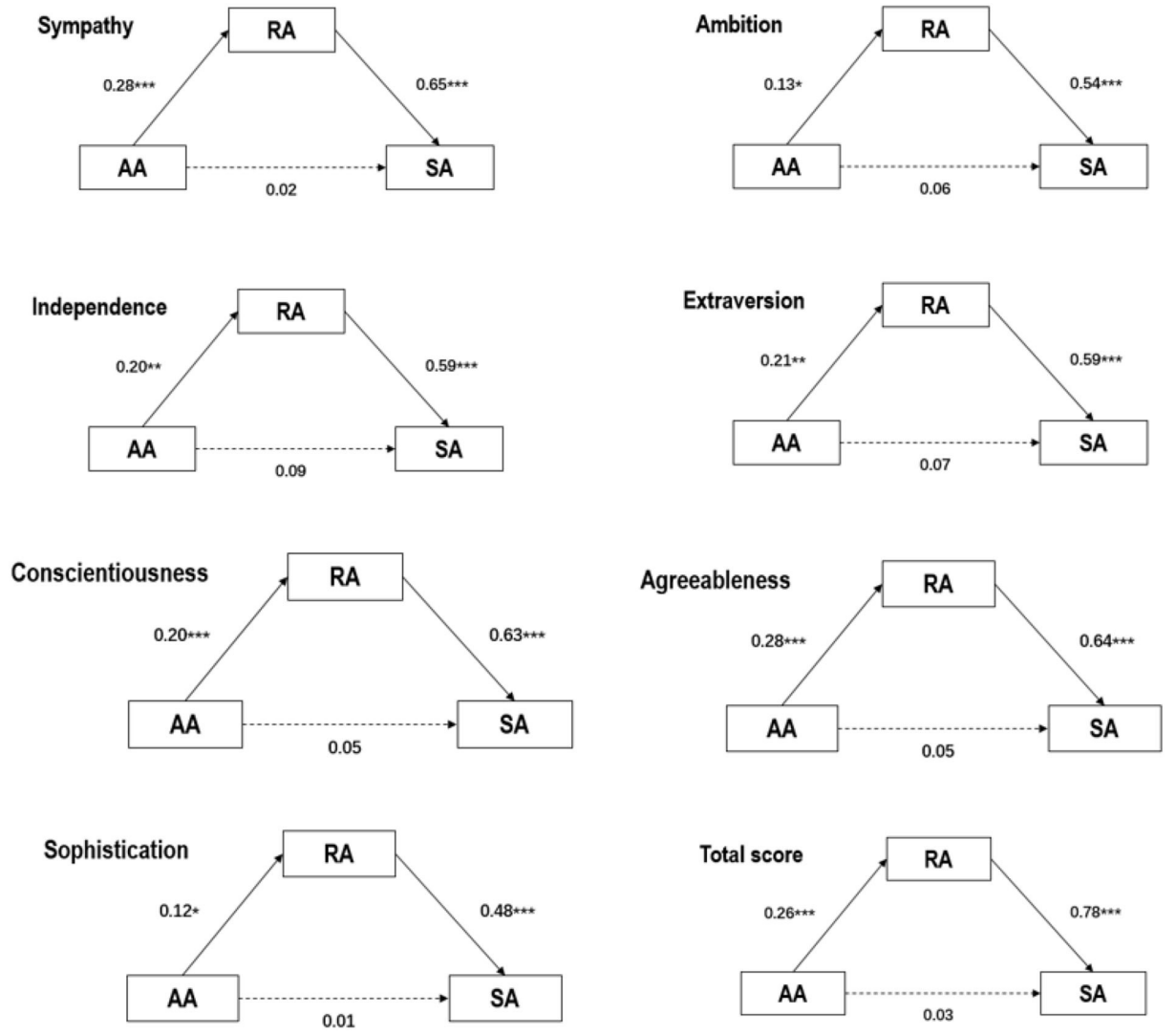

FIGURE 1
Mediation models of the effect of peers' actual appraisals and self-appraisals *via* peers' reflected appraisals.

were more sensitive to others' feedback information (Pfeifer and Peake, 2012), and they more focused on others' appraisals of them (Harter, 2015), so others' actual appraisals had a greater effect on their self-representations. When individuals entered adulthood, their self-concept became more stable, and they moderately paid less attention to others' views whose influence on individuals' self-representations was relatively smaller (Yue, 2019). In general, both in the eastern culture and the western culture, the effectiveness of the reflected appraisals model should depend on whether the stability of the individuals' self-knowledge was or not. When individuals were in the early stage or the initial stage of new environmental adaptation (such as normal university students' early stage of their career Hu et al., 2014, they were more sensitive to the environment, and their domain self in this environment were in the stage of exploration), they would pay more attention to and infer others' views of them, and the influence of others' views on individuals' self-representations was greater. However, when individuals entered adulthood or the adjustment period in the environment, their attention to others' views was relatively lower, and the influence of others' views on individuals' self-representations was relatively smaller, for example, the studies about the accuracy of adults' reflected appraisals also found that perceived others' views were more from the self-views, not from others' actual appraisals (Carlson and Kenny, 2012).

On the relationships among self-appraisals, peers' reflected appraisals, and peers' actual appraisals, the results of this study indicated that self-reflected appraisals had high correlations,

reflected-actual appraisals had medium and low correlations, self-actual appraisals had medium and low correlations, as well as the relational schemas of self-actual appraisals and reflected-actual appraisals of early adolescents were more similar. The results were different from those of researching parents' reflected appraisals of early adolescents (Silva et al., 2020), as well as different from those of researching college students (Yue et al., 2021) and adults (Yue, 2019). There were two reasons why these results were different: the one was related to the type of others. Silva et al. (2020) selected parents as important others in research and found that there were medium correlations among self-appraisals of early adolescents and parents' actual appraisals, as well as parents' reflected appraisals and parents' actual appraisals. This indicated that peers become more and more important as individuals grow up (Borghuis et al., 2017; Luan and Bleidorn, 2019), but the parent-child relationship was still the most important for individuals at the stage of early adolescents, and parents' appraisals had a greater impact on early adolescents' self-representations. The other was related to the ages of the individuals. The results of researching college students (Yue et al., 2021) and adults (Yue, 2019) found that different from the medium and low correlation between self-actual appraisals in this study, the correlation between self-actual appraisals of college students, or adults was not significant. This result could indicate that although peers' relationships were one of the most important relationships in adolescence and adulthood, peers' appraisals had a greater impact on early adolescents.

This study also found the cultural traits of peers' reflected appraisals. It was found that, in general, self-appraisals and peers' reflected appraisals were lower than peers' actual appraisals across all dimensions of moral personality, which showed that, compared with others' actual appraisals of them, Chinese adolescents appraised themselves less positively and underestimated their others' appraisals of them. This result was similar to those of previous studies on Chinese college students and adults (Hu et al., 2014; Yue, 2019; Yue et al., 2021); however, different from studies on western participants, which found that western individuals generally overestimate others' actual appraisals of them (Carlson and Kenny, 2012). The fact that Chinese individuals often underestimate how others evaluate them may reflect cultural differences in social interaction. Different from a western culture which emphasizes individual independence and individual choice, the Chinese culture puts more emphasis on interpersonal interdependence, pays attention to social order, promotes interpersonal harmony (Kim et al., 2006), and considers "face" in interpersonal interaction (Cao et al., 2009), which means others' actual appraisals on individuals will be more indirect and implicit (Hu et al., 2014), especially in moral appraisals, and others will have more positive feedbacks, but will not directly express negative information. In addition, the Chinese culture places great emphasis on individual reflection. For example, "I reflect on myself three times a day" requires individuals to have more introspection about themselves and view themselves from different angles. In addition, the Chinese culture emphasizes individuals' reflectivity more, for instance, "one should reflect on oneself in a day" requires individuals to be more introspective about themselves and to view themselves from different perspectives. The pursuit of interpersonal harmony in the Chinese culture makes people not show their uniqueness too much in group interactions but cover up their own uniqueness to make themselves harmonious with groups. The exhortation of "the tall trees that rise above the forest are always blown first by the strong wind" also causes individuals to take relatively low-key behaviors, showing lower self-appraisals and more adopting a self-modesty approach in interpersonal interactions (Hu and Huang, 2009). Therefore, based on the cognitive approach of self-modesty and the implicitness of interpersonal expression, Chinese adolescents show relatively low self-appraisals and underestimate others' appraisals of them.

This study verified the validity of Looking Glass Self Hypothesis in the collectivistic culture, but it also had some limitations. First, as the relationship between adolescents and their peers is developing gradually, how do peers' actual appraisals affect individual self-representation? In the future, longitudinal research techniques should be used to try to answer this question. Second, teachers, as significant others, have a greater impact on forming adolescents' morality. It is worth further exploring whether Looking Glass Self Hypothesis is efficient in the effect of teachers on adolescents' moral self-representations. Finally, whether the results of this study can be expanded to other groups under the collectivistic culture, the following study can be tried to expand to other countries (such as Japan and Korea) under the collectivistic culture, which can be helpful to learn more about whether individuals will underestimate others' actual appraisals under the collectivistic culture, and to understand the stability of the cultural features of others' reflected appraisals.

In conclusion, the theoretical perspectives of Looking Glass Self Hypothesis were tested under the collectivistic culture, and this study found that there was cross-cultural applicability of Looking Glass Self Hypothesis. This study showed that peers' actual appraisals indirectly affected the moral self-representations of early Chinese adolescents through peers' reflected appraisals. Compared with college students or adults, the relational schemas of self-actual appraisals and reflected-actual appraisals of early adolescents were more similar. This study also found that the cultural features of reflected appraisals, different from western participants overestimated others' appraisals of them, Chinese participants often underestimated others' actual appraisals of them. This study would be beneficial to understand the formation of Chinese adolescents' moral self-representations.

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 human participants were reviewed and approved by Ethics Committee of Guizhou Minzu University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

CY designed the study. YL and KO carried out the survey. CY, KO, and XD analyzed the data. CY, YL, and FC drafted the initial manuscript and revised it. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

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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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Core belief challenge moderated the relationship between posttraumatic growth and adolescent academic burnout in Wenchuan area during the COVID-19 pandemic

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This study investigates the characteristics of posttraumatic growth (PTG) and academic burnout among adolescents in an ethnic minority area in China during the COVID-19 pandemic, and examines the moderating role of core belief challenge on the association between PTG and academic burnout. This study surveyed 941 secondary school students in Wenchuan using the posttraumatic growth inventory, adolescent academic burnout inventory, core beliefs inventory, and a self-designed demographic questionnaire. The results showed that: (1) Five months after the COVID-19 outbreak in China, the level of PTG among adolescents in the Wenchuan area was high and its prevalence was 32.3%. Among them, the dimension of perceived changes in self was the highest, and the PTG level of junior high school students was higher than that of high school students. The academic burnout level of adolescents, particularly emotional exhaustion, was also high. The academic burnout level of the high school students was higher than that of junior high school students. (2) There was a significant negative correlation between PTG and academic burnout among adolescents. (3) Core belief challenge moderated the relationship between PTG and academic burnout. PTG had a significant negative predictive effect on adolescents' academic burnout only when the core belief challenge was above a moderate level. These results showed the uniqueness of PTG and psychological behavioral problems of adolescents in ethnic minority areas during the COVID-19 pandemic. They also emphasized the key role of core belief challenge in the process of PTG in reducing adolescents' academic burnout. Based on these results, recommendations are provided to alleviate academic burnout among adolescents in Wenchuan against the background of the COVID-19 pandemic. While providing full play to ethnic minority cultural characteristics to promote posttraumatic growth, guiding adolescents' value reflection and cognitive reconstruction should be focused on.

KEYWORDS

posttraumatic growth, academic burnout, core belief challenge, adolescent, COVID-19

Introduction

The coronavirus disease (COVID-19) pandemic is a major public health emergency worldwide. Since its outbreak, individuals have experienced many problems such as the rapid transmission of the virus, suspension of school and work, interpersonal isolation, resource shortages, and economic crises, which seriously threatened their physical and mental health (Li et al., 2020; Dozois, 2021; Zheng et al., 2021). In China, the rapid and effective control measures of the Chinese government effectively controlled individuals' objective exposure to the personal experience of loss and casualties in regions other than key pandemic areas, such as Wuhan; however, subjective trauma exposure remained relatively serious. Subjective trauma exposure refers to subjective fear, with indirect and alternative characteristics, and may lead to post-traumatic stress disorder (PTSD) and various psychological and behavioral problems (Zhang et al., 2021). A systematic review of studies conducted in eight countries, including China, showed a high prevalence of psychological problems among the general population during the outbreak, including PTSD (7–53.8%), depression (4.6–48.3%), anxiety (6.33–50.9%), and stress (8.1–81.9%) (Xiong et al., 2020). As a stress-susceptible population, adolescents have been significantly affected by the COVID-19 pandemic. In addition to the anxiety, fear, and stress caused by the pandemic itself, prolonged home isolation, online learning, and parent–child conflict further exacerbated the adaptation problems of adolescent groups (Guessoum et al., 2020; Wang C. et al., 2020; Wang G. et al., 2020; Zhou et al., 2020; Li et al., 2021).

Literature review

Posttraumatic growth

While stressful events can lead to PTSD and various psychological and behavioral problems, it can also lead to positive individual growth. Conceptually, posttraumatic growth (PTG) refers to positive psychological changes experienced because of struggling with a highly challenging event or crisis (Tedeschi and Calhoun, 1996). These positive changes involve diverse fields, including self-change as perceived by individuals, interpersonal relations, and the philosophy of life (Tedeschi and Calhoun, 1996, 2004). Physical diseases, stress events, natural disasters, and seeing the vicarious trauma of others may trigger PTG in individuals. PTG levels are usually influenced by personality (Mattson et al., 2018), social support (Yang et al., 2010) and coping strategies (Kesimci et al., 2005; Schroevers and Teo, 2008), among others. A meta-analysis of trauma subjects, including firefighters, cancer patients, earthquake survivors, and only child-lost parents, showed that the prevalence of PTG after trauma events was between 10% and 77.3% (Wu et al., 2019).

In the context of the COVID-19 pandemic, subjective/objective trauma exposure may also trigger individual PTG. For example, individuals who experience isolation can learn to overcome adversity, improve themselves, and achieve self-transcendence (Zhang et al., 2020). Research has shown that during the COVID-19 pandemic, the prevalence of adolescent PTG was 27.9% among Greek adolescents (Ulset and Soest, 2022) and 22.0% in Hubei Province, a high-risk area in China (Zhen and Zhou, 2021). The incidence of PTG among adolescents in medium-risk areas such as Leshan City and Jianyang City in Sichuan Province was 20.6% (Jian et al., 2022). Overall, girls have significantly higher PTG levels than boys (Erman, 2021; Kristo, 2021). There was significantly lower PTG levels in higher grades than lower grades (Zhen et al., 2022).

Academic burnout

Burnout is a state of physical and mental exhaustion caused by an individual's failure to cope successfully with excessive demands of their external resources and energy (Freudenberger, 1974). Academic burnout refers to students' emotional exhaustion due to excessive learning needs, alienation, and indifference to learning, and their sense of worthlessness and low sense of achievement in school (Schaufeli et al., 2002). Academic burnout is the most significant manifestation of burnout among teenagers. The stimulus–response interaction model of stress shows that stressful events may lead to burnout (Carson, 2001). Studies on adolescents who experienced tornadoes (Yuan et al., 2018) and earthquakes (Zhou et al., 2017) have found that stress trauma can significantly predict academic burnout levels.

The COVID-19 pandemic has been widespread and long-lasting. Its repeated uncertainty and closed environment leads to a mismatch between the needs and available resources of adolescents, making them prone to academic burnout (Salmela-Aro and Upadyaya, 2014). A study of college students in Shandong Province, China, showed that 39.29% of students had a high degree of academic burnout during the COVID-19 pandemic (Wang et al., 2021). Studies in Croatia, the United States, and Poland have also found varying degrees of academic burnout among students (Zis et al., 2021; Žuljević et al., 2021; Tomaszek and Muchacka-Cymerman, 2022). Overall, freshmen and graduates have higher levels of academic burnout (Gonzalez-Ramirez et al., 2021). This is also significantly higher among high school students than junior high school students (Sunawan et al., 2021). There are no significant gender differences (Li and Li, 2015), although girls' emotional exhaustion is approximately twice as high as that of boys (Aljadani et al., 2021).

Relationship between PTG and academic burnout

PTG has a positive effect on alleviating post-traumatic psychological and behavioral problems. Many studies have shown that PTG helps alleviate psychological problems, such as anxiety

Abbreviations: PTG, posttraumatic growth.

(Milam et al., 2005), depression (Vaughn et al., 2009), emotional distress (Ickovics et al., 2006), and burnout among social workers (Gibbons et al., 2011). However, existing research on adolescent academic burnout is rare and inconsistent. Researches on middle school students after the Yancheng tornado showed that PTG had a significant negative effect on academic burnout (Li Y., 2019; An et al., 2022). However, a study of 828 adolescents who experienced the Wenchuan earthquake found that PTG was not significantly related to academic burnout (Lin et al., 2013). This finding suggests that there may be important moderating factors between PTG and academic burnout. For example, Ying et al. (2016) found that trait resilience moderates the relationship between them.

Based on theoretical analysis, this study believes that core belief challenge may play a significant role in the relationship between them. Core belief challenge refers to trauma events that challenge individuals' prior core belief systems, forcing them to seriously examine each core belief (Janoff-Bulman, 2006). According to the affective-cognitive processing model (Joseph et al., 2012), PTG is an iterative process of growth through event cognition, evaluation mechanism, emotional state, and coping style. The broken assumptive worlds hypothesis (Janoff-Bulman, 1989) highlights that cognitive imbalance after the challenge of core beliefs forces individuals to change their original cognitive style, re-evaluate traumatic situations, and think about their impact. This is more likely to lead to positive behavioral changes. Therefore, a higher core belief challenge may be an important condition for triggering cognitive reappraisal and value reflection, and translating the higher psychological function of individual PTG into action.

Social and cultural background of Wenchuan area in China

As a minority area in Southwest China, Wenchuan has a unique social and cultural background. First, as a mixed ethnic settlement of Tibetan, Qiang, and Han ethnic groups, the Wenchuan region integrates multicultural and religious beliefs. The local inhabitants are largely influenced by Tibetan Buddhism and traditional Qiang folk beliefs (Ran, 2011; Li, 2019b). Tibetan Buddhism emphasizes an open-minded view of life and death, optimism, conservatism, and gregariousness, to enable individuals to view traumatic events more peacefully (Lan, 2011). The mountain culture of the Qiang people and their awe of nature and obedience to fate can help individuals reduce their post-disaster denial and misfortune (Fan et al., 2009).

Second, during the COVID-19 pandemic, specific pandemic prevention and control measures were implemented in the Wenchuan region. Limited traffic and low population mobility are conducive to preventing and controlling local pandemic, reducing the risk of transmission. Thus, the public's objective exposure to the pandemic was low. However, economic development in minority areas is relatively regressive and public health services are relatively weak (Fang, 2021). Furthermore, boarding students returned home after schools were suspended. Based on poor online learning conditions, adolescents perceived low support and security during the pandemic; thus, their subjective trauma exposure was relatively high. Based on this social and cultural background, adolescents in Wenchuan may have unique psychological and behavioral responses that differ from those in other regions.

The current study

It can be seen from the literature review that studies on the characteristics of adolescent PTG and academic burnout in the context of COVID-19 pandemic mainly focuses on mainstream cultural areas, and has not yet seen research on adolescents in ethnic areas. Furthermore, previous studies on the relationship between PTG and academic burnout have focused on natural disaster backgrounds such as earthquakes, tornado, and tsunamis, and the research results are inconsistent. Therefore, this study intends to focus on the following two aspects: (1) Taking adolescents in ethnic minority areas as participants, reveal the characteristics of PTG and academic burnout of adolescents in non-mainstream cultural areas with unique religious culture and social environment during the COVID-19 pandemic. (2) On the basis of theoretical analysis, explore the moderating role of core belief challenge, so as to reveal the relationship between PTG and academic burnout more accurately.

The specific research hypotheses are as follows:H1: During the COVID-19 pandemic, the level of PTG and academic burnout of adolescents in the Wenchuan area is high. There are significant ethnic, gender, and academic stage differences in PTG, and significant ethnic and academic stage differences in academic burnout.H2: During the COVID-19 pandemic, there is a significant negative correlation between PTG and academic burnout among adolescents in the Wenchuan area.H3: During the COVID-19 pandemic, core belief challenge moderates the relationship between PTG and academic burnout in adolescents.

Materials and methods

Participants

This study used a cluster sample of 982 adolescents from a secondary school in Wenchuan County, Sichuan Province, China. Questionnaires completed in too short a time were excluded. No participant was excluded because of mental health problems. A total of 941 valid questionnaires (effective rate: 95.82%) were included in the study. The participants included 326 males (34.64%) and 615 females (65.36%), with 238 junior high school students (25.29%), and 703 senior high school students (74.71%). Participants belonged to the following ethnic groups: 435 Qiang (46.23%), 356 Tibetan (37.83%), 110 Han (11.69%), and 40 were from other minorities (4.25%). The average age was

15.95 ± 1.95 years. The Chinese version of the questionnaire was used in this study, because the school curriculum is taught in Chinese and participants can read and write well in Chinese.

Instruments

Posttraumatic growth inventory

The Posttraumatic Growth Inventory developed by Tedeschi and Calhoun (1996) was revised by Zhou et al. (2014). The condition provided in the guidelines was changed to "Since the outbreak of the COVID-19 pandemic." The revised version has three subscales with 22 items: perceived changes in self, a changed sense of relationships with others, and a changed philosophy of life. Each item is scored on a 6-point scale ranging from 0 (no change) to 5 (a very high degree of change). An example of an item is "I would rather try to change things that need to change." High total average scores indicated high PTG levels. The PTGI has been used among adolescents in the ethnic minority areas of China with good reliability and validity (Zhou et al., 2015). Cronbach's alpha was 0.97 in the current study.

Adolescent academic burnout inventory

The Adolescent Academic Burnout Inventory by Hu and Dai (2007) was used to measure academic burnout of adolescents during the COVID-19 pandemic. It has four subscales with 21 items: emotional exhaustion, physical exhaustion, alienation between teachers and students, and academic inefficiency. Each item was rated on a 5-point Likert scale ranging from 1 (never) to 5 (always). An example of an item is: "Learning makes me feel uncomfortable." Higher total average scores indicate higher academic burnout. The inventory has been used among adolescents in the ethnic minority areas of China with good reliability and validity (Zhou et al., 2019). Cronbach's alpha was 0.90 in this study.

Core beliefs inventory

Challenges to core beliefs were measured using a modified version of the Core Beliefs Inventory (Zhou et al., 2014) developed by Cann et al. (2010) and Zhou et al. (2014). The condition provided in the guidelines was changed to "Since the outbreak of the COVID-19 pandemic." There are nine items, each scored on a 6-point scale ranging from 0 (not at all) to 5 (to a very high degree). A higher total average score indicated a greater degree of challenge to core beliefs. An example of an item is: "After this, I will think about my value as a person." The inventory has been used among adolescents in the ethnic minority areas of China with good reliability and validity (Zhou et al., 2015). Cronbach's alpha was 0.95 in the present study.

Self-made demographic questionnaire

A self-designed demographic questionnaire was used to collect participants' demographic information, including age, sex, ethnicity, grade, and pandemic exposure.

Procedure

We collected online data for this study from April 29, 2020 to May 13, 2020, approximately five months after the outbreak of COVID-19 in China, and one and a half months before the final examinations of the spring semester. Due to pandemic prevention and control requirements, all schools were suspended for months and students attended classes online at home. School leaders, students, and parents provided informed consent. The mental health teacher used a push notification to instruct students to respond to the questionnaire online.

Data analysis

We used SPSS 26.0 to analyze the data. Variance analysis and independent samples t-tests were used to compare the differences between PTG and academic burnout among demographic variables, such as ethnicity, gender, and academic stage. We conducted a repeated-measures analysis of variance to compare the differences between PTG and academic burnout across the various dimensions. A summary independent samples t-test was conducted to compare our findings with those of previous studies. Pearson's correlation coefficient was used to calculate PTG, academic burnout, and core belief challenge. Hierarchical multiple regression was used to test the moderating effect of core belief challenge. If the results showed an obvious interaction effect, a simple effect analysis was conducted.

Results

Characteristics of PTG among adolescents in Wenchuan area

Table 1 shows the PTG results among adolescents in Wenchuan.

Average mean scores >3 on the PTGI indicate moderate levels of PTG (Tang, 2006; Xu and Liao, 2011). In this study, 32.3% of the adolescents reported moderate or high levels of PTG. Assuming a similar degree of harm in the COVID-19 pandemic and using the same survey tools, the study of 2,090 secondary school students in Leshan City and Jianyang City, Sichuan Province, was used as a reference (Tang et al., 2022). A summary independent samples t-test was conducted on the total average score and PTG standard deviation. The results showed that the PTG level of adolescents in Wenchuan was significantly higher than that of secondary school students in Leshan and Jianyang, Sichuan Province [t (3029) = −13.56, $p < 0.001$].

Single factor analysis of variance and independent samples t-tests were used to test the ethnic, gender, and academic stage differences in PTG. The results showed no significant differences in ethnicity [F (2, 898) = 2.97, $p > 0.05$] and gender [t (939) = 0.50, $p > 0.05$] in adolescents with PTG during the COVID-19 pandemic. Furthermore, the PTG of junior high school students

TABLE 1 PTG among adolescents in Wenchuan area during the COVID-19 pandemic (M±SD).

	Perceived changes in self	A changed sense of relationship with others	A changed philosophy of life	Total average score
Han nationality ($n = 110$)	2.46 ± 1.38	2.36 ± 1.35	2.13 ± 1.21	2.34 ± 1.28
Qiang ethnic minority ($n = 435$)	2.43 ± 1.26	2.40 ± 1.27	2.14 ± 1.10	2.34 ± 1.17
Tibetan ($n = 356$)	2.62 ± 1.26	2.58 ± 1.26	2.37 ± 1.19	2.54 ± 1.19
Male ($n = 326$)	2.60 ± 1.33	2.54 ± 1.33	2.29 ± 1.20	2.49 ± 1.25
Female ($n = 615$)	2.47 ± 1.26	2.44 ± 1.26	2.21 ± 1.14	2.39 ± 1.17
Junior high ($n = 238$)	2.72 ± 1.33	2.69 ± 1.32	2.38 ± 1.19	2.62 ± 1.23
Senior high ($n = 703$)	2.44 ± 1.26	2.40 ± 1.26	2.19 ± 1.15	2.36 ± 1.18
Total	2.51 ± 1.28	2.48 ± 1.28	2.24 ± 1.16	2.43 ± 1.20

was significantly higher than that of senior high school students [t (939) = 2.88, $p < 0.01$].

A repeated-measures analysis of variance was conducted to compare the three dimensions of the PTG. The results showed significant differences in the scores among the dimensions [F (1.64, 1880) = 1308.52, $p < 0.001$]. Post-hoc comparisons indicated that the dimension of perceived changes in self was significantly higher than in the other two dimensions ($p < 0.05$), and the changed sense of relationship with others was significantly higher than the changed philosophy of life ($p < 0.001$).

Characteristics of academic burnout among adolescents in Wenchuan area

Table 2 shows the results of adolescents' academic burnout in Wenchuan.

Assuming a similar degree of harm during the COVID-19 pandemic and using the same survey tools, a study of 936 junior middle school students in Quanzhou City, Fujian Province, was used as a reference (Li and Li, 2015). The total average score and standard deviation of academic burnout were employed to conduct a summary independent samples t-test. The results showed that the degree of academic burnout among adolescents in Wenchuan was significantly higher than those in Quanzhou, Fujian Province [t (1875) = 9.96, $p < 0.001$].

Single factor analysis of variance and independent samples t-tests were used to test the ethnic, gender, and academic stage differences in academic burnout. The results showed no significant differences in ethnicity [F (2, 898) = 2.59, $p > 0.05$] and gender [t (939) = 0.50, $p > 0.05$] on academic burnout among adolescents in the Wenchuan area during the COVID-19 pandemic. The academic burnout of junior high school students was significantly lower than that of high school students [t (939) = −8.00, $p < 0.001$].

A repeated-measures analysis of variance was conducted to compare the four dimensions of academic burnout. The results indicated significant differences in the scores among the dimensions [F (2.30, 2,820) = 2353.96, $p < 0.001$]. *Post hoc* comparisons showed that emotional exhaustion was significantly higher than the other three dimensions ($p < 0.001$), and academic inefficiency was significantly higher than physical exhaustion and alienation between teachers and students ($p < 0.001$). There was no significant difference in physical exhaustion and alienation between teachers and students ($p > 0.05$).

Relationship between PTG, academic burnout, and core belief challenge

Pearson's correlation coefficients were calculated to examine the relationships between the main study variables (see Table 3). The categorical variable "academic stage" was dummy coded. The results showed a significant negative correlation between PTG and academic burnout among adolescents in the Wenchuan region. Furthermore, core belief challenge correlated positively with PTG and negatively with academic burnout.

Hierarchical regression analysis was conducted to test the moderating effect of core belief challenge on the relationship between PTG and academic burnout. The academic stage was also dummy coded and added as a control variable to the first-level regression. Centralized PTG and core belief challenge were added to the second-level regression. The interaction between PTG and core belief challenge was added to the third-level regression (Academic burnout was used as the outcome variable).

As reflected in Table 4, PTG has a significant negative predictive effect on academic burnout, while core belief challenge did not. The interaction between PTG and core belief challenge had a significant negative predictive effect on academic burnout. This indicated that core belief challenge played a significant moderating role between PTG and academic burnout. To further analyze the moderating effect of the core belief challenge, this study divided core belief challenge scores into three groups—high (M + 1SD, >3.71), medium (M, 1.31–3.71), and low (M − 1SD, <1.31) levels—for the simple effects analysis. The results are presented in Table 5.

The effect of PTG on academic burnout was not significant for low core belief challenge ($\beta_{(M-1SD)} = -0.07$, $p > 0.05$). PTG had a significant negative predictive effect on academic burnout ($\beta_{(M)} = -0.15$, $\beta_{(M+1SD)} = -0.23$, $p < 0.001$) for medium and high levels of core belief challenge. The simple slope test diagram in Figure 1 illustrates the moderating effect of core belief challenge on the relationship between PTG and academic burnout.

TABLE 2 Academic burnout among adolescents in Wenchuan area during the COVID-19 pandemic (M±SD).

	Emotional exhaustion	Alienation between teachers and students	Academic inefficiency	Physical exhaustion	Total average score
Han nationality ($n = 110$)	2.29 ± 0.69	1.97 ± 0.80	2.96 ± 0.81	2.17 ± 0.85	2.34 ± 0.61
Qiang ethnic minority ($n = 435$)	2.43 ± 0.72	2.26 ± 0.86	3.01 ± 0.75	2.29 ± 0.86	2.51 ± 0.60
Tibetan ($n = 356$)	2.41 ± 0.72	2.23 ± 0.87	2.92 ± 0.75	2.24 ± 0.90	2.46 ± 0.62
Male ($n = 326$)	2.44 ± 0.80	2.23 ± 0.90	2.93 ± 0.82	2.28 ± 0.96	2.49 ± 0.69
Female ($n = 615$)	2.39 ± 0.67	2.21 ± 0.83	2.97 ± 0.73	2.24 ± 0.84	2.46 ± 0.57
Junior high ($n = 238$)	2.10 ± 0.72	1.97 ± 0.91	2.73 ± 0.80	2.00 ± 0.89	2.21 ± 0.63
Senior high ($n = 703$)	2.51 ± 0.69	2.30 ± 0.82	3.03 ± 0.73	2.34 ± 0.86	2.56 ± 0.58
Total	2.41 ± 0.72	2.21 ± 0.86	2.96 ± 0.76	2.26 ± 0.88	2.47 ± 0.61

TABLE 3 Descriptive statistics and inter-correlations between variables.

Variables	*M*	*SD*	1	2	3
1. Academic stage (junior high = 0; senior high = 1)	–	–	–		
2. PTG	2.43	1.20	−0.09**	–	
3. Academic burnout	2.47	0.61	0.25***	−0.18***	–
4. Core belief challenge	2.51	1.20	−0.05	0.43***	−0.10**

$N = 941$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TABLE 4 Moderating effect of the core belief challenge on PTG and academic burnout.

Variables	Academic burnout					
	Model 1		Model 2		Model 3	
	β	*SE*	*β*	*SE*	*β*	*SE*
Academic stage (junior high = 0; senior high = 1)	0.25***	0.94	0.24***	0.93	0.24***	0.92
PTG			−0.15***	0.02	−0.13**	0.02
Core belief challenge			−0.02	0.04	−0.04	0.04
PTG × core belief challenge					−0.11**	0.03
R	0.25		0.30		0.32	
R^2	0.06		0.09		0.10	
ΔR^2	0.06		0.03		0.01	
F	63.99***		12.75***		11.87**	

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

Discussion

Characteristics of PTG among adolescents in Wenchuan area

This study found that five months after the outbreak of the COVID-19 pandemic, the level of PTG in adolescents in the Wenchuan area was relatively high, and its prevalence was above the moderate level (32.3%). Compared to previous studies on adolescents in Leshan City and Jianyang City of Sichuan Province (Tang et al., 2022), the prevalence and PTG levels in the Wenchuan area were significantly higher, supporting H1. This may be related to adolescents in Wenchuan being influenced more by Tibetan Buddhism and traditional Qiang culture (Ran, 2011; Li Z., 2019). Therefore, they may be more active and adaptive to traumatic events (Fan et al., 2009). However, unlike H1, this study found no significant ethnic or sex differences in PTG. This may be related to the high degree of ethnic integration in the Wenchuan area, where adolescents of different ethnicities and genders are widely affected by local cultural customs, and generally have higher PTG. We also found that junior high school students' PTG was higher than that of senior high school students, supporting H1. This may be because junior high school students had lower anxiety about death (Wang et al., 2018) and a more positive outlook toward traumatic events during the COVID-19 pandemic (Huang and Yao, 2020).

Furthermore, we found that adolescents' self-perception changed the most in all the PTG dimensions, which differs from

the results of previous studies on the Wenchuan and Southeast Asian earthquakes (Tang, 2007; Taku et al., 2012; An et al., 2013). This may be because compared with regional natural disasters such as earthquakes, social attention, and assistance in Wenchuan after the outbreak were significantly lower than those after the earthquake. Affected by prevention and control requirements, there was more interpersonal isolation during the pandemic than the mutual cooperation seen after natural disasters. By contrast, home segregation and reduced social activities may have increased self-reflection and improved self-protection, thus increasing perceived changes of self.

Characteristics of academic burnout among adolescents in Wenchuan area

This study found that the level of academic burnout among adolescents in the Wenchuan area was significantly higher than previous results in Quanzhou City, Fujian Province (Li and Li, 2015), supporting H1 to some extent. This is possibly related to the lack of medical resources in ethnic minority areas, relatively regressive public health services, and online learning conditions (Fang, 2021). Adolescents are more prone to anxiety and academic burnout. This study also found that academic burnout among junior high school students was significantly lower than that among senior high school students, which is consistent with previous studies (Sunawan et al., 2021) and H1. This may be due to the higher academic stress and anxiety among high school students during the pandemic. In addition, research has shown that junior high school students use more positive coping styles, such as problem solving, help-seeking, and rationalization (Wang and Ding, 2003). However, unlike H1, this study found no ethnic differences in academic burnout. This may be related to the high degree of ethnic integration in the Wenchuan region. Additionally, this may be because academic burnout is significantly affected by the situation. During the COVID-19 pandemic, the social and cultural environment, academic stress, and difficulties of adolescents from different ethnic groups in the region demonstrated more similarities than differences.

This study found that emotional exhaustion was the most serious dimension of academic burnout among adolescents in Wenchuan. This may be due to the subjective trauma exposure associated with the pandemic and increased anxiety, depression, and stress (Nicole et al., 2021). Furthermore, the increase in parent–child conflict (Liu et al., 2021) and decrease in social and outdoor activities (de Figueiredo et al., 2021) during isolation may have further exacerbated emotional exhaustion among adolescents.

TABLE 5 Influence of PTG on academic burnout at different levels of core belief challenge.

Core belief challenge	*β*	*SE*	*t*	*p*	Lower	Upper
M-1*SD*	−0.07	0.02	−0.71	0.48	−0.06	0.03
M	−0.15	0.02	−3.32	0.00	−0.09	−0.02
M + 1*SD*	−0.23	0.02	−4.97	0.00	−0.14	−0.06

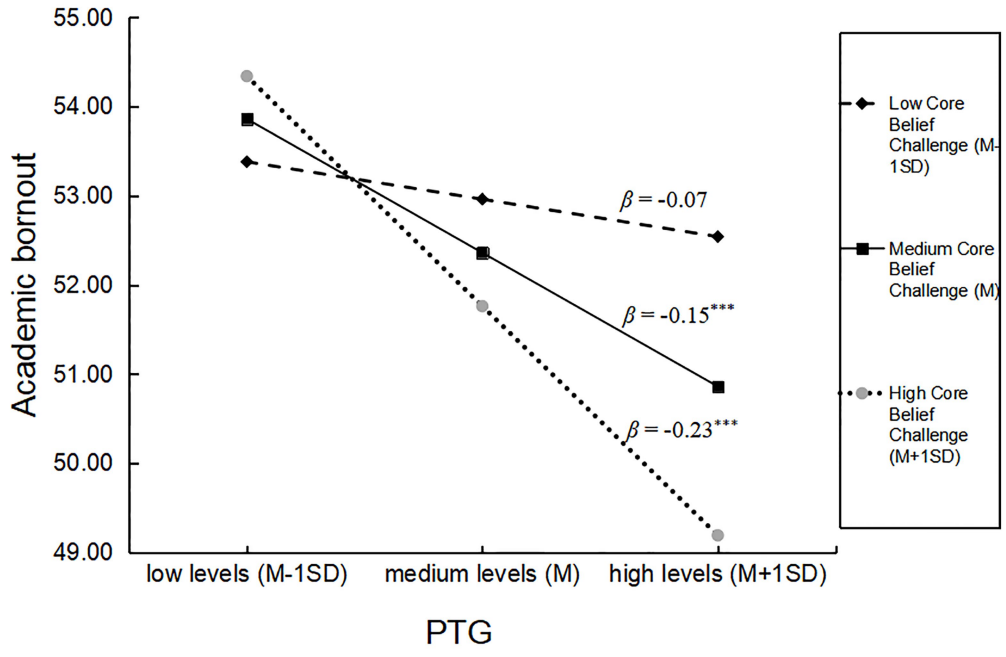

FIGURE 1
Moderating effect of the core belief challenge on the relationship between PTG and academic burnout in adolescents.

Relationship between PTG, academic burnout, and core belief challenge

This study found a significant negative correlation between PTG and academic burnout. The higher the PTG level of adolescents, the lower the level of academic burnout, which supports H2 and the results of previous studies (Li Y., 2019; An et al., 2022). Studies have shown that individuals with higher PTG are better at effective emotion regulation and obtain a higher level of positive emotions and self-efficacy (Mo et al., 2013), which may alleviate academic burnout among adolescents. Additionally, core belief challenge can significantly moderate the relationship between PTG and academic burnout, supporting H3. The results also support the broken assumptive worlds hypothesis (Janoff-Bulman, 1989) and the affective-cognitive processing model (Joseph et al., 2012) to some extent, suggesting that core cognitive change plays an important role in the process of PTG alleviating academic burnout.

When the core belief challenge level was above the medium level, PTG had a significant negative predictive effect on academic burnout. This result supports the view that PTG is adaptive (Tedeschi and Calhoun, 1996), meaning that the positive growth experienced by adolescents in the process of fighting against trauma can improve their learning attitudes and behaviors. Studies have shown that cognitive reconstruction caused by core belief challenge can change individual worldviews and perceptions of stressors (Joseph and Linley, 2005; Cho and Park, 2013). During the COVID-19 pandemic, higher core belief challenge may lead adolescents to rethink the value of life, adopt more positive coping styles, plan their own ideals, and live more actively, and resist the risk of increased academic burnout.

In contrast, when the level of core belief challenge was low, PTG had no significant predictive effect on academic burnout. According to the functional descriptive model of PTG (Tedeschi and Calhoun, 2004), positive changes after trauma require cognitive reconstruction. Adolescents with low core belief challenge may have less active thinking and cognitive reconstructions. PTG may enhance psychological adaptation and reduce negative emotions (Sumalla et al., 2009), but it is difficult to translate this into cognitive and behavioral changes.

Contributions and implications

After the large-scale outbreak of the COVID-19 pandemic, how adolescents alleviate academic burnout and invest in and adapt to the new learning environment has become an important practical issue for educational researchers and practitioners. Based on the results of this study, we propose the following four recommendations:

First, considering the high level of academic burnout among adolescents in Wenchuan, it is necessary to strengthen the evaluation of adolescents' psychological adaptation, particularly for high school students who need continuous psychological intervention. Considering serious emotional exhaustion, it is necessary to teach local adolescents skills in emotion regulation and coping with changes in learning conditions. Furthermore, a family school-society linkage is needed to enable adolescents to experience more interpersonal connections and social support while preventing and controlling the pandemic.

Second, it provides full play to the advantages of ethnic minority cultures in promoting PTG among local adolescents. It is necessary to fully tap and use unique ethnic mental health education resources in sports, dance, religious activities, and customs to promote adolescents' self-experience and interpersonal cooperation as well as experience with philosophical wisdom, and help more adolescents achieve PTG.

Third, there should be focus on cognitive reconstruction and value guidance of adolescents during the pandemic. Based on the key role of core belief challenge between PTG and academic burnout, school mental health education should focus on guiding adolescents' reflections on the pandemic and themselves. For example, it is necessary to encourage them to express their feelings and ideas about the impact of the pandemic, guide them to actively redefine trauma, think about its positive impact, and improve their patriotism to promote their cognitive reconstruction of pandemic trauma and prevent and reduce psychological and behavioral problems, such as academic burnout.

Fourth, it is necessary for the government to accelerate the construction of public psychological service system in ethnic areas during the COVID-19 pandemic. On the one hand, it is necessary to strengthen the promotion of existing hotline psychological anti-pandemic services and popular science propaganda in ethnic areas, so as to provide more targeted psychological counseling and health education for adolescents in ethnic areas. On the other hand, combined with the current situation that the extreme shortage of professional psychological teachers in ethnic minority areas and it is difficult to effectively carry out psychological screening and key population guidance during the pandemic, the education department could organize targeted teacher training and match assistance from relevant colleges and universities for ethnic minority areas.

Limitations and future research

First, the cross-sectional research methods used in this study cannot reveal the dynamic changes in PTG, academic burnout, and their relationships among adolescents in the Wenchuan area over time. Thus, considering the persistent and repeated outbreak characteristics of the COVID-19 pandemic, it is necessary to conduct longitudinal studies in the future.

Second, this study did not directly sample the control group when comparing adolescents in Wenchuan and other regions using only previous studies as a reference. It failed to strictly control for the level of economic development, educational resources, and other irrelevant variables. Further studies should

select areas with more similarities to conduct more rigorous comparative studies.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

XY, XW, and QC contributed to conception and design of the study. ZZ performed the statistical analysis and wrote the first draft of the manuscript. XY, ZZ, XW, and YG contributed to manuscript revision. All authors contributed to the article and approved the submitted version.

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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/fpsyg.2022.1005176/full#supplementary-material

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The impact of perceived control and power on adolescents' acceptance intention of intelligent online services

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A higher level of intelligence can improve adolescents' interactions with intelligent online services, although overemphasizing intelligent online services may nullify their sense of autonomy and in turn affect their acceptance intention. Enterprises have therefore focused on the best ways through which to provide intelligent online services. Based on the technology acceptance model, this study constructs a theoretical model of the impact of perceived control and power on adolescents' acceptance intention of intelligent services. Through a scenario experiment involving an intelligent online recommendation service, 195 participants were obtained to test the model. The results show that the adolescents' perceived control affects their acceptance intention of intelligent online services through their perceived usefulness. The adolescents' sense of power moderates the influence of perceived control on perceived usefulness. This study supplements the research on intelligent online services and provides a reference for online merchants seeking to design such service processes.

KEYWORDS

adolescent, intelligent service, perceived control, perceived usefulness, sense of power, acceptance intention

Introduction

With the rapid development of the digital economy, the applications of artificial intelligence (AI) have been expanding into new and unexplored areas in recent years. According to McKinsey, AI is expected to increase global economic activity by US$13 trillion and account for 1.2% of global GDP growth over the next fifteen years (McKinsey Global Institute, 2018). In the context of the rapid development of AI, innovation in intelligent online services has gradually become a key way for enterprises to seek new opportunities and remain competitive. Accordingly, it has attracted the attention of marketing scholars and entrepreneurs, as effectively combining online services and AI technology can help enterprises handle data collection tasks, promote communication between buyers and sellers, improve the consumer experience while reducing risks, and

significantly improve satisfaction (Ng and Wakenshaw, 2017). At present, intelligent online services have been pursued to effectuate upgrades in many fields and involve interfaces such as personalized AI consumer assistants and sentiment analysis systems to assist consumers in making purchasing decisions during travel (Hartmann et al., 2019; Singh et al., 2020).

With the continuous improvement of AI, emerging intelligent online services products reflect more personalized anthropomorphic attributes such as social interaction and emotional communication, which improve the degree of human–computer interaction and have been increasingly adopted by businesses as a result. However, with the increase in demand for consumer interaction, the non-human characteristics of AI technology also affect users' behavior and decisions, which greatly reduces the utilization rate of intelligent services. For example, intelligent online services providers usually design their algorithms to obtain optimal results, which may lead to deviation in decision-making. Therefore, improving consumers' acceptance of intelligent online services has become an increasingly widespread focus among software enterprises.

In terms of the actual consumer experience, intelligent online services usually provide precise and results-oriented services to consumers to help them achieve their goals. However, overemphasizing intelligent online services may largely destroy consumers' sense of autonomy, reduce their perceived control, and directly affect their acceptance intention. Consumers' perceived control in the service process will largely determine whether and the degree to which they accept intelligent services. In addition, consumers with different senses of power have varying levels of control over smart services. Perceived control refers to the extent to which consumers believe that they can control the service process and its results (Collier and Sherrell, 2010). When people's freedom in their daily lives is threatened, they feel powerless because of their lack of control and may therefore begin to resist, both psychologically and behaviorally (Miller and Seligman, 1975). Therefore, it is crucial for online merchants to understand how to optimally design intelligent online services processes according to consumers' sense of power.

Prior studies have focused on the interactive perspective of consumer perception in specific intelligent online services settings and investigate their characteristics and influence (Wirtz et al., 2018), their anthropomorphic behaviors (Adam et al., 2021), task-oriented types of intelligent online services (André et al., 2018; Castelo et al., 2019), and the effect of personalized interaction (Chattaraman et al., 2019; Huang and Rust, 2021a) on consumers' attitudes (Verhagen et al., 2014; Fernandes and Oliveira, 2021), and behavioral intentions (Wirtz et al., 2018; McLean and Osei-Frimpong, 2019). There are few studies on the influence of consumer perceived control on the acceptance intention of intelligent services (Seo and Bernsen, 2016; Zhang et al., 2021). In addition, previous studies have mainly focused on positive attitudes towards intelligent online services and research on acceptance intentions among different age groups, such as the impact of adolescents' active use of online services on adolescents' growth (Liu et al., 2020; Li and Mora, 2022). However, from the perspective of marketing, with the emergence of intelligent services in more industries and fields, more and more users actively or unconsciously participate in them, and the influence of consumer perceived control plays a more significant role in consumers' acceptance intentions. In addition, from the perspective of social interaction, previous studies have mainly examined the relationship between service providers and users while only considering the influence of utilitarianism and ignoring that of the sense of power. Therefore, it is of great theoretical and practical value to investigate the influence mechanism of perceived control on consumers' intention to accept intelligent online services and the moderating effect of power sense from the perspective of the interaction between consumers and intelligent services.

This study focuses on the following research questions. First, does consumer-perceived control affect consumers' acceptance intentions with regard to intelligent services? Second, what is the influence mechanism of consumer-perceived control on consumers' acceptance intentions? Third, does sense of power have a moderating effect on this relationship? To answer these questions, this study develops a research model to investigate the impact of consumer-perceived control on consumers' acceptance intention of intelligent online services and explore the moderating effect of their sense of power based on the technology acceptance model. This study supplements the research on intelligent online services and provides a reference for online merchants seeking to design and implement such processes.

Hypothesis development

Perceived control and acceptance intention of intelligent service

Intelligent services are a type of service innovation that incorporate the use of AI in an adaptive and autonomous system that directly communicates and interacts with customers and provides services (Wirtz et al., 2018). Unlike traditional human services, intelligent online services have unique intelligent characteristics in the dimensions of form (i.e., entity embedding, virtual interface), anthropomorphism (i.e., their degree of similarity to humans), and task orientation (i.e., computing prediction and emotional delivery tasks). Intelligent services offer a wide range of effects to consumers or business organizations through their large-scale storage and rapid analysis capabilities. Research has found that efficient and timely intelligent online services can improve consumers' overall online experience (Paz and Delgado, 2020). The application of AI can promote the standardization of services, help marketers develop more personalized marketing strategies, and analyze consumers' emotions in real-time to improve their attitudes (Ghasemaghaei, 2020; Huang and Rust, 2021a). However, previous research results indicate that there are potential problems in the practical

application of intelligent services. For example, more and more data and decisions rely on real-time information in specific scenarios, while intelligent online services have limited access to information and may not be able to obtain sufficient information to make decisions in some cases (Huang and Rust, 2021b). Even in the presence of such data, it is possible that intelligent online services will make mistakes due to changing consumer behaviors (André et al., 2018).

Consumers' perceived control can be influenced in the process of interacting with intelligent services. Perceived control is one of the important determinants of consumers' behavioral intentions. Previous studies on perceived control are mainly based on the psychological resistance and planned behavior theories (Brehm, 1972; Fishbein and Ajzen, 2011). Perceived control is a necessary prerequisite for predicting intentions and behaviors (Conner and Armitage, 1998). In addition, in the consumer service recovery process, perceived control indirectly affects consumers' overall satisfaction with the service (Chang, 2008).

Consumers' acceptance intention refers to the their overall acceptance tendency with regard to intelligent online services technology. The technology acceptance model shows that the factors influencing consumers' intention to accept technology are related to their performance expectations, effort level, social influence, optimism, and experience as well as its convenience and perceived cost (Venkatesh et al., 2012). Averill (1973) showed that selective perception has a positive impact on a person's level of perceptual control, which can in turn influence their acceptance of intelligent online services (Reinders et al., 2008). In the process of consuming services, consumers' perception of choice can amplify their perceived control and bring positive emotions, thereby increasing their intention to adopt technology (Hui and Bateson, 1991). Taking the perspective of consumer autonomy can help to understand the potential impact of consumer-perceived control on their acceptance intention of intelligent services. The key to the autonomous consumer experience is to make consumers aware of selective behaviors and minimize the constraints in their consumption decisions (André et al., 2018). Higher autonomy implies a higher level of perceived control, which may increase consumers' well-being and influence their acceptance intentions towards new technologies. Therefore, this study assumes that with an improvement in consumers' perceived level of control, they will have a greater sense of autonomy and thus be more willing to accept intelligent services. Therefore, we propose the following hypothesis:

> *Hypothesis 1*: Perceived control positively affects consumers' acceptance intention of intelligent services.

Perceived control and perceived usefulness

According to the technology acceptance model, perceived usefulness refers to the degree to which individuals can improve their job performance by using technology (Davis, 1989). More specifically, it includes consumers' subjective attitudes towards the usefulness of a technology after considering such factors as its image, job relevance, output quality, provability of results, and perceived ease of use as well as other subjective norms (Venkatesh et al., 2012). In the intelligent online services context, consumers can judge the usefulness of new technologies according to the full range of their perceptions, which form the basis of the perceived usefulness of intelligent services (Wirtz et al., 2018; Friedrich et al., 2019).

Perceived control can affect consumers' risk perception with regard to autonomous service technologies (Lee and Allaway, 2002). Furthermore, this perceived risk can affect consumers' judgment of the quality of the technology, which in turn significantly affects consumers' perceptions of its usefulness (André et al., 2018). Eastlick et al. (2006) find that brand associations related to perceived control affect consumers' trust in brands and thus their perception of the brands' usefulness. In addition, perceived control can improve consumers' tendency to actively acquire knowledge related to the service as well as the pleasure they derive from using it and increase its perceived ease of use and therefore its perceived usefulness (Collier and Sherrell, 2010; Zhang et al., 2021).

Cognitive dissonance theory can also be used to explain the influence of consumers' perceived control on the perceived usefulness of intelligent services. In general, when individuals are limited in their choices, they feel devalued by the results they obtain (Pepitone and Festinger, 1959). Previous studies have found that when consumers' decisions are restricted, they may have a persistently negative attitude towards service providers. In addition, Seo and Bernsen (2016), in studying the influence of perceived usefulness on consumers' acceptance intentions, find that the influence of individuals' constraints should be considered. Therefore, this study assumes that in the context of smart services, the higher the level of consumers' perceived control, the more useful consumer will perceive intelligent online services to be. Therefore, we propose the following hypothesis:

> *Hypothesis 2*: Perceived control positively affects the degree to which consumers perceive intelligent online services to be useful.

Perceived usefulness and acceptance intention of intelligent services

Perceived usefulness can significantly improve consumers' perceived enjoyment (Friedrich et al., 2019), positive attitude toward technology use (McLean and Osei-Frimpong, 2019), and intention to accept technology (Venkatesh et al., 2012). The perceived usefulness of e-commerce websites can significantly affect consumers' online behaviors, such as website usage behaviors (Cheng et al., 2022). In addition, consumers are faced

with many uncertainties in the online shopping experience, such as information asymmetries (Shao et al., 2019). If consumers perceive an intelligent online services technology to be useful, they are likely to have a higher degree of trust in the service provider and thus have a higher acceptance intention (Hampton-Sosa and Koufaris, 2005; Cheng et al., 2022). In addition, Friedrich et al. (2019) find that users' perceived usefulness of intelligent technology has a significant and positive correlation with their intention to use the technology. Following Friedrich et al. (2019), it can be argued that improving consumers' perceived usefulness of intelligent online services technology may increase their intention to adopt it. Therefore, we propose the following hypothesis:

> *Hypothesis 3*: Perceived usefulness positively affects consumers' acceptance intention of intelligent services.

Perceived usefulness and sense of power

Sense of power refers to an individual's perception of their ability to influence others in social relations and asymmetric control of valuable resources (Galinsky et al., 2003). The individual's sense of power is mainly determined by two factors: individual character and social background (Anderson et al., 2012). In social interactions, sense of power reflects individuals' influence on the attitudes, behaviors, and results of other individuals in social interactions (Magee and Galinsky, 2008). Previous studies have found that individuals with a higher sense of power tend to have a higher sense of control and lower environmental constraints than those with a lower sense of power (Bandura, 1977). Some studies show that consumers' sense of power affects their acceptance intention of advertisements (Jin et al., 2014; Wang and Zhang, 2020). In addition, the power approach inhibition theory shows that consumers with a high sense of power are more likely to pay attention to positive information, have more self-confidence, and show positive emotions and disinhibition behaviors in social interactions and choice judgments, while consumers with a low sense of power are more likely to pay attention to risk threat information, have lower self-confidence, and show negative emotions and disinhibition behaviors (Keltner et al., 2003). Especially, the power approach inhibition theory explains the relationship between power sense and self-efficacy. Individuals with high power sense have a higher level of self-efficacy, while individuals with low power sense have a lower level of self-efficacy (Bandura, 1977). In addition, See et al. (2011) find that individuals with a higher sense of power tend to be overconfident and cognitively optimistic and thus overestimate the competence of service providers and give better evaluations. Therefore, this study assumes that individuals with high power are more likely to ignore the risks brought about by technology and have an inflated perception of the usefulness of a technology, while those with low power are excessively concerned with negative information and risks and have a lower perception of the usefulness of that technology. Therefore, we propose the following hypothesis:

> *Hypothesis 4*: The higher the consumer's sense of power, the greater the impact of their perceived control on a technology's perceived usefulness.

According to the research hypotheses proposed above, this study constructs the following theoretical model, as shown in Figure 1.

Research design

Experimental design

Scenario selection

This study selected an online recommendation intelligent customer service in a travel service app as the experimental setting for the following three reasons. First, in a service such as tourism, young people tend to use intelligent services to complete simple and repetitive tasks (Ivanov et al., 2017), which is consistent with the target group of the experiment. Second, intelligent services require continuous enhancement through the learning and adaptive training capabilities of AI and should not only remain at the technical level of being able to assist human beings but also consider the social attributes of AI (Huang and Rust, 2021b). Intelligent customer service is one of the most effective ways to consider both the technical level of an AI as well as the nature of its social interactions with customers. Third, the most widely used AI technology is the intelligent recommendation system (Chung et al., 2016), which uses an intelligent online customer service

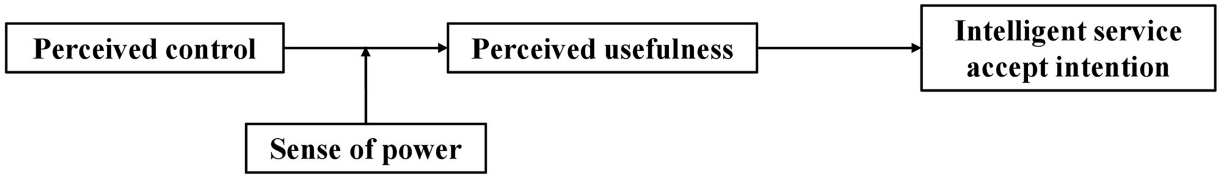

FIGURE 1
Research model.

system as the experimental setting to ensure that subjects understand the setting.

Design and procedures

This study used a group experiment (number of recommended options: 3 *vs*. 1). The "Wenjuanxing" platform was used to design experiments and generate links as well as recruit participants. The experimental questionnaire consisted of five parts. The first part informs the subjects that this is an experiment on memory. The stronger the immersion in reading, the stronger the memory effect, so as to prevent the subjects from guessing the intention of the experiment. The second part described the experimental scenario as "Imagine that after working and studying for a long time, you are taking a long vacation in a few weeks and plan to travel to the domestic coastal city A or M with your friends. After a lot of discussion, everyone has decided to let you make the travel plans, and the *per capita* budget is around 8,000 yuan RMB. However, because there are many scenic spots in City A and City M, which are far away from the urban areas, it will be troublesome to travel freely, so you plan to sign up for a group tour. At this time, you open the commonly used travel app and ask to speak with customer service. An intelligent customer service robot nicknamed "An An" immediately replies with the following message. Please fill in the relevant questions after reading the customer service reply (the number of recommended options 3 is shown in Figure 2, and the number of recommended options 1 is shown in Figure 3)." The third part presented the measurement scales for perceived control, sense of power, perceived usefulness, and acceptance intention. The fourth part requested demographic information, such as the gender, education, and age of participants. The fifth part included the measurement items about the participants' subjective feelings toward, and familiarity with, the experimental materials. The participants were randomly assigned to one of two experimental groups. First, the participants imagined that they were consulting an intelligent customer service while making the travel group booking plan in the travel app by reading descriptions. Then, they see the intelligent customer service response content corresponding to their experimental group. Finally, participants complete the relevant questions and provide their demographic information. A total of 195 participants participated in the experiment, of which 128 completed the experiment. Specifically, there were 64 samples in the 3-recommended-options group and 64 samples in the 1-recommended-option group. Among the 128 samples, 49 were male, accounting for 38.3%, and 79 were female, accounting for the remaining 61.7%. In terms of age, the participants were mainly young people, concentrated in the two

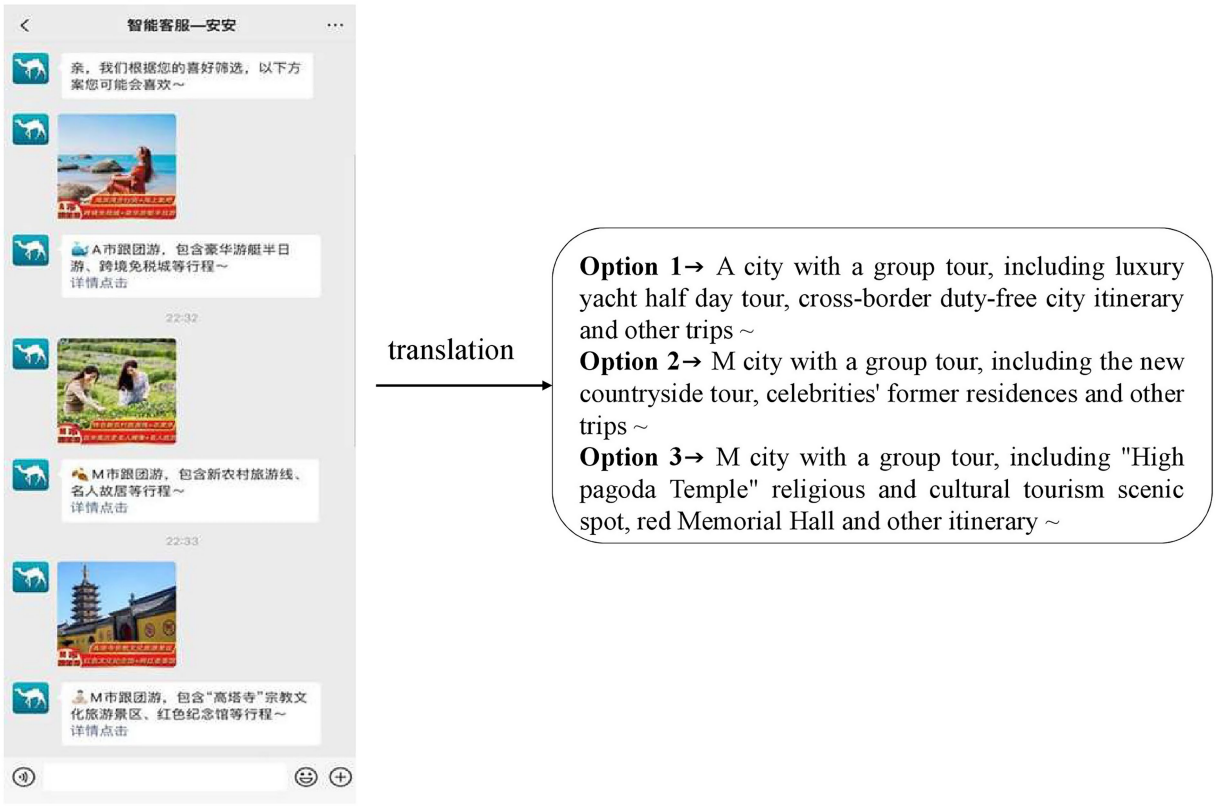

FIGURE 2
Experimental scenario of the number of recommended options 3. Images source from: m.qunar.com. Reproduced with permission.

FIGURE 3
Experimental scenario of the number of recommended options 1. Images sourced from: m.qunar.com. Reproduced with permission.

age groups of 16–22 years of age and 22–30 years of age, accounting for 63.6 and 35.7% of the sample, respectively.

Variable manipulation

This study divides the recommendations of intelligent customer services into 3-option and 1-option schemes. In order to simulate the real online travel ordering scenario, the experiment referred to the tourism product display of the existing online platform. At the same time, in order to reduce the error caused by the subjective bias of the subjects to the recommended content, the options are all either virtual or vague. In addition, in order to eliminate the impact of service satisfaction risk, the scenario provides the requirements and restrictions for seeking solutions, and the matching solutions are given in both experimental scenarios.

Variable measurement

Perceived control was measured using four items based on a scale following Collier and Sherrell (2010), and modified to better reflect the context of this research. Specific questions include: "In the process of customer service recommendation, I believe I can master the choice of the final plan," "I feel that I have the right to make a decision in the customer service recommendation program," "In the customer service recommendation, I feel that my preferences or characteristics affect the content that the customer service recommends to me," and "When the customer service recommends other solutions (such as recommending restaurants, attractions, etc.), I feel that I have the right to decide."

Perceived usefulness was measured using four items based on a scale following Venkatesh et al. (2012) and modified to better reflect the context of this research. Specific questions include "Customer service recommendations improve my ability to find the desired solution," "Customer service recommendations can help me find the most useful information effectively," "Customer service recommendations provide quick answers to my questions," and "Overall, I found customer service recommendations useful."

Acceptance intention was measured using three items based on a scale following Venkatesh et al. (2012) and modified to better reflect the context of this research. Specific questions include "I will consider using customer service recommendations for future tour bookings," "I will also use customer service recommendations for future tour bookings," and "I will also use customer service recommendations if other problems arise during the trip (such as finding the right hotel)."

Sense of power was measured using four items based on a scale following Anderson et al. (2012) and modified to better reflect the context of this research. Specific questions include "In my daily life, I can make others listen to what I say," "In my daily life, I can often make others do what I want," "In my daily life, I think I have a lot of power," and "In my daily life, I can make my own decisions as long as I like."

The above items were measured using a 7-level Likert scale, where 1 means "strongly disagree" and 7 means "strongly agree." In addition, all measurement items were translated from Chinese to English. Comparing the questionnaires before and after translation, no semantic differences were found.

Data analysis

Reliability and validity test

In this study, SPSS24.0 was used to test the reliability and validity of the experimental data. As shown in Table 1, the Cronbach's α for all variables is above 0.7, thus suggesting that the internal consistency of each construct is high. In addition, confirmatory factor analysis is used to test the combination reliability (CR). As shown in Table 1, the combination reliability of each construct is higher than 0.7, thus indicating that the combination reliability of each construct is good. Therefore, each construct in the model has good reliability.

TABLE 1 Test for reliability and validity.

Variables	Items	Mean	SD	FL	Alpha	CR	AVE
Perceived control (PC)	PC1	4.86	1.332	0.886	0.907	0.936	0.785
	PC2	4.90	1.229	0.912			
	PC3	4.99	1.181	0.904			
	PC4	5.02	1.072	0.842			
Perceived usefulness (PU)	PU1	4.98	0.887	0.858	0.874	0.914	0.727
	PU2	4.96	0.942	0.860			
	PU3	5.01	0.918	0.827			
	PU4	4.98	0.951	0.865			
Acceptance intention (AI)	AI 1	4.88	0.980	0.885	0.819	0.895	0.741
	AI 2	4.69	1.010	0.888			
	AI 3	4.73	1.133	0.806			
Sense of power (SP)	SP1	4.55	1.078	0.769	0.709	0.861	0.610
	SP2	4.21	1.113	0.865			
	SP3	4.20	1.211	0.722			
	SP4	5.19	1.107	0.759			

For the validity of the scale problem, the Kaiser-Meyer-Olkin (KMO) of the scale used in this research is 0.935, which is above 0.6, and the significance of Bartley's spherical test is less than 0.05, which is suitable for exploratory factor analysis. In addition, for confirmatory factor analysis, as shown in Table 1, the standard factor load (FL) of each item is greater than 0.5, which suggests that the overall convergence validity is good. The value of the average variance extracted (AVE) of all variables is higher than 0.5, which indicates that the model has sufficient discriminant validity.

Correlation analysis

As shown in Table 2, the Pearson's correlation coefficients between perceived control and perceived usefulness and acceptance intention are 0.806 and 0.678, respectively, thus suggesting that there are positive correlations between perceived control and the other two variables. In addition, the Pearson's correlation coefficient between perceived usefulness and acceptance intention is 0.790, which shows that there is a positive correlation between these two variables. Finally, the Pearson's correlation coefficient between perceived control and perceived usefulness and sense of power are 0.488 and 0.542, respectively, thus indicating that there are positive correlations between these two variables and sense of power.

Manipulation check

The manipulation of perceived control was examined using an independent-samples t-test. As shown in Table 3, $M_{\text{low perceived control}} = 3.079$ with a standard deviation (SD) of 0.797, and $M_{\text{high perceived control}} = 5.727$ with an SD of 0.640. $p < 0.001$ and the result is significant, which indicates that there is a significant difference in the level of perceived control between the two groups of subjects. Thus, the manipulation of perceived control is supported.

TABLE 2 Correlation coefficient matrix.

Variables	PC	PU	AI	SP
PC	0.886			
PU	0.806	0.852		
AI	0.678	0.790	0.860	
SP	0.488	0.542	0.533	0.781

The value on the diagonal is the square root of AVE, and other data are the correlation coefficients between the corresponding variables.

TABLE 3 Manipulation check results for perceived control.

Group	N	Mean	SD	SE
Low perceived control	64	4.156	0.797	0.099
High perceived control	64	5.727	0.640	0.080

Hypothesis test

Main effect testing

This study uses the independent-samples t-test to verify the influence of perceived control on consumers' acceptance intention of intelligent services. Figure 4 shows consumers' acceptance intentions of intelligent online services under different levels of perceived control. The results show that the $M_{\text{high perceived control}} = 5.203$ with an SD of 0.868, and the $M_{\text{low perceived control}} = 4.328$ with an SD of 0.684. The effect of the high perceived control group on acceptance intention was significantly higher than that of the low perceived control group ($p < 0.001$, $t(126) = 6.335$). Therefore, H1 is supported.

Core path testing

This research uses the PROCESS plug-in of SPSS23.0 to test the relationship between perceived control, perceived usefulness, and consumer acceptance intention based on regression analysis and the bootstrapping method. In the present study, 5,000 samples are used in the bootstrapping analysis, the sampling method is the non-parametric percentile method of bias-corrected correction, and the 95% confidence interval is constructed for testing.

As shown in Table 4, for the correlation path between perceived control and perceived usefulness, $T = 15.173$, $\beta = 0.593$, and $p < 0.001$, thus indicating that perceived control has a significant and positive impact on perceived usefulness. In addition, for the correlation path between perceived usefulness and acceptance intention, $T = 14.449$, $\beta = 0.895$, and $p < 0.001$, which confirms that perceived usefulness has a significant and positive influence on acceptance intention. Therefore, H2 and H3 are supported.

In addition, this study takes perceived control as an independent variable, perceived usefulness as a mediating variable, and acceptance intention as a dependent variable to

verify whether perceived usefulness plays a mediating role between perceived control and acceptance intention. As shown in Table 4, the confidence interval of the indirect influence of perceived control on acceptance intention is [0.313, 0.631], excluding zero ($p < 0.001$), which indicates that the mediation effect is significant with a value of 0.465. After controlling the perceived usefulness of the mediator variable, the direct effect of perceived control on acceptance intention is not significant ($\beta = 0.102$), and the confidence interval is [−0.049, 0.253], including zero. Therefore, perceived usefulness plays a significant mediating role in the influence of perceived control on consumers' acceptance intention.

Moderating effect testing

This study used SPSS regression analysis to examine the moderating effect of sense of power between perceived control and perceived usefulness. Sense of power is set as a classified variable to verify that it plays a moderating role in the relationship between perceived control and perceived usefulness.

The test results show that the interaction terms of perceived control and sense of power have a significant influence on perceived usefulness ($\beta = 0.231$, $p < 0.05$, $R^2 = 0.672$). Figure 5 further tests the moderating effect of sense of power. According to the results, When sense of power is low, compared with low perceived control, consumers with high perceived control have stronger acceptance intention ($\beta = 0.506$, $p < 0.001$, 95% confidence interval is [0.412, 0.599], excluding zero). When the sense of power is high, compared with low perceived control, consumers with high perceived control have stronger acceptance intention ($\beta = 0.737$, $p < 0.001$, 95% confidence interval is [0.562, 0.911], excluding zero). Therefore, sense of power moderates the relationship between perceived control and perceived usefulness, and thus H4 is supported.

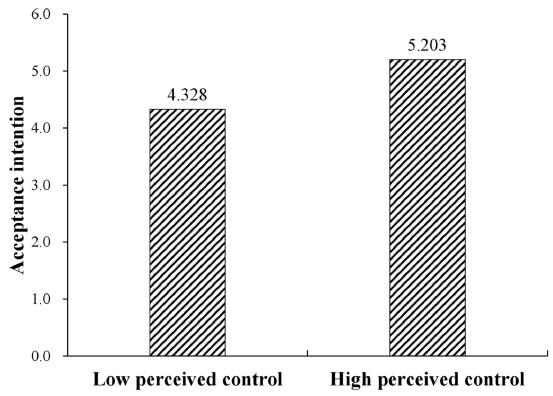

FIGURE 4
Acceptance intention under different levels of perceived control.

General discussion

Research conclusion

Based on the technology acceptance model, this study investigated the influence of perceived control on consumers' acceptance intention of intelligent online services and examined the moderating effect of consumers' sense of power.

There are three findings in this study. First, consumers' perceived control affects their acceptance intention of intelligent services; the higher consumers' perceived control, the stronger their acceptance intention of intelligent online services will be. This also further illustrates the effect of consumers' perceived control over recommendation depth on the recommendation effect of recommendation agents, further developing the research conclusions of Ghasemaghaei (2020).

Second, consumers' perceived control affects their perceived usefulness of intelligent online services as well as their acceptance intention of intelligent services. This further validates similar studies that the number of consumer choices can affect consumers' acceptance intentions (Hui and Bateson, 1991).

Third, consumers' sense of power moderates the influence of perceived control on perceived usefulness. When consumers' sense of power is high, the influence of consumers' perceived control on the usefulness of intelligent online services is more significant. This further develops the research conclusion of Wang and Zhang (2020).

Theoretical implications

This study makes several theoretical contributions. First, this study investigates the influence of perceived control on consumers' acceptance intention of intelligent online services from the perspective of social interaction, which enriches the research on intelligent online services. Prior studies have focused on the interactive perspective of consumer perception and specific intelligent online services scenarios and investigate the influence of the characteristics of such services in terms of their anthropomorphic behaviors, task-orientation, and personalized

TABLE 4 Core path testing.

Paths	Coefficients	SD	T	P
Perceived control –> Perceived usefulness	0.593	0.039	15.173	0.000
Perceived usefulness –> Acceptance intention	0.895	0.062	14.449	0.000
Perceived control –> Perceived usefulness –> Acceptance intention	0.784	0.104	7.550	0.000

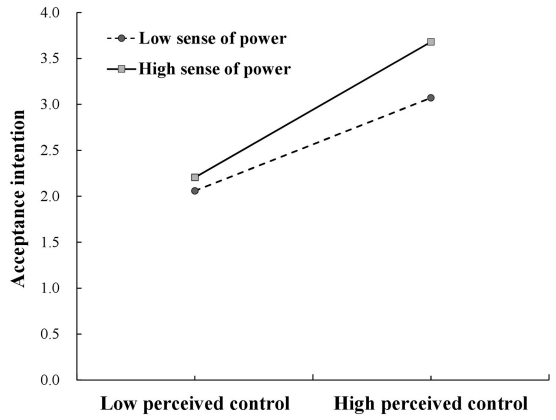

FIGURE 5
Moderating effect test of sense of power.

interaction on consumers' attitudes and behavioral intentions. However, there are few studies on the influence of consumer-perceived control on the acceptance intention of intelligent services. In practice, overemphasizing intelligent online services may destroy consumers' sense of autonomy and directly affect their acceptance intention. Therefore, this study focuses on the perceived control and sense of power that arise in the process of social interaction to develop a new direction in the research on intelligent customer service.

Second, this study introduces consumers' sense of power, which defines a new boundary condition, as a moderating factor in the field of online intelligent customer service research. Previous studies mainly examine the relationship between service providers and users, while this study proposes and verifies the moderating effect of consumers' sense of power based on an actual interactive setting recommended by an intelligent customer service in a travel app. The conclusions deepen our knowledge of the moderating factors of intelligent services.

Third, this study expands the potential applications of the technology acceptance model. Based on this model, this study proposes and verifies that perceived usefulness plays a mediating role in the influence of consumer-perceived control on intelligent online services acceptance intention. Therefore, this study introduces perceived control into the research on technology acceptance, which expands the potential applications of this theory.

Practical implications

The current research is of great significance to online enterprises. First, this study causes online merchants to rethink and attach renewed importance to results- and process-oriented service goals. The results show that the number of recommended options in intelligent online services affects consumers' perceived control, which then affects their acceptance intention of intelligent services. Therefore, online merchants should consider whether to reduce consumers' perceived control while providing them with faster and more convenient services. When consumers' perceived control is low, the technology originally aimed at optimizing services may not serve its intended purpose, thus compromising the connection between consumers and enterprises.

Second, this study provides a reference for online merchants to use in formulating intelligent product recommendation strategies. The results of this study show that consumers' sense of power moderates the influence of their perceived control on the perceived usefulness of intelligent services. When consumers have a greater sense of power, consumers' perceived control has a greater impact on the perceived usefulness of intelligent services. Therefore, online merchants should market "smart" products according to consumers' sense of power and divide the target markets of such products in a targeted manner. Specifically, in the early stages of the lifecycle of smart products, enterprises should take consumers with a high sense of power as the target market because such consumers have higher acceptance intentions with regard to smart products and are more likely to accept them.

Limitations and further research

Although the findings of this study are valid and valuable, there are still some limitations that provide directions for future research. First, this study explored the influence of perceived control on consumers' acceptance intention through a scenario-based experiment. We structured our research in this way because it is a causal exploratory study of consumer behavior, which requires strict control of many factors and must ensure high internal validity. Future studies can collaborate with online merchants and conduct field studies to further verify the relationship between perceived control and consumers' acceptance intention.

Second, this study used the intelligent customer service recommendations of a travel app as the experimental scenario because online intelligent customer service recommendation services are the most widely used intelligent online services technologies at present and young people tend to use intelligent online services to fulfill related needs in the field of travel services. Future research can be extended to different experimental scenarios to verify and improve the robustness of the research conclusions.

Third, this study only examines the influence of perceived control on perceived usefulness, and then on consumers' acceptance intention. Future studies can examine the influence of consumers' acceptance intention of intelligent online services from the aspects of perceived ease of use and privacy concerns.

Finally, this study focuses on the adolescents' acceptance of intelligent online services, and the subjects in the research experiment are mainly concentrated in adolescents. Future research can further verify the applicability of this research model in other age groups, and compare the interaction of different age

groups on consumers' acceptance intention of intelligent online services.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

YY, WF, and YL contributed to the conceptualization, methodology, statistical analysis, data curation, and writing. BS and WF contributed to the revision, investigation, supervision, funding acquisition, and project administration. All authors contributed to the article and approved the submitted version.

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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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How active and passive social media use affects impulse buying in Chinese college students? The roles of emotional responses, gender, materialism and self-control

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Social media plays a vital role in consumers' purchasing decision making. There are still gaps in existing research on the relationship between divided dimensions of social media use and impulse buying, as well as the mediating and moderating effects therein. This study explored the mediation and moderation effects in the relationship between different social media usage patterns, emotional responses, and consumer impulse buying. Data from 479 college students who were social media users in China were analyzed using structural equation modeling. The results showed that active and passive social media use were significantly and positively associated with users' enjoyment, whereas passive social media use significantly increased depression. Both enjoyment and depression were significantly and positively associated with users' impulse buying. Materialism positively moderated the relationship between enjoyment and impulsive consumption, while self-control significantly reduced the effect of depression on impulse buying. These findings that emotion mediated and personality traits moderated relationships between social media use and impulse buying expand impulsive purchase literature and provide insights for guiding college students' healthy use of social media and rational consumption.

KEYWORDS

social media use, impulse buying, emotional responses, college students, China

Introduction

With the continuous development of mobile internet, especially during the COVID-19 pandemic, social media (e.g., Facebook and YouTube) encompasses a broad range of online venues that facilitate communication, interaction, and the exchange of content among users (Kim and Johnson, 2016; Wang P. et al., 2020). In addition to its social feature, social media also

offers commercial features, which have created a new e-commerce model known as social commerce (Van Tran et al., 2022). For example, social media provides a platform for businesses to attract consumers and promote products, and for consumers to obtain suggestions and share experiences (Leong et al., 2018). Through new ways of marketing (e.g., word-of-mouth marketing, brand marketing, and influencer marketing), social media has greatly changed business marketing strategies and consumer purchase decision-making processes (Kim and Johnson, 2016; Guo and Li, 2022). Several studies have demonstrated that social media significantly influences consumer behavior (Kim and Johnson, 2016; Zafar et al., 2020, 2021), but the purchase decision-making process of social media users with different usage patterns has been relatively ignored. It has been claimed that 30 to 50% of purchase decisions are impulsive purchases, and that 84% of all shoppers have bought items impulsively (Husnain et al., 2019; Zafar et al., 2021). Therefore, the main concern of this study is to explore how social media usage patterns affect users' impulse buying behavior.

A few scholars have mainly focused on the direct relationship between social media use and impulse buying (Leong et al., 2018; Lahath et al., 2021; Pellegrino et al., 2022). Pellegrino et al. (2022) found a direct relationship between social media intensity and impulsive consumption behavior. Similarly, Lahath et al. (2021) study also confirmed the positive direct impact of social media use on impulse buying during the COVID-19 pandemic. Leong et al. (2018) investigated the influence of Facebook usage intensity on F-commerce impulse buying and the mediating role of urge to purchase. However, the existing literature lacks specific studies on the impact of different social media usage patterns on impulse buying and other mediating variables, such as emotion.

Research shows that the two most common patterns of social media use refer to active and passive use (Burke et al., 2010; Chen, 2021). Active use includes posting, liking, commenting on content, and interacting with others on social media, whereas passive use refers to browsing others' posts or content shared by friends without any liking, commenting, or interacting (Verduyn et al., 2017). Previous empirical studies have reported that active social media use increases users' social connection and social support, and enhances their positive emotion and well-being, whereas passive social media use increases users' negative emotions, such as upward social comparison, envy, depression, and anxiety (Chen S. et al., 2019; Valkenburg et al., 2021, 2022). Accordingly, active and passive social media use induce different emotional responses. It has been shown that emotions play a vital role in shaping impulse purchases, whether positively or negatively (Verplanken et al., 2005; Liu et al., 2019; Zhao et al., 2021). Therefore, active and passive social media use may impact users' impulse purchases through different mediating effects of positive or negative emotions. The outbreak of COVID-19 has led to a rapid growth of individuals' social media use, greater emotional ups and downs, and exacerbated depression and anxiety (Wang C. et al., 2020; Luo et al., 2021b), which cause increased impulsive consumption (Lahath et al., 2021). However, to the authors' best knowledge, no study has examined how active and passive social media use influence users' impulse buying behavior, and the emotional mediation therein. Past research indicates that gender, materialism, and self-control play key roles in impulsive consumption decision-making (Isabelle, 2016; Li et al., 2020), but how these factors moderate the relationship between social media use and impulsive consumption is still unknown.

The above evidence suggests that the current understanding of the relationship between social media usage patterns and impulse buying, as well as the moderating and emotional mediating effects therein, is limited. To fill this gap, we developed a model drawing on social cognitive theory (SCT) to explore the relationship between active and passive social media use, different emotions (e.g., enjoyment and depression), and impulse buying behavior. The moderating effects of gender, materialism, and self-control were also examined. The next section reviews the related literature and develops hypotheses. Section 3 provides the research method, and section 4 presents the results of the data analysis. The conclusion and discussion are elaborated in section 5. In the last section, implications and limitations are illustrated.

Theoretical background and hypotheses

Social cognitive theory

Social cognitive theory was first proposed by Bandura (1986), and proposes that there is a triadic reciprocity relationship between an individual, the environment, and behavior. Specifically, this triadic reciprocity relationship refers to the interaction between an individual's behavior, psychology, or cognition and their environment (Mohamed and Ahmad, 2012). This theory provides a useful framework for explaining the complex relationships between users' psychological and environmental factors and behavior in social media. For example, Yoo and Jeong (2017) found a reciprocal interaction between social media use and depression. Moreover, Chen S. et al. (2019) study showed that social network use affects users' mood, well-being, and social capital, which in turn predict their continued use intention. According to social support theory, active social media use could boost social support and positive emotions (Frison and Eggermont, 2016). Based on social comparison theory, passive browsing of social media content could exacerbate negative emotions (Tandoc et al., 2015). The Stimuli-Organism-Response model indicates that emotional stimuli are the key factors predicting consumer behavior (Zhao et al., 2021). Given that SCT highlights the reciprocal effects between behavioral and psychological factors, it could serve as the theoretical framework for this study to investigate the relationships between social media use, emotion, and impulse buying (see Figure 1).

Active and passive social media Use

Active social media use refers to the behavioral pattern of actively creating content or interacting with others; specific

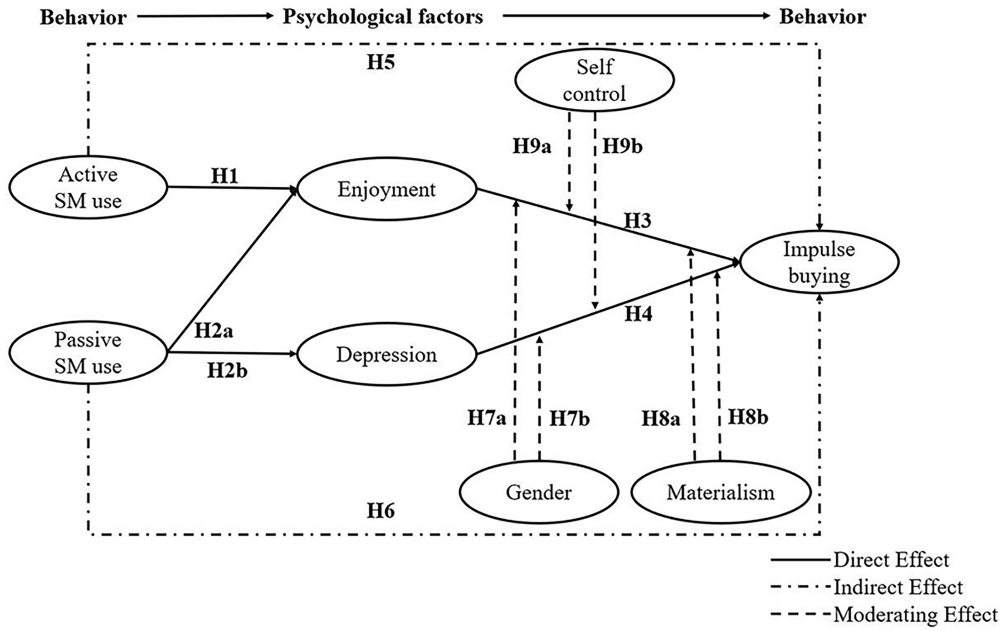

FIGURE 1
Theoretical model.

behaviors include posting updates and photos, sharing information, meeting new people online and chatting with them, and participating in groups (Shaw et al., 2015). Passive social media use refers to the behavioral pattern of only browsing and consuming information, such as browsing friends' statuses or personal homepages (Ding et al., 2017). Active use contributes content and relational resources to the social media platform, while passive use does not (Chen et al., 2014).

The contradictory findings on the impact of general social media use on psychological outcomes may be because scholars have failed to consider the different ways in which users use social media, namely, active and passive use (Verduyn et al., 2017). Several studies that have taken this difference into account have found that individuals' active social media use usually has a positive impact on their psychological factors, and, conversely, that passive social media use usually has a negative impact on psychological factors (Matook et al., 2015; Frison and Eggermont, 2016, 2020). Thus, active and passive social media use could lead to different emotions and behaviors.

Impulse buying

Although previous studies have adopted different definitions of impulse buying, they agree that impulse buying has three characteristics. First, it is an unplanned behavior (Stern, 1962; Li et al., 2020; Lina et al., 2022). Second, it is an impulsive reaction. Consumers will react impulsively when they are affected by external stimuli, and this impulsive response can generate new purchase needs or stimulate potential purchase needs that manifest as strong, sudden, or accidental impulses (Rook, 1987; Parboteeah et al., 2009; Xiang et al., 2016). Third is emotional factors. Impulse buying is often caused by strong emotional factors that can make consumers temporarily irrational, which results in impulse buying behavior (Liu et al., 2019).

Previous work has concentrated on the determinants of impulsive consumption in social commerce according to environmental stimuli, such as platform-related factors, social-related factors, and marketing-related factors (Chen Y. et al., 2019; Liu et al., 2019; Abdelsalam et al., 2020; Zafar et al., 2021; Yu, 2022). Consumer characteristics such as arousal, pleasure, and urgency have often been regarded as mediating variables in the relationship between environmental stimuli and impulse buying (Abdelsalam et al., 2020). The few studies on social media use and impulse buying have largely confirmed the presence of a direct effect of social media use intensity on consumers' impulse buying (Leong et al., 2018; Lahath et al., 2021; Pellegrino et al., 2022). Moreover, one study found no direct correlation between passive browsing and impulse buying, but that the urge to buy fully mediated passive browsing and impulse consumption (Leong et al., 2018). However, the relationship between active and passive social media use, emotion, and impulse buying remains unclear.

Active and passive social media use and emotion

Active social media use, such as interacting with others, can help increase users' immediate positive emotions, thereby increasing their perceived social support and improving their life

satisfaction in the long-term (Kross et al., 2013; Oh et al., 2014). Through interaction and communication on social media, people can also experience more happiness and excitement (Zhang and Leung, 2015). According to Ekman (1992), enjoyment is one of the seven basic emotions. Enjoyment has been defined as a pleasurable emotional response to an enjoyment-inducing environment (Valkenburg et al., 2021). Active social media use also has a significant positive effect on users' positive emotion and sense of social connection (Verduyn et al., 2017), which can be enjoyable for them. It is worth mentioning that numerous (36) cross-sectional and longitudinal studies found no significant association between active social use and depression (Valkenburg et al., 2022). Considering this existing empirical evidence, we expected to see no significant correlation between active social media use and depression. Based on the above findings, we made the following hypothesis:

> *H1*: Active social media use is positively associated with users' enjoyment.

That said, there is strong evidence that passive social media use can often impair users' mental health, such as increased depression, anxiety, and loneliness, and decreased subjective well-being (Krasnova et al., 2015; Shaw et al., 2015). However, this does not necessarily mean that browsing social media has negative psychological outcomes. For example, Lin and Utz (2015) demonstrated that users may experience more positive emotions when browsing Facebook. The authors also observed the phenomenon of "emotional contagion" in social media, whereby individuals tend to experience positive emotions when browsing posts containing positive emotions. Valkenburg et al. (2021) also confirmed this finding in adolescents, whereby browsing-induced enjoyment had positive effects. Accordingly, we made the following hypothesis:

> *H2a*: Passive social media use is positively associated with users' enjoyment.

Depression can be defined as an emotional state in which an individual feels sad and gradually loses interest in engaging in activities, and this is usually accompanied by many negative emotions, such as disgust, frustrated, and annoyance (Yoo and Jeong, 2017). According to social comparison theory, individuals usually compare themselves with similar others when they evaluate themselves (Festinger, 1954). Social media has become an important channel for individuals to present themselves positively (Tandoc et al., 2015). When browsing others' generated content on social media, consumers are likely to encounter positive self-presentations of other people, which may lead to lurkers' social comparison and envy (Frison and Eggermont, 2016; Valkenburg et al., 2021). Users may believe that other people live happier lives than themselves, which could cause an exacerbation in depression (Chen S. et al., 2019; Valkenburg et al., 2022). Based on these previous findings, we made the following hypothesis:

> *H2b*: Passive social media use is positively associated with users' depression.

Emotion and impulse buying

According to Rook (1987), impulse buying could be considered as an irrational consumption behavior characterized by low cognitive assessment and high emotional arousal. Previous research has confirmed that pleasure is a key emotional factor driving impulse buying (Zhao et al., 2021). Shen and Khalifa (2012) found that a delighted emotional experience has a positive effect on subsequent buying behavior. Moreover, Xiang et al. (2016) demonstrated that users who feel that social commerce usage is pleasing and enjoyable are more likely to buy items on impulse. Enjoyment can be defined as a pleasurable emotional response (Valkenburg et al., 2021). When users feel pleasant while on a social media platform, they are likely to have the urge to engage in impulse buying. Therefore, we made the following hypothesis:

> *H3*: Enjoyment is positively associated with social media users' impulse buying.

Several studies have reported that impulsive consumption can be fueled by negative affect (Verplanken et al., 2005; Liu et al., 2019). Indeed, consumers with more negative emotions during the COVID-19 pandemic reported more frequent daily impulse purchases (Xiao et al., 2020). This can be explained by the "mood congruency effect" (Cunningham, 1988). According to this effect, when experiencing negative emotions, an individual's thoughts and judgments are often distorted towards being more negative. Furthermore, people with negative emotions process information less systematically when making judgments and decisions (Raghunathan and Pham, 1999). Previous work has shown that consumers may consider impulsive buying as a way to escape negative emotions (Silvera et al., 2008). Considering that depression is often accompanied by negative emotions, such as sadness, frustration, annoyance, consumers who feel depressed while using social media may view impulse buying behavior as a form of self-soothing that alleviates negative emotion and makes them feel better. Thus, we hypothesized the following:

> *H4*: Depression is positively associated with social media users' impulse buying.

The mediation effect of enjoyment and depression

Several studies have reported the mediating role of enjoyment in the relationship between external stimuli and behavioral intention, such as purchase or electronic-word-of-mouth intention (Ukpabi and Karjaluoto, 2018). In addition, depression has been reported to be a mediator in the relationship between

users' different social media use and their subsequent behaviors (Chen S. et al., 2019). Following SCT, there is a mutual interaction between an individual's emotion or cognition and his/her behavior (Mohamed and Ahmad, 2012). Considering the phenomenon of emotional contagion (Lin and Utz, 2015) and social comparison theory (Frison and Eggermont, 2016), active and passive social media use is positively associated with enjoyment, whereas passive social media use positively predicts depression. According to the emotional stimulation effect of the stimulus-organism-response model (Zhao et al., 2021) and the mood congruency effect (Cunningham, 1988), enjoyment and depression positively predict consumers' impulse buying behavior. Thus, based on the above inferences (H1-H5) and previous research findings, it is possible that enjoyment and depression mediate the relationship between consumers' social media use and their impulse purchasing behavior. We therefore proposed the following hypotheses:

> *H5*: Enjoyment mediates the association between active social media use and impulse buying.
>
> *H6a*: Enjoyment mediates the association between passive social media use and impulse buying.
>
> *H6b*: Depression mediates the association between passive social media use and impulse buying.

The moderation of gender, materialism, and self-control

With regard to gender, recent studies have shown that women have stronger impulse buying tendencies and are more prone to making impulse purchases than men (Segal and Podoshen, 2013; Styvén et al., 2017). This is not only the case in adults; female adolescents are also more inclined to be impulsive buyers than male adolescents (Isabelle, 2016). One reason for this is that girls are higher scored on all measures of emotional states than boys, underlying a more emotional background for girls than for boys (Moksnes et al., 2010; Isabelle, 2016). That is, female users are more likely to have higher positive or negative emotional states and thus are more likely to have impulse buying tendencies than male users. This is consistent with previous research showing that female consumers may exhibit stronger impulse buying tendency than male consumers, when influenced by emotions (Coley and Burgess, 2003). In addition, women are more likely to buy to manage their emotions or compensate for their bad emotions than men (Coley and Burgess, 2003; Ching et al., 2016). Based on the above, we made the following hypothesis:

> *H7a*: Gender moderates the relationship between enjoyment and social media users' impulse buying. Specifically, for female users, enjoyment has a greater impact on their impulse buying than it does for male users.
>
> *H7b*: Gender moderates the relationship between depression and social media users' impulse buying. Specifically, for female users, depression has a greater impact on their impulse buying than it does for male users.

The effect of the personal trait of materialism on impulse buying behavior has been increasingly emphasized by scholars (Pellegrino et al., 2022). Materialism refers to a value that emphasizes the importance of having material wealth in one's life (Richins and Dawson, 1992). This value highlights personal value and meaning in life through the possession of material wealth, thereby enhancing well-being (Kilbourne and Pickett, 2008). Prior research has suggested that individuals with high materialism tend to evaluate their success by the quantity and quality of purchased goods or services, which leads to more impulsive buying behaviors (Podoshen and Andrzejewski, 2012; Pellegrino et al., 2022). Materialistic people buy goods impulsively because of the positive emotion this provides. For individuals with high materialism, the influence of emotions on impulse buying will be stronger. Based on the above evidence, we made the following hypotheses:

> *H8a*: Materialism positively moderates the relationship between enjoyment and social media users' impulse buying.
>
> *H8b*: Materialism positively moderates the relationship between depression and social media users' impulse buying.

Self-control refers to an individual's ability to transcend or alter their internal responses, as well as interrupt undesired behavioral tendencies (such as impulsiveness) and restrain their behavior (Tangney et al., 2004). Self-control is one of the vital influencing factors of impulse buying. Rational buying behavior requires a struggle between self-control and the desire to buy impulsively (Nagar, 2016). If control is overwhelmed by desire, the consumer succumbs to the emotional push and product appeal and makes a purchase. When feeling out of control, an individual's emotions accelerate to produce irrational and impulsive behavior, such as impulsive consumption (Loewenstein, 1996; Li et al., 2020). Therefore, social media users with low self-control are more likely to make impulse purchases due to emotional stimuli. Thus, the two following hypotheses were made:

> *H9a*: Self-control negatively moderates the relationship between enjoyment and social media users' impulse buying.
>
> *H9b*: Self-control negatively moderates the relationship between depression and social media users' impulse buying.

Materials and methods

Sample and data collection

The research model was tested using data collected from college students by employing a professional questionnaire

platform through random sampling method. College students were chosen as the sample for three main reasons. First, compared to other age groups, young people are more impulsive (Pechmann et al., 2005). Second, young people are the main users of social media (Van Tran et al., 2022). College students who grew up in the Internet age are more inclined to use social media to communicate than to engage in face-to-face communication (Punyanunt-Carter et al., 2018). Third, young people are the main force of online shopping (Van Tran et al., 2022).

Given the prevention and control policies in place during the COVID-19 pandemic in China, we conducted an online survey through the Credamo platform. Credamo has a sample pool of more than 2.8 million members from diverse backgrounds. The questionnaire was randomly sent to college students on Credamo from June to July, 2022. All respondents were informed of the objectives of the study, the anonymity of their answers, were told that participation was completely voluntary, and confirmed that their survey data could be transmitted to researchers. They continued to complete the questionnaire after giving their informed consent.

To ensure the quality of answers, we set up two attention screening questions and limited the IP and the number of answers (namely, participants with the same IP address could only complete the questionnaire once). Structural equation modeling was used to test our research model. A well-known "rule of 10," as reported in previous studies, states that structural equation modeling estimation requires at least 10 subjects for each indicator (Nunnally, 1967; Westland, 2010). A total of 523 respondents completed the survey questionnaire, and 44 invalid samples were excluded. Data from a final total of 479 undergraduate and graduate students were included, covering 110 prefecture-level cities in 29 provincial administrative regions in China. Considering the division groups of Chinese young people (CBNData, 2019), we divided the age of the subjects into three levels, the criteria of which were adult (above 18 years), post-00s (22 years and younger), and post-95 s (27 years and younger). Post-95 s are also known as Generation Z (Djafarova and Bowes, 2021). Of the 479 respondents, 50.7% were male, 49.3% were female, and 99.4% of them were Generation Z (27 years and younger). Most participants had a monthly expense of 1,000–2000 RMB (66.4%) and used social media for more than 2 h per day (69.2%) (see Table 1).

Measures

The questionnaire contained two sections. The first section collected data on the demographics of participants (e.g., gender, age, and education), expenses per month, and the time spent on social media per day. The second section consisted of seven constructs that assessed active and passive social media use, depression, enjoyment, materialism, self-control, and impulse buying.

Independent variables

Active and passive social media use was assessed using the measurement scales developed by Gerson et al. (2017) and

TABLE 1 Profile of the respondents.

Characteristics	Levels	Frequency	Percentage (%)
Gender	Male	243	50.7
	Female	236	49.3
Age	18–22	400	83.5
	23–27	76	15.9
	28–40	3	0.6
Education	Junior college	42	8.8
	Undergraduate	412	86
	Postgraduate	25	5.2
Expense per month	0 ~ 1,000 RMB	43	9.0
	1,000–2,000 RMB	318	66.4
	2000–3,000 RMB	89	18.6
	3,000–4,000 RMB	12	2.5
	4,000–5,000 RMB	6	1.3
	5,000–8,000 RMB	8	1.7
	8,000–10,000 RMB	2	0.4
	10, 000–20,000 RMB	1	0.2
Time spent on social media per day	<30 min	4	0.8
	30 min ~ 1 h	26	5.4
	1–2 h	118	24.6
	2–4 h	177	37.0
	>4 h	154	32.2

Chen S. et al. (2019). Active social media use was measured using 5 items (e.g., "Posting status updates"; see Appendix A), and passive social media use was measured using 2 items (e.g., "Browsing the postings on social media passively without liking or commenting on anything"). Three items (ASMU3, PSMU3, and PSMU4) were excluded to ensure reliability, because these item loadings were below 0.5 in the factor analysis. Participants responded to items on a 5-point scale ranging from 1 (never (0% of the time)) to 5 (very frequently (100% of the time)). The Cronbach's α values of the active and passive social media use measures in this study were 0.784 and 0.779, respectively.

Dependent variable

The 3-item Impulsive Consumption Scale (Li et al., 2020) was used to assess impulsive buying behavior (e.g., "Recently, I often have the impulse to buy products that I did not intend to buy"; see Appendix A). Items were scored on a 5-point Likert ranging from 1 (strongly disagree) to 5 (strongly agree), for which the Cronbach's α coefficient was 0.877.

Mediation variables

The measurement items of enjoyment were adapted from Heijden (2003) and Gan and Li (2018), and included 4 items (e.g., "Using social media is an agreeable way of passing time"; see Appendix A). Participants responded to items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α coefficient in this study was 0.82.

The measurement of depression was adapted from Tandoc et al. (2015) and Chen S. et al. (2019). The scale included 5 items (e.g., "I felt sad"; see Appendix A). Respondents were asked to report the frequency of depression symptoms in the last week. Items were scored on a 5-point scale ranging from 1 (not at all) to 4 (a lot). The Cronbach's α coefficient of the depression scale in this study was 0.852.

Moderation variables

The measures of materialism were adapted from Richins and Dawson (1992) and Li et al. (2020). The scale included 5 items (e.g., "I'd be happier if I could afford to buy more things"; see Appendix A). The items were scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α coefficient in this study was 0.823.

Four measurement items from the "impulse control" dimension of the Chinese version of the Brief Self-Control Scale were used to measure self-control (Luo et al., 2021a). All of these measures were reverse-scored (e.g., "Sometimes I cannot help but do things that I know are wrong"). Participants responded to items on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α of the self-control measures in this study was 0.83.

Control variables

Two control variables that measured users' characteristics were also included in this study: monthly expenditure and time spent on social media per day. The existing literature has demonstrated that monthly spending level is closely associated with consumer's impulse buying behavior (Vohs and Faber, 2007). Moreover, some scholars have reported that the time spent on social media is correlated with users' psychological factors, such as well-being, social comparison, and envy (Arampatzi et al., 2018; Van Tran et al., 2022).

Results

This study used structural equation modeling algorithms to analyze the data and test the hypotheses. Following a two-step approach, we examined the measurement model and structural model sequentially. During this process, estimations performed using AMOS 24 and SPSS 25 software (IBM, United States).

Measurement model

Both reliability and validity were fulfilled in estimating the measurement model. Reliability can be established using Cronbach's alpha values and composite reliabilities. As shown above and in Table 2, the Cronbach's α and composite reliability values of all constructs were greater than 0.7, which implies that the results obtained from the scale's seven variables are reliable (Fornell and Larcker, 1981; Hair et al., 2009).

TABLE 2 Construct reliability and validity.

Constructs	AVE	CR	ASMU	PSMU	EN	DE	IB	MA	SC
ASMU	0.519	0.843	**0.720**						
PSMU	0.758	0.862	0.233	**0.871**					
EN	0.605	0.859	0.357	0.315	**0.778**				
DE	0.615	0.888	−0.061	0.136	−0.222	**0.784**			
IB	0.707	0.879	0.265	0.058	0.126	0.173	**0.841**		
MA	0.544	0.856	0.122	0.221	0.287	0.154	0.462	**0.738**	
SC	0.619	0.867	0.07	−0.131	0.055	−0.299	−0.371	−0.368	**0.787**

ASMU, active social media use, PSMU, passive social media use, EN, enjoyment, DE, depression, IB, impulse buying, MA, materialism, SC, self-control.

TABLE 3 Factor loadings.

	ASMU	PSMU	EN	DE	IB	MA	SC
ASMU1	**0.730**	−0.066	0.125	0.007	0.080	−0.029	−0.060
ASMU2	**0.746**	−0.023	0.068	0.063	0.108	−0.009	0.063
ASMU4	**0.650**	0.078	0.081	−0.111	0.062	0.117	0.055
ASMU5	**0.708**	0.154	0.050	0.019	0.014	0.125	0.083
ASMU6	**0.762**	0.082	0.145	−0.063	0.065	−0.029	−0.015
PSMU1	0.144	**0.878**	0.097	0.085	0.016	0.085	−0.020
PSMU2	0.054	**0.863**	0.179	0.054	−0.022	0.073	−0.077
EN1	0.150	0.039	**0.781**	−0.116	0.074	0.075	0.014
EN2	0.104	0.176	**0.694**	−0.055	−0.062	0.232	−0.019
EN3	0.122	0.098	**0.835**	−0.114	−0.005	0.097	0.008
EN4	0.114	0.011	**0.795**	−0.059	0.093	0.084	0.081
DE1	0.000	0.046	−0.109	**0.822**	−0.018	0.080	−0.121
DE2	−0.022	0.078	−0.102	**0.850**	0.049	0.031	−0.114
DE3	−0.049	0.084	−0.012	**0.759**	0.038	0.059	−0.035
DE4	0.033	−0.034	−0.043	**0.748**	0.111	0.010	0.036
DE5	−0.052	−0.019	−0.084	**0.736**	0.042	0.034	−0.199
IB1	0.147	−0.052	0.052	0.093	**0.824**	0.164	−0.156
IB2	0.062	0.031	0.061	0.059	**0.861**	0.205	−0.177
IB3	0.166	0.017	−0.001	0.084	**0.837**	0.233	−0.114
MA1	0.057	0.120	0.142	0.056	0.149	**0.661**	−0.143
MA2	0.063	−0.020	0.107	−0.017	0.067	**0.739**	−0.007
MA3	0.093	−0.016	0.135	0.019	0.112	**0.756**	−0.077
MA4	−0.029	0.055	0.021	0.100	0.111	**0.802**	−0.153
MA5	−0.008	0.073	0.069	0.070	0.145	**0.724**	−0.135
SC1	−0.029	−0.092	0.053	−0.124	−0.013	−0.169	**0.782**
SC2	0.070	−0.044	0.018	−0.127	−0.125	−0.181	**0.771**
SC3	0.022	−0.067	0.052	−0.099	−0.098	−0.106	**0.830**
SC4	0.073	0.093	−0.036	−0.050	−0.195	−0.035	**0.763**

ASMU, active social media use; PSMU, passive social media use; EN, enjoyment; DE, depression; IB, impulse buying; MA, materialism; SC, self-control.

Validity can be established by convergent validity and discriminant validity. Average variance extracted values exceeded the suggested threshold value of 0.5 (see Table 2), and showed an adequate convergent validity (Fornell and Larcker, 1981; Hair et al., 2009). A good discriminant validity is verified in two ways. As shown in Table 2, the square roots of the average variance extracted values (diagonal elements in bold) are greater than the correlation coefficients between any two variables (non-diagonal elements) (Fornell and Larcker, 1981). Moreover, every within-construct item loads on the measured construct (bold values) higher than on the other constructs (Chin et al., 2003) (see Table 3).

In addition, there was no problem of multicollinearity in this study, because the variance inflation factors of all constructs were between 1.116 and 1.282, which is well below the threshold of 5 (Hair et al., 2011). In order to overcome common method bias (CMB), some remedies were employed in this study. First, we informed the subjects of the purpose of this study and the confidentiality and anonymity of the questionnaire data (Akhtar et al., 2022a). Second, gender, materialism, and self-control were added as moderators in this study because moderators contribute to the reduction of CMB (Aslam et al., 2021; Akhtar et al., 2022b). Moreover, according to Harman's single-factor test, the first factor in this research explained 11.5% of the total variance; this was below the 50% threshold (Podsakoff et al., 2003), which indicates that there was no problem of CMB in this study.

Structural model

The structural equation modeling results demonstrated a good model fit by absolute fit indices (χ^2/df = 2.412 < 3; RMSEA = 0.054 < 0.08) and incremental fit indices (CFI = 0.928 > 0.9; GFI = 0.919 > 0.9; TLI = 0.917 > 0.9; IFI = 0.928 > 0.9).

The proposed hypotheses were examined by evaluating the structural model. The results showed that active and passive social media use significantly and positively affected users' enjoyment ($\beta = 0.242$, $p < 0.001$; $\beta = 0.185$, $p < 0.001$), which supported H1 and H2a. Passive social media use significantly and positively affected users' depression ($\beta = 0.082$, $p < 0.05$), which supported H3b.

Enjoyment (β = 0.209, $p < 0.01$) and depression (β = 0.28, $p < 0.001$) significantly and positively affected users' impulsive buying, which supported H3 and H4.

Of the two control variables, only monthly expenditure (β = 0.096, $p < 0.05$) was significantly and positively associated with users' impulse buying (see Table 4). After adding the two control variables, all research hypotheses were still supported, which indicates that the control variables did not bias the results of this study.

Mediating and moderating effects

Mediating effects

We tested the mediation model using model 4 of the PROCESS macro and the bootstrapping method (with bootstrap resamples $N = 5{,}000$) (Hayes, 2013). This method has been widely used in many mediating and moderating effects tests (Cai et al., 2021; Van Tran et al., 2022). At the 95% confidence level, the confidence intervals (CIs) did not contain 0, which indicates that the indirect effect was significant.

As shown in Table 5, the indirect effect of active social media use on impulse buying was significant for the mediating variable of enjoyment (β = 0.021, CI = 0.001–0.071), and the CIs did not contain 0. Thus, H5 was supported. The direct effect was also significant (β = 0.285, $p < 0.001$), which revealed a partial mediating role of enjoyment in the relationship between active social media use and impulse buying.

The indirect effects of passive social media use on impulse buying were significant for both the mediating variables of enjoyment (β = 0.043, CI = 0.007–0.09) and depression (β = 0.032, CI = 0.003–0.074), which excluded the value of zero. However, the direct effect was not significant (β = 0.079, $p > 0.05$), which indicates that enjoyment and depression fully mediated the relationship between passive social media use and impulse buying. Therefore, H6a and H6b were supported.

Moderating effects

We tested the moderation model using model 1 of the PROCESS macro and the bootstrapping method (with bootstrap resamples $N = 5{,}000$) (Hayes, 2013). Gender did not significantly moderate the effects of either enjoyment ($F = 0.066$, $p = 0.798$) or depression ($F = 1.272$, $p = 0.26$) on impulse buying. Therefore, H7a and H7b were rejected.

Materialism significantly and positively moderated the effect of enjoyment ($F = 9.473$, $p = 0.022$) on impulse buying (Figure 2), which supported H8a. However, materialism did not significantly moderate the association between depression and impulse buying ($F = 3.83$, $p = 0.051$). Therefore, H8b was rejected.

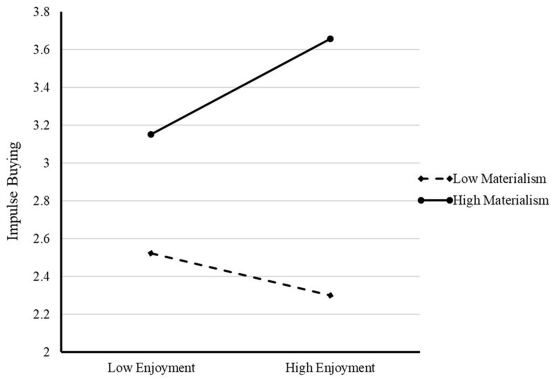

FIGURE 2
Materialism moderates the relationship between enjoyment and impulse buying (H8a).

TABLE 4 Path analysis results.

Hypotheses	Standardized (b)	*P*-value	Results
H1: ASMU → EN	0.245	0.000***	Supported
H2a: PSMU → EN	0.185	0.000***	Supported
H2b: PSMU → DE	0.082	0.046*	Supported
H3: EN → IB	0.209	0.005**	Supported
H4: DE → IB	0.280	0.000***	Supported
Expense per month	0.096	0.011*	
SM time spent per day	0.058	0.124	

ASMU, active social media use; PSMU, passive social media use; EN, enjoyment; DE, depression; IB, impulse buying.
***$p < 0.001$; **$p < 0.01$; and *$p < 0.05$.

TABLE 5 Mediating effect test results.

Path	Coefficients	*P*-value	95% confidence interval		Results
			Lower	Upper	
Direct effect					
ASMU → IB	0.288	0.000***			
PSMU → IB	−0.012	0.787			
Indirect effect					
ASMU → EN → IB	0.021		0.001	0.071	H6 supported
PSMU → EN → IB	0.035		0.015	0.066	H7a supported
PSMU → DE → IB	0.02		0.002	0.044	H7b supported

ASMU, active social media use; PSMU, passive social media use; EN, enjoyment; DE, depression; IB, impulse buying. ***$p < 0.001$.

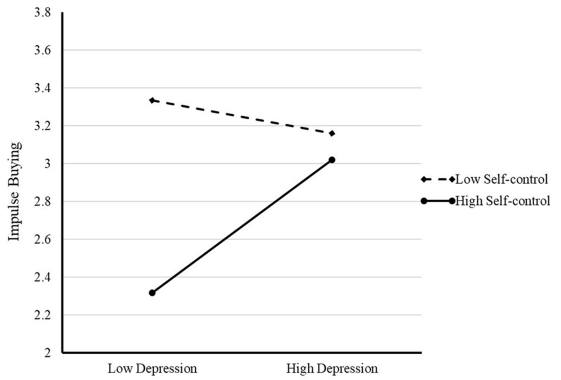

FIGURE 3
Self-control moderates the relationship between depression and impulse buying (H9b).

Self-control did not significantly moderate the effect of enjoyment on impulse buying ($F = 2.391$, $p = 0.123$). Therefore, H9a was rejected. Consistent with H9b, self-control significantly and negatively moderated the association between depression and impulse buying ($F = 11.297$, $p = 0.001$) (see Figure 3).

Discussion and conclusion

The purpose of this study was to explore the relationships between different social media use patterns and impulse buying in Chinese college students, as well as the differential emotional mediators and personality trait moderators. We collected data through an online survey and tested the proposed hypotheses and research model using the structural equation modeling method. The results revealed that users' active and passive social media use were positively associated with their enjoyment, and passive use positively predicted depression. Our results also indicated that both enjoyment and depression can trigger users' impulse buying. Furthermore, there was an inhibitory effect of self-control on depression-driven impulse buying, and an enhancement effect of materialism on enjoyment-driven impulse buying. The present results have important implications for understanding the mechanisms underlying impulse buying in the context of social media and guiding rational online consumption.

The results indicated that different patterns (active and passive) of social media use had different emotional impact mechanisms on users' impulse buying. Active social media use increased users' enjoyment (H1), whereas passive browsing boosted users' depression (H2b), which is consistent with previous research (Verduyn et al., 2017; Chen S. et al., 2019; Valkenburg et al., 2022). The findings from this study confirm our contention that passive social media use significantly enhances users' enjoyment (H2a), which further supported the "emotional contagion phenomenon" proposed by Lin and Utz (2015). Given that social media is flooded with positive statuses, users can experience contagion and delight by these when browsing social media, even when they are not interacting with other people. Notably, in agreement with our expectations and prior research (Escobar-Viera et al., 2018; Valkenburg et al., 2022), the association between active use and depression was not significant ($\beta = -0.075$, $p = 0.08$). Our research findings support hypotheses H3 and H4 that enjoyment and depression are positively and significantly associated with social media users' impulse buying, which is in line with previous results (Liu et al., 2019; Zhao et al., 2021). When individuals feel pleasure and enjoyment in social media use, they may have the urge to make an impulse purchase; however, they can also feel the urge to impulse buy when they feel depressed, sad, or unhappy.

The main findings of the study revealed the mediating effects of enjoyment and depression between different social media use and impulse buying. Enjoyment significantly partially mediated the relationship between active social media use and impulse buying (H5). Users actively interact with other people on social media (e.g., by chatting, liking, and commenting), perhaps because they are interested in a specific product, or due to recommendations from social media friends. These active interactions could make them feel happiness and enjoyment, and promote impulse purchases. Other scholars have proposed a similar association (Chen Y. et al., 2019). Furthermore, passive social media use significantly and indirectly predicted users' impulsive consumption *via* the mediating effects of enjoyment and depressive mood (H6), but not directly. This insignificant direct effect between passive browsing and impulse buying aligns with Leong et al. (2018) results, and may be because enjoyment and depression have full mediating effects. These results indicate that when users browse many positive posts on social media, they are likely to make impulse purchases only when they are experiencing enjoyment or feeling depressed.

Gender was found to be a non-significant moderator of the relationships between enjoyment, depression, and impulse buying (H7a/b). The results were inconsistent with those of Atulkar and Kesari (2018), who found that gender positively moderates the relationship between enjoyment and impulsive consumption. This contradictory result may be because the participants in this study were young people, who engage in more impulse buying than older people (Styvén et al., 2017). Compared with demographic factors, psychological factors may be more influential in triggering impulse purchase behaviors in social commerce consumers (Leong et al., 2018).

As predicted, materialism significantly positively moderated the relationship between enjoyment and impulse buying in social media users (H8a). Atulkar and Kesari (2018) indicated that enjoyment and materialism positively predict impulsive consumption. The findings of the present study further extended the existing literature by verifying the reinforcing effect of materialism on the positive relationship between enjoyment and impulse buying. Individuals with high materialism were more likely to consume impulsively to satisfy their material desires and obtain more happiness when they are experiencing enjoyment on social media. Contrary to hypothesis 8b, we found no significant moderating effect of materialism in the relationship between depression and impulse buying. One possible explanation for this phenomenon is that consumers' negative emotions can prompt similar negative valence memories, which

renders them unable to think systematically and make rational judgments (Raghunathan and Pham, 1999), thereby shaping impulse buying decisions. This process occurs in both high materialists and low materialists, with no significant difference between the two.

Another interesting finding is the negative moderating effect of self-control on the association between depression and impulse buying (H9b). Other scholars have proposed a similar association (Li et al., 2021). Young people with weaker impulse control are more inclined to spend money impulsively to cope with their negative affect. This is in line with previous findings that people with low self-control are more likely to exhibit impulsiveness, which is driven by negative emotion (Loewenstein, 1996). However, we found no such significant moderating effect of self-control in the relationship between enjoyment and impulse buying (H9a). When people feel enjoyment during social media usage, they buy products on impulse, and there is no significant difference between those with high self-control and those with low self-control. The results are consistent with earlier research (Balleyer and Fennis, 2022), which claimed that positive emotions lead to less vigilance and thereby reduce self-regulation. When individuals experience enjoyment, those with high self-control are not significantly different from those with low self-control in their ability to control impulsive spending.

Implications and limitations

Theoretical implications

Several valuable theoretical implications have been put forth by this study. Prior research has examined direct associations between social media use and impulsive purchase (Leong et al., 2018; Pellegrino et al., 2022), with a lack of consideration of different social media usage patterns and mediating effects. This research expands the impulse buying literature by developing a model of the relationship between active and passive social media use, emotion, and impulse buying behavior. The present study also adds to the body of knowledge on how emotions of different valences (enjoyment and depression) mediate the association between active and passive social media use and impulsive consumption behavior. It is noted that this study finds a partial mediating effect of enjoyment on the relationship between active social media use and impulse buying, and a full mediating effect of enjoyment and depression between passive social media use and impulsive buying. Finally, the moderating effects of self-control and materialism on the relationship between emotions and impulse buying were explored, which is uncommon in the current research on impulsive consumption. As a result, this study proposes a thorough mediated and moderated model to investigate the effect of active and passive social media use on impulse buying.

Practical implications

The study findings also have valuable implications for young consumers, social media platform providers, and government practices. Young people spend a lot of time using social media, and although browsing social media can increase enjoyment, it also increases the risks of depression and impulse buying. Comparatively, actively interacting with others (e.g., chatting, liking, and commenting) or actively posting status updates on social media can enhance positive emotion. It could be useful to educate young users about ways to connect with other people online, such as interacting with friends as well as strangers, that are better for their mental health. However, when interacting with friends, users should be sensible and vigilant about recommendations from friends to avoid impulsive and excessive consumption. Built on the direct impact of active social media use on impulse purchases, social media platform providers should track cookies to identify the items users mentioned in their interactions (e.g., comments or likes) and time spent completing a transaction. This information can be used in the design of algorithms for personalized content or advertisement push, which may increase social media users' consumption. According to the emotional contagion phenomenon confirmed in this study, browsing positive content posted on social media can enhance users' positive emotions and impulse buying. The Chinese government should strive to formulate laws, regulations, and related policies to strengthen the supervision of content posted on social media platforms in order to maintain more positive content and eliminate harmful information, which is beneficial to expand consumption.

Both enjoyment and depression may increase impulsive consumption, but young people with poor self-control should be wary of unhealthy impulsive purchases when they are depressed. College students should consciously improve their self-control, which can reduce irrational consumption caused by depression. Materialists should be wary of irrational consumption when they are feeling enjoyment on social media. Schools and universities should increase communication and lectures to guide young people to establish the correct view of money and values. In addition, the government should consider posting content on its official homepage of social media (e.g., Weibo or their WeChat Official Account) calling on young social media users to reduce materialism and maintain rational consumption. Therefore, our findings that emotion mediated, and personality traits moderated, the relationship between social media use and impulse buying have implications for interventions that target college students' healthy use of social media and rational consumption.

Limitations and future research direction

This study has several limitations. First, this study has some methodological limitations. This was a cross-sectional study, which makes it difficult to infer causal relationships between social media use and impulse buying. Future experimental or longitudinal studies could further verify the results of this research. Second, our results are limited to Chinese college student samples, and care should be taken when generalizing our findings to other age groups, other social media, or other countries. Third, active social media use can be further divided into active social

use and active non-social use, according to previous studies (Gerson et al., 2017). Future research could explore the underlying mechanisms in greater depth by subdividing these dimensions. Finally, the effect size of passive use on depression and the explanatory R-squares of enjoyment, depression, and impulse buying were small in this study. Additional mediating variables, such as envy and anxiety, should be explored in future work.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SC: conceptualization, methodology, and writing a draft of the manuscript. KZ: reviewing and editing. YC: reviewing and supervising. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1011337/full#supplementary-material

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Appendix A

Constructs	Items	
Active social media use (Gerson et al., 2017; Chen S. et al., 2019)	ASMU1	Posting status updates on social media
	ASMU2	Posting photos on social media
	ASMU3	Posting videos on social media (delete)
	ASMU4	Chatting or interacting with others on social media
	ASMU5	Liking others' statuses, pictures, etc
	ASMU6	Commenting on others' statuses, pictures, etc
Passive social media use (Gerson et al., 2017; Chen S. et al., 2019)	PSMU1	Browsing others' statuses passively (without liking or commenting on anything)
	PSMU2	Browsing others' pictures or videos passively (without liking or commenting on anything)
	PSMU3	Browsing others' homepages (delete)
	PSMU4	Checking to see what others are up to (delete)
Enjoyment (Heijden, 2003; Gan and Li, 2018)	EN1	I find social media to be entertaining overall
	EN2	Using social media is an agreeable way of passing time
	EN3	I find using social media to be pleasurable overall
	EN4	I find that using social media makes me enjoy
Depression (Tandoc et al., 2015; Chen S. et al., 2019)	DE1	I felt depressed
	DE2	I felt fearful
	DE3	I felt lonely
	DE4	I felt sad
	DE5	I thought my life had been a failure
Impulse buying (Li et al., 2020)	IB1	I always have the impulse to have a product immediately when I see it on social media
	IB2	I always have the impulse to buy some unplanned products that I did not intend to buy
	IB3	I have an impulse to consumption on social media
Materialism (Li et al., 2020)	MA1	I admire people who own expensive homes, cars, and clothes
	MA2	The things I own say a lot about how well I'm doing in life
	MA3	Buying things gives me a lot of pleasure
	MA4	I'd be happier if I could afford to buy more things
	MA5	My life would be better if I owned certain things I do not have
Self-control (Luo et al., 2021a)	SC1	I do things that bring me happiness but are harmful to me (R)
	SC2	Sometimes I get distracted by having fun and cannot finish the task on time (R)
	SC3	Sometimes I cannot help but do things that I know are wrong (R)
	SC4	I often act without thinking (R)

"R" means this item was reverse coded.

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The heterogeneity of negative problem orientation in Chinese adolescents: A latent profile analysis

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Negative problem orientation (NPO) has become an essential construct for comprehending social problem-solving deficits. However, the heterogeneity of NPO has not yet been explored. With a sample of Chinese adolescents (N=2,174), four latent profiles were identified as *lower NPO*, *moderate NPO*, self-inefficacy and negative outcome expectancy (*SI&NOE*), and *dysfunctional NPO*. Compared to the *lower NPO* and *moderate NPO*, a greater percentage of boys in the *SI&NOE* and *dysfunctional NPO* profiles than were girls. In addition, lower grades and younger adolescents tended to engage in the *moderate NPO* and *SI&NOE* profiles. The *dysfunctional NPO* reported higher levels of worry, depressive symptoms, anxiety, and stress, and worse sleep quality than the other profiles. The implications of these findings are discussed herein.

KEYWORDS

negative problem orientation, adolescents, latent profile analysis, cognitive vulnerabilities, psychological symptoms

Introduction

Negative problem orientation (NPO) has increasingly become an essential construct for understanding deficits in social problem-solving ability. It is known for causing negative emotions and avoidance motivation that inhibits subsequent problem-solving endeavors (Lee and Woodruff-Borden, 2018; Söğüt et al., 2021). According to social problem-solving theory, NPO refers to a comprehensively disruptive cognitive-emotional set and/or attitude toward social problems encountered, increasing useless worry about those problems and inhibiting the establishment of effective resolutions (Nezu, 2004). Specifically, it involves three components: (a) view of a problem as a significant threat to wellbeing (including psychological, social, and economic), (b) doubt about one's own personal ability to solve problems successfully, and (c) easily becoming frustrated and upset when confronted with social problems (D'Zurilla et al., 2004; Nezu et al., 2013).

The vital role NPO plays in adolescent psychotherapy and mental health is well-recognized. For example, previous studies have shown that NPO increases adolescent worry

and anxiety (Donovan et al., 2016; Kasik et al., 2017; Lee and Woodruff-Borden, 2018), reduces the effort expended to solve social problems (Chu et al., 2017), and thus leads to several psychopathological issues such as generalized anxiety disorder (GAD) (Koerner et al., 2015), social anxiety disorder (SAD) (Hearn et al., 2017), obsessive–compulsive disorder (OCD) (Fergus and Wu, 2010), and major depressive disorder (MDD) (Becker-Weidman et al., 2010). These results were mainly obtained from a variable-oriented perspective. The potential heterogeneity of adolescent NPO, however, has thus far been neglected.

Negative problem orientation is often assessed *via* a well-known self-reported measure called the Negative Problem Orientation Questionnaire (NPOQ) (Robichaud and Dugas, 2005a,b). Although the NPOQ was initially primitively manifested as a uni-dimensional construct related to negative beliefs regarding social problems, it now assesses a comprehensively disruptive cognitive-emotional set of social problems, including perceived threat, self-inefficiency, and negative outcome expectancy (Robichaud and Dugas, 2005a). Xiao et al. (2020) supported a bifactor model of the NPOQ, with a general NPO factor and three domain-specific factors (i.e., perceived threat, self-inefficacy, and negative outcome expectancy). The main purpose of the present study was to explore the latent profiles of adolescent NPO with latent profile analysis (LPA), hypothesizing that potential subgroups of adolescent NPO could be characterized by their NPOQ scores and/or three domain-specific factors.

Latent profile analysis, a person-centered method, can identify latent subpopulations within populations, based on certain variables (Masyn, 2013). Population heterogeneity is explained by the identification of latent profiles that are unique from one another but consist of individuals who are similar with regard to a set of observed variables (Lanza et al., 2013). Theoretically, it is possible that subgroups of adolescents exist as characterized by their different levels of NPO. Recent research has also used person-centered methods to anticipate potential outcomes. For example, Durham et al. (2022) identified three classes of participants with posttraumatic stress disorder who endorsed a posttraumatic sequelae but differed in terms of the level of exposure to trauma (i.e., high, moderate, and low). Similar results were found for eating disorders (Gagliardini et al., 2020), suicidal ideation and behavior (Love and Durtschi, 2021), and intolerance of uncertainty (Boelen and Lenferink, 2018).

Identifying such subgroups would provide valuable information for research and clinical practice. For instance, delineating NPO patterns across potentially emerging subgroups would provide an additional foundation for further clarification of the underlying NPO mechanism and its role in reflecting fundamental anxiety. Moreover, subgroups of adolescents being distinguishable based on NPO profiles underscore the importance of administering tailored interventions to the most problematic groups.

The second purpose of this study was to investigate whether adolescents in different NPO subgroups were distinct in terms of certain cognitive vulnerabilities and psychological symptoms. With regard to cognitive vulnerabilities, worry is examined more as a cognitive vulnerability, such as repetitive thought about negative future events (Borkovec et al., 1998). Thus, this study mainly focused on worry. For psychological symptoms, this research predominately explored stress, anxiety, depressive symptoms, and sleep problems. Given the scarcity of research on latent NPO subgroups, we selected these variables based mainly on previous NPO studies using variable-centered approaches, sufficiently supporting that NPO is a critical cognitive vulnerability for these psychological symptoms (Dugas et al., 2005; Fialko et al., 2012; Hasegawa et al., 2018; Romano et al., 2019). It was thus important to identify the results for the NPO subgroups in terms of these psychological vulnerabilities and symptoms.

Additional significant reasons prompted us to examine associations among different NPO profiles demonstrating these cognitive vulnerabilities and symptoms. First, it would be helpful to enhance our theoretical knowledge of NPO by investigating the distinctiveness of the emerging subgroups in terms of these variables. Specifically, it would be beneficial to understand whether inclusion in different NPO profiles conferred different levels of risk of maladaptive cognitive processes and psychological problems. Second, it would be clinically helpful to explore differences in cognitive vulnerabilities and symptoms among the NPO profiles. In particular, if we could identify NPO profiles as characterized by various cognitive vulnerabilities and symptoms, it would help with determining which NPO aspects or features should be targeted in treatment.

In sum, though NPO has increasingly emerged as an essential construct for understanding deficits in social problem-solving, its heterogeneity has yet to be explored. Through a survey of a large sample of Chinese adolescents ($N = 2{,}174$) *via* the widely-used NPOQ, this study explored latent subgroups of Chinese adolescents categorized according to NPO indicators, examined the antecedent variables of the NPO profiles, and determined whether they were significantly diverse in terms of particular cognitive vulnerabilities and psychological symptoms. Based on the evidence of latent subgroups found in related research fields (Crow et al., 2012; Boelen and Lenferink, 2018; Xiao et al., 2019), we preliminarily hypothesized that among the different subgroups of Chinese adolescents, there would be at least two subgroups of NPO characterized by relatively low and high NPO on the NPOQ. Given that latent NPO profiles are exploratory, we were hesitant to formulate specific hypotheses related to our second research goal.

Methods

Participants

With a stratified cluster sampling (i.e., each class was seen as a cluster, and each grade was considered a level), 2,174 Chinese adolescents were recruited from Fuzhou, Fujian Province in PRC. Approval was obtained from each participant's head teacher and parents. Invalid questionnaires (characterized by blank or duplicate

selections on more than half of the instrument) were eliminated. The remaining 2,050 participants were retained, for a validity rate of 94.3%. Of the valid sample, 1,027 were boys (50.1%) and 1,023 were girls (49.9%); 518 were in the 7th grade (25.3%), 529 in the 8th grade (25.8%), 548 in the 10th grade (26.7%), and 455 in the 11th grade (22.2%). The mean age of the participants was 14.3 years ($SD = 1.6$), with ages ranging from 10 to 19 years. Written informed consent was obtained from participants' teachers and parents. This study was approved by the Academic Committee of Fujian Normal University.

Measures

Negative problem orientation questionnaire

The NPOQ assesses individual negative beliefs regarding social problems, including considering problems as a threat, doubting one's problem-solving abilities, and being pessimistic about the outcomes (Robichaud and Dugas, 2005a). The NPOQ consists of 12 items, each rated on a five-point Likert scale, with responses ranging from 1 ("not at all true of me") to 5 ("extremely true of me"). Higher scores indicate a greater NPO. The NPOQ was shown to have excellent internal consistency ($\alpha = 0.92$) and good test–retest reliability ($r = 0.80$; five-week interval) (Xiao et al., 2020). In the current study, the Cronbach's alpha coefficient for the NPOQ was.93.

Depression-anxiety-stress scale

The depression-anxiety-stress scale (DASS-21) assesses typical dysphoria and sadness, physiological arousal and fear, and states of tension and stress (Brown et al., 1997). It includes three subscales: depression, anxiety, and stress. Participants rate each item on a four-point Likert scale, with responses ranging from 0 ("did not apply to me at all") to 3 ("applied to me very much or most of the time"), according to the frequency and severity of symptoms experienced the previous week. Higher scores on the DASS-21 indicate higher levels of negative emotionality. Previous studies have supported the good internal consistency of the DASS-21 and its subscales (Szabo, 2010; Osman et al., 2012). In the current study, the Cronbach's alpha coefficients for the DASS-21 were 0.94 and for its subscales 0.86, 0.83, and 0.84, respectively.

Penn state worry questionnaire

The Penn state worry questionnaire (PSWQ) uses 16 items to measure the frequency and intensity of the tendency to worry (Meyer et al., 1990). Participants rate each item on a five-point Likert scale, with responses ranging from 1 ("not typical at all") to 5 ("very typical"), with 1, 3, 8, and 11 being the reverse scoring items. The total score ranges from 16 to 80, with higher scores indicating a greater tendency to worry after reversing the reverse scoring items. Previous studies have shown that the PSWQ enjoys excellent internal consistency (Meyer et al., 1990). In this study, the Cronbach's alpha coefficient for the PSWQ was 0.85.

Pittsburgh sleep quality index

The Pittsburgh sleep quality index (PSQI) is an 18-item self-reported instrument measuring sleep quality according to seven factors: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medications, and daytime dysfunction (Buysse et al., 1989). Each item is rated on a four-point Likert scale, with responses ranging between 0 and 3. Higher scores indicate lower levels of sleep quality. The PSQI shows good internal consistency (Scialpi et al., 2022). In the current study, the Cronbach's alpha coefficient for the PSQI was 0.63.

Statistical analysis heterogeneity

The statistical analysis was conducted in Mplus 8.0 and SPSS 25.0. Based on the Mplus 8.0, LPA was used to identify the number of heterogeneity adolescents in NPO subgroups. All items on the NPOQ were subjected to LPA. First, a one-profile model was constructed, followed by two-, three-, four-, and five-profile models. The optimal model was determined by the following indices of model fit: Akaike information criterion (*AIC*), Bayesian information criterion (*BIC*), sample size-adjusted *BIC* (*aBIC*), Lo–Mendell–Rubin (*LMR*), the bootstrapped likelihood ratio test (*BLRT*), and *Entropy* values (Meyer and Morin, 2016). Lower *AIC*, *BIC*, and *aBIC* values indicate a better model fit. *Entropy* values closer to 1 demonstrate a more accurate classification. *LMR* and *BLRT* were adopted to compare the models of *K* profiles to models of *K-1* profiles. The significant *value of p* suggested that the models of *K* profiles had a better fit than the models of *K-1* profiles (Nylund et al., 2007).

After the best profile of the model was selected, latent mixture modeling was further employed to examine the antecedents and consequences of the NPO profiles. The antecedents, which mainly included socio-demographic variables (i.e., gender, age, and grade), were tested using a three-step approach (Asparouhov and Muthen, 2014). The consequence variables, which included worry, depression, stress, anxiety, and sleep quality, were tested by Bolck, Croon, and Hagenaars (BCH) approach (Bolck et al., 2004).

Results

Descriptive statistics and correlation analysis

Inter-correlations of the NPOQ, PSWQ, PSQI, and DASS-21 subscales are presented in Table 1. The correlations between the NPOQ and DASS-21 subscales (i.e., depression, anxiety, and stress) were significant ($r_s = 0.55 \sim 0.65$, $p < 0.01$). The NPOQ correlations

with the PSWQ and PSQI were also significant ($r_s = 0.49 \sim 0.62$, $p < 0.01$; $r_s = 0.37 \sim 0.46$, $p < 0.01$).

Latent profile analysis

The fit statistic for the different profile models is presented in Table 2. The results showed that the three-, four-, and five-profile models revealed relatively lower *AIC*, *BIC*, and *aBIC* values as compared to the two-profile model (even with a higher *Entropy*). Meanwhile, the four-profile model showed lower statistical criteria values (i.e., *AIC*, *BIC*, and *aBIC*) as compared to the three-profile model. The statistical criteria for the four-profile model with higher *Entropy* (0.89) and significant *LMR* ($p < 0.001$) and *BLRT* ($p < 0.001$) compared to that of five-profile model. In sum, compared with the three-profile and the five-profile model, the four-profile model indicated demonstrated good discriminability and theoretical interpretability which was accepted. Figure 1 shows the four-profile model for the three domain-specific factors on the NPOQ.

Profile 1 (30.8%) was characterized most clearly by lowest Z-scores on the perceived threat, self-inefficacy, and negative outcome expectancy, resulting in Profile 1 being named *lower NPO*. Profile 2 (25.7%) was characterized by Z-scores close to but less than zero for the three domain-specific dimensions, leading Profile 2 to be named *moderate NPO*. Profile 3 (34.5%) was the largest and defined primarily by below-average scores for perceived threat and above-average scores for self-inefficacy and negative outcome expectancy. This profile was characterized by obvious self-inefficacy and negative outcome expectancy, and thus was named *SI&NOE*. Profile 4 (9.0%) was the smallest and characterized most notably by significant above-average scores on all dimensions related to NPO. The individuals in the profile tended to be dysfunctional and/or exhibit inhibitive cognitive-emotional patterns in response to social problems; thus, the group was named *dysfunctional NPO*.

Three-step approach

A three-step approach was taken to analyze the socio-demographic variables (i.e., gender, age, and grade) as possible background characteristics of the NPO profiles. As shown in Table 3, when the *lower NPO* profile was the reference group, the regression coefficients of gender for *SI&NOE* and *dysfunctional NPO* were significantly negative, indicating that a higher proportion of boys were categorized as *SI&NOE* and *dysfunctional NPO* as compared to *lower NPO*. The regression coefficients of grade and age for the *moderate NPO* and *SI&NOE* profiles were also significantly negative, indicating that there were higher percentages of students in the lower grades and younger adolescents in the *moderate NPO* and *SI&NOE* profiles, as compared to *lower NPO*. In addition, when compared to *moderate NPO*, the regression coefficients of gender for *dysfunctional NPO* were significantly negative. They differed significantly for girls and boys, with boys being more likely than girls to be in the *dysfunctional* rather than the *moderate NPO* profile.

BCH approach

The BCH approach was used for the cognitive vulnerability and psychological symptoms variables (i.e., sleep quality, worry, depression, stress, and anxiety), which served as consequence variables for the NPO profiles. As shown in Table 4, worse sleep quality, worry, depression, stress, and anxiety all differed significantly across the four NPO profiles. The mean scores for worse sleep quality, worry, depression, stress, and anxiety were highest for the *dysfunctional NPO* profile; the order of the mean scores was: *lower NPO* < *moderate NPO* < *SI&NOE* < *dysfunctional NPO*.

TABLE 1 Inter-correlation and descriptive statistics.

	NPOQ-factor			Depression	Anxiety	Stress	PSQI	PSWQ
	F1	F2	F3					
F1	–							
F2	0.67**							
F3	0.71**	0.82**						
Depression	0.56**	0.60**	0.62**					
Anxiety	0.55**	0.57**	0.61**	0.78**				
Stress	0.57**	0.61**	0.65**	0.77**	0.83**			
PSQI	0.37**	0.43**	0.46**	0.48**	0.51**	0.52**		
PSWQ	0.49**	0.59**	0.62**	0.51**	0.58**	0.62**	0.47**	
Mean	6.27	9.95	12.57	9.18	11.29	12.81	7.00	50.09
SD	3.00	4.51	5.30	9.60	9.46	9.82	3.39	11.55
CR	0.76	0.87	0.86	0.85	0.83	0.84	0.89	0.85
AVE	0.51	0.62	0.55	0.45	0.41	0.43	0.35	0.32

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. F1, perceived threat; F2, self-inefficacy; F3, negative outcome expectancy; PSQI, Pittsburgh Sleep Quality Index; PSWQ, Penn State Worry Questionnaire; CR, construct reliability; AVE, average variance extracted.

TABLE 2 Fit indices for one-to five-profile models of latent profile analysis.

Profile	*LL*	*FP*	*AIC*	*BIC*	*aBIC*	Entropy	*LMR* (p)	*BLRT* (p)
1	−41299.11	24	82646.22	82781.23	82704.98	–	–	–
2	−36292.54	37	72659.08	72867.23	72749.68	0.93	<0.001	<0.001
3	−34951.31	50	70002.61	70283.89	70125.04	0.91	<0.001	<0.001
4	−34377.74	63	68881.48	69235.89	69035.74	0.89	<0.001	<0.001
5	−34149.32	76	68450.64	68878.19	68636.73	0.88	0.1739	<0.001

AIC, Akaike information criterion; *BIC*, Bayesian information criterion; *aBIC*, adjusted Bayesian information criterion; *LMR* (p), value of p of likelihood ratio test index; *BLRT* (p), value of p of bootstrapped likelihood ratio test index; LL, loglikelihood; FP, free parameters.

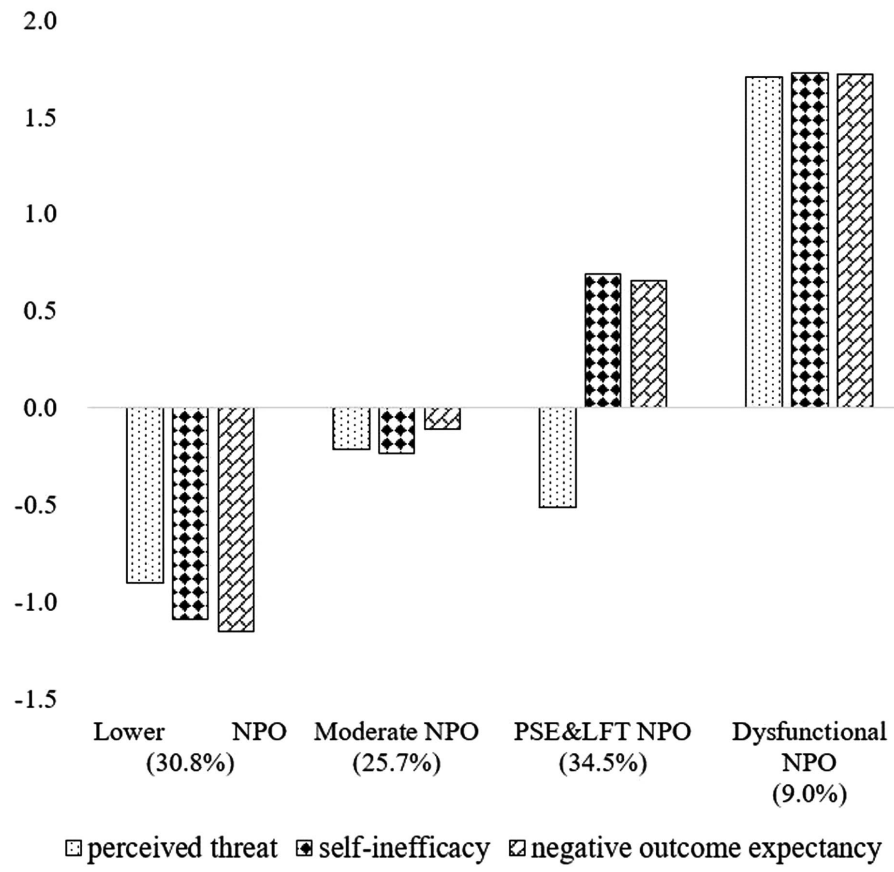

FIGURE 1
Means of the three domain-specific factors of NPOQ for the four-profile model. profile 1, *lower NPO*; profile 2, *moderate NPO*; profile 3, *SI & NOE*; profile 4, *dysfunctional NPO*; NPO, negative problem orientation; *SI&NOE*, self-inefficacy and negative outcome expectancy.

Discussion

The main purpose of this study was to explore the heterogeneity of NPO in Chinese adolescents. The results showed that four NPO profiles could be distinguished among the Chinese adolescents (i.e., *lower NPO*, *moderate NPO*, *SI&NOE*, and *dysfunctional NPO*). The three-step regression mixture model showed significant gender, grade, and age differences, and the BCH approach revealed significant differences between the *four profiles* with regard to sleep quality, worry, depression, stress, and anxiety. This study analyzed and discussed the latent profiles, antecedents, and after-effects of NPO, revealing the extent to which they contribute to adolescent NPO.

Latent profiles of NPO

Four distinct NPO profiles were first distinguished by the three domain-specific factors (i.e., perceived threat, self-inefficacy, and negative outcome expectancy): *lower NPO*, *moderate NPO*, *SI&NOE*, and *dysfunctional NPO*. The *lower NPO* profile included individuals likely to endorse the three domain-specific factors,

TABLE 3 Multinomial logistical regression results predicting the four profiles of NPOQ.

Reference profile		Moderate NPO			*SI&NOE*			Dysfunctional NPO		
		Gender	Grade	Age	Gender	Grade	Age	Gender	Grade	Age
Lower NPO	*B*	−0.08	**−0.15***	**−0.09***	**−0.25***	**−0.11***	**−0.09***	**−0.52****	−0.27	−0.01
	SE	0.13	0.06	0.04	0.12	0.05	0.04	0.18	0.08	0.06
	OR	0.93	**0.89****	**0.92***	**0.78***	**0.90***	**0.91****	**0.60*****	0.97	0.10
Moderate NPO	*B*				−0.17	0.05	−0.01	**−0.44***	0.13	0.09
	SE				0.13	0.06	0.04	0.18	0.09	0.06
	OR				0.84	1.05	1.00	**0.64****	1.13	1.09
SI&NOE	*B*							−0.27	0.08	0.09
	SE							0.18	0.08	0.06
	OR							0.76	1.08	1.09

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. The negative numbers mean there are more boys and more younger adolescents. The bold values means the data is significant.

TABLE 4 Parameter estimates of cognitive vulnerabilities and psychological symptoms on the four profiles, *M*(*SE*).

	M(*SE*)	Pairwise comparisons (χ^2)					
		C1 vs. C2	C1 vs. C3	C1 vs. C4	C2 vs. C3	C2 vs. C4	C3 vs. C4
PSQI	C1 = 4.94 (0.14)	72.50***	221.71***	145.61***	11.56***	69.18***	46.62***
	C2 = 7.24 (0.22)						
	C3 = 8.27 (0.18)						
	C4 = 12.95 (0.65)						
PSWQ	C1 = 38.78(0.57)	55.59***	262.13***	233.99***	34.18***	92.12***	34.08***
	C2 = 46.13 (0.76)						
	C3 = 52.11 (0.60)						
	C4 = 60.71 (1.32)						
Depression	C1 = 2.68 (0.18)	88.83***	591.49***	552.06***	122.95***	328.40***	133.95***
	C2 = 6.55 (0.35)						
	C3 = 12.43 (0.36)						
	C4 = 23.49 (0.87)						
Anxiety	C1 = 4.76 (0.25)	120.65***	490.81***	607.90***	78.57***	332.27***	161.42***
	C2 = 9.50 (0.34)						
	C3 = 14.05 (0.35)						
	C4 = 25.34 (0.80)						
Stress	C1 = 5.62 (0.25)	119.17***	600.58***	638.76***	124.30***	345.21***	129.14***
	C2 = 10.52 (0.35)						
	C3 = 16.43 (0.36)						
	C4 = 26.44 (0.78)						

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. C1, lower NPO, C2, moderate NPO; C3, *SI&NOE*; C4, dysfunctional NPO.
NPO, negative problem orientation; *SI&NOE*, self-inefficacy and negative outcome expectancy.

reflecting a significantly low extent of NPO compared to other individuals, followed incrementally by *moderate NPO*. Importantly, the *SI&NOE* adolescents had not yet viewed problem-solving as threatening; nevertheless, they had a relatively higher probability of endorsing self-inefficacy and negative outcome expectancy. This profile reflects a low level of perceived uncertainty about the future. However, such individuals feature a particular cognitive manifestation of more generalized negative thinking. Furthermore, adolescents with the *dysfunctional NPO* profile were characterized by the highest levels of the three domain-specific factors measured by the NPOQ. They tended to consider problems as threats, question their problem-solving abilities, and be pessimistic about the likely outcomes, reflecting a dysfunctional and/or inhibitive cognitive-emotional pattern in response to social problems.

Compared with the *lower NPO* and *moderate NPO* profiles, the *SI&NOE* and *dysfunctional NPO* profiles explored in this study have more prominent implications. *SI&NOE* individuals have a lower perceived threat to their wellbeing but demonstrate negative cognitive thinking that could also lead to worry and anxiety. This result is consistent with that of social problem-solving, in which worry is associated with one's confidence and outcome expectancy (D'Zurilla et al., 2004). The *dysfunctional NPO* profile included individuals with

an intense response to all three domain-specific factors and strong associations with the symptoms of anxiety and worry (Wilson et al., 2011). Adolescents with this profile are more likely to engage in anxiety and worry, have symptoms related to emotional disorders, and avoid or postpone making an effort to engage in social problem-solving (Becker-Weidman et al., 2010; Anderson et al., 2011). In addition, the *lower* and *moderate NPO* profiles represented relatively reduced NPO and the potential to facilitate proactive problem-solving.

This study also found significant predictive gender and age effects related to the NPO profiles. Boys were more frequently seen in the *SI&NOE* and *dysfunctional NPO* profiles than were girls. This gender difference agrees with prior research showing higher levels of NPO in boys, from which researchers argued that some of the variables could be triggering self-inefficacy and negative outcome expectancy (Barahmand, 2008). Thus, adolescent boys may manifest a more or less upward trend in terms of their negative beliefs about social problems and have more significant doubts regarding whether they can effectively cope. Furthermore, the students in the lower grades and younger adolescents tended to appear in the *moderate NPO* and *SI&NOE* profiles. It can be clearly understood that the reason for this result is due to the result of different psychological development rate of different adolescents. Adolescents may hold up to two polarized beliefs of the social problems they encounter. A part of adolescents tend to believe that problems are solvable, while others doubt their ability to solve problems effectively. In addition, result from their psychological and physiological development are not synchronized, whose transition from immature to mature can be hindered in the period of turbulent development (Hazen et al., 2008).

Cognitive vulnerabilities and psychological symptoms

This study also investigated the relationships among the latent NPO profiles and certain cognitive vulnerabilities and psychological symptoms. An examination of the differences in cognitive vulnerabilities among the profiles revealed that worry scores were significantly different for all four profiles. The subgroups of NPO manifesting various characteristics of worry can be explained by the cognitive model of worry. Dugas et al. (2005) argued that NPO can be conceptualized as a cognitive process for developing and maintaining worry. Specifically, the *SI&NOE* and *dysfunctional NPO* adolescents tended to have less confidence in their problem-solving abilities, with negative cognitive processes and emotions leading to the avoidance of real problems and engagement in worry, diminishing their social problem-solving abilities and thus leading to negative psychological symptoms. In the cognitive-behavioral therapies (CBT) framework, NPO is a dysfunctional attitude related to intermediate beliefs; from the perspective of problem-solving training (PST), the belief that one cannot solve social problems reflects NPO. Fergus et al. (2015) found that NPO could be a mechanism of change in CBT, in that NPO is viewed as a type of self-efficacy and CBT aims to increase individual self-efficacy. More broadly, according to the person-centered approach, this study further corroborates the cognitive process of NPO.

With regard to psychological symptoms among the latent profiles, we found that compared to participants in the *lower* and *moderate NPO* profiles, the *SI&NOE* and *dysfunctional NPO* adolescents evidenced significantly more severe stress, anxiety, and depressive symptoms and worse sleep quality. Adolescents with *dysfunctional NPO* group have stronger emotional dysregulation and are more prone to repetitive thinking about negative events, which can lead to a variety of psychological symptoms. These findings corroborate prior evidence supporting that NPO can serve as a risk predictor for the development of anxiety, stress, and symptoms of depression, and NPO is an antecedent of a negative affect (e.g., sadness, fear, hostility, and joviality) in adolescents (Ciarrochi et al., 2009; Becker-Weidman et al., 2010; Lee et al., 2018). Moreover, this study found that the *SI&NOE and dysfunctional NPO* adolescents reported worse sleep quality than did the other profiles, and tended to worry excessively about sleep problems. This is consistent with the cognitive model of insomnia, by which cognitive processes promote an individual's preoccupation with sleep problems (Harvey, 2002; Lin et al., 2017; Tousignant et al., 2019). When individuals perceive the possibility of a bad night's sleep, they tend to have negative thoughts about sleep problems that influence their individual sleep quality.

Implications and limitations

In summary, this study is a preliminary attempt to identify subpopulations of individuals characterized by different NPO profiles by using LPA. The heterogeneity of NPO in Chinese adolescents allowed for four NPO profiles to be distinguished according to three domain-specific factors. Adolescents in the *SI&NOE* and *dysfunctional NPO* profiles may suffer from dysfunctional and/or inhibitive cognitive-emotional expressions. The present study contributes to the NPO literature by revealing the important role of social problem orientation, based on health-related correlates (Jaffee and D'zurilla, 2009; Clarke et al., 2016; Suh and Lee, 2018). This study also has several important implications for those seeking to understand adolescents with dysfunctional NPO and other psychological symptoms. For researchers, attention should be focused on the three dimensions of adolescents with dysfunctional NPO to increase positive problem orientation (i.e., perceived challenge, self-efficacy, and positive outcome expectancy). For educators and mental health providers, more tailored interventions should be developed for adolescents in the *dysfunctional NPO* group. Such interventions might include training in problem-solving, cognitive-behavioral therapies, acceptance and commitment therapy, and other effective stress management and prevention methods.

The present study is not without limitations, which may serve as guidance for future research directions. Firstly, no complete set of social-demographic characteristics was tested. For this study, the 7th, 8th, 10th, and 11th grades were included, but the 9th and 12th grades were not considered. In China, students in these two grades are busy

preparing for the senior high school entrance examination and the national college entrance examination, respectively. Secondly, only a non-clinical sample of adolescents was considered in this study, which makes it difficult to determine whether the results can be generalized to other populations. Future research should select samples comprised of clinical adolescents. Moreover, a baseline measure to gauge mental health would have provided useful information. Future research should employ a longitudinal design to track the high NPO of the adolescents who participated in this study, further validating the NPO mechanism.

Data availability statement

The original contributions presented in the study is publicly available. This data can be found at: https://pan.baidu.com/s/1JIm_JizLYczcx47Ob9fDig (accession code: 2ejw).

Ethics statement

This study was approved by the Academic Committee of Fujian Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

R-ML conceived the original idea for the study. R-ML and X-XX wrote the manuscript. Y-LS and NL revised the manuscript. R-ML and Y-PC supervised this study. All authors contributed to the article and approved the submitted version.

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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Altruistic preferences of pre-service teachers: The mediating role of empathic concern and the moderating role of self-control

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Empathy and altruistic behavior are more crucial abilities for pre-service teachers to possess when compared with other study fields. The relationship between empathy and altruistic behavior in Chinese pre-service teachers and their underlying mechanisms, however, has received relatively little attention in the literature. Therefore, the goal of the current study was to examine the links between study fields (i.e., pre-service teachers whose study field is pedagogy and non-pre-service teachers whose study field is non-pedagogy), self-control, emotional empathy (i.e., empathic concern), and altruistic preferences among undergraduates and graduates in five Chinese universities (the age range of participants is 18–20 years; 58.4% women) with the Interpersonal Reactivity Index-C Questionnaire, the Self-Control Scale, and the Chinese Self-Report Altruism Scale tests. The results showed a significant difference between pre-service and non-pre-service teachers in empathic concern and self-control. Furthermore, empathic concern and altruistic behavior tendency of pre-service teachers were significantly higher than those of non-pre-service teachers. Moreover, mediation analyses indicated that empathic concern partially mediated the relationship between study fields and altruistic tendency. Moderated mediation analysis further revealed that self-control buffered the relation between empathic concern and altruistic behavior tendency. These results demonstrate that altruistic tendency of pre-service teachers is influenced by empathic concern and self-control.

KEYWORDS

pre-service teachers, non-pre-service teachers, altruistic tendency, self-control, empathic concern

Introduction

InChina, a saying goes, "it takes ten years to grow a tree, whereas a hundred years to cultivate a good man." Teachers play an essential role in students' growth and development. Teachers' altruistic behaviors will affect students, which has an impact on the future development of the country and society. In the current Chinese education system, the primary source of teachers is pre-service students with professional education knowledge in a normal university. In China, normal universities are universities that prioritize teacher education (Wang and Zhao, 2021). Pre-service teachers refer to undergraduate or graduate students whose study field is pedagogy and who undertake a teacher education curriculum to qualify for a degree in education (National Council for Accreditation for Accreditation of Teacher Education [NCATE], 2002). Some studies found that altruistic behavior among youth groups in contemporary society has been weakened (Tettegah and Anderson, 2007; Haddara and Lingard, 2017), which will undoubtedly bring a series of adverse effects on the construction of a harmonious society. Pre-service teachers are a part of the youth group who take the responsibility of educating students, so it is of paramount significance to evaluate the altruistic behavior of pre-service teachers.

Existing studies found that it is more conducive for teachers to become the promoters of students' learning if teachers can actively perceive students' emotions and feelings (Viadero, 2004) and even influence students' later careers and interpersonal communication (Myrick, 2003). Therefore, society has more positive expectations of teachers, requiring teachers to have more altruistic behaviors.

Altruistic behavior refers to a kind of behavior in which an individual would rather sacrifice his interests to meet the needs of others (Fehr and Fischbacher, 2003; Fehr and Rockenbach, 2004). According to previous research, motivations for altruistic behavior include negative emotions (Blair and Mitchell, 2009; Kimonis et al., 2019; Thielmann et al., 2020), a desire for fairness (Fehr et al., 2008; Engelmann and Tomasello, 2019), and moral emotions (de Oliveira-Souza et al., 2016). Altruistic behavior, however, is a decision behavior that demands rational analysis by the brain rather than just being a simple, intuitive behavior. According to neuroscientific studies, the anterior cingulate cortex and the anterior insula are activated when people see other people in pain. The degree of activation in these brain regions significantly correlates with a person's capacity for empathy. More importantly, the response of the anterior insula and anterior cingulate cortex can accurately predict individuals' later helping behavior (Hein et al., 2010). In addition, the arousal-cost-reward model proposed by Penner et al. (2005) suggests that when someone's distress induces the individual's empathy arousal, empathy arousal will lead to an individual's negative emotions, which motivates the individual to take some actions to alleviate these negative emotions. Altruistic behavior is one of the ways to achieve this goal. Thus, empathy, an individual's ability to perceive and understand others' emotions and respond appropriately (Decety and Svetlova, 2012; Decety et al., 2016), is an essential mediator between individuals and altruistic behaviors (Davis and Kraus, 1997).

Empathy includes both affective empathy and cognitive empathy (Gladstein, 1983). Cognitive empathy is a top-down ability that allows people to think about problems from the perspective of others, primarily including perspective taking, whereas affective empathy is a bottom-up ability that will enable people to perceive the emotions of others, principally including empathic concern (Decety and Meyer, 2008; Heyes, 2018).

Previous studies examined the prediction of affective empathy on altruism (Batson and Coke, 1981; Batson and Toi, 1982; Batson, 1997; Cialdini et al., 1997; Klimecki et al., 2016). Batson et al. (2007) proposed that empathic concern will arise when (a) another person's welfare is valued terminally, not as an instrumental means to self-benefit, and (b) that person is perceived to be in need. As teachers, when we desire to help students actively, the awakening of empathic concern will allow us to perceive students' emotions and feelings to better help students. Cialdini et al. (1997) also suggest that empathic concern for others results in selflessness and true altruism. Notably, empathic concern affects helping primarily as an emotional signal of oneness. Namely, teachers are also "students" who have experienced the learning difficulties their students are experiencing. Consequently, they can perceive more of themselves in the other (i.e., their students). In addition, studies on altruistic punishment found that, when subjects had both the choice of "helping the victim" and "punishing the perpetrator," there was a significant positive correlation between empathic concern and helping the victim (Leliveld et al., 2012; Hu et al., 2015). Studies on teachers' empathy found that teachers' ability to empathize is beneficial for addressing school bullying (Tettegah and Anderson, 2007) and is positively correlated with students' prosocial behavior in self-report (Raskauskas et al., 2010). Moreover, as students grow through life, they will not always take the initiative to tell teachers their current emotional feelings. Therefore, teachers must be able to perceive students' emotions and feelings accurately. Affective empathy plays a significant role in this process. Consequently, affective empathy is regarded as a necessary trait and competency for normal students relative to students in other study fields, contributing to students' overall development and teachers' professional growth (Peck et al., 2014).

Studies on self-control suggest that self-control also plays a vital role in altruistic behavior. Self-control is the ability of individuals to control their consciousness (including thoughts) and behaviors in a goal-oriented fashion (Bowers et al., 2011). As has been argued, negative emotions are part of

the motivation for altruistic behavior (Cialdini et al., 1981; Cialdini and Trost, 1998; Jordan et al., 2016b; Kimonis et al., 2019; Thielmann et al., 2020). When the individual as an observer finds that others are in distress, empathic arousal will induce the individual's negative emotions and lead to altruistic behavior (Cialdini et al., 1987; Nelissen and Zeelenberg, 2009). However, altruistic behavior requires individuals to sacrifice their interests (Jordan et al., 2016a). In this case, it is necessary to restrain selfishness through self-control to act in altruistic behaviors (Müller-Leinß et al., 2018). In addition, there is a need when it comes to self-control to modulate the relationship between negative emotions and altruistic behavior in this process of restraining selfishness through self-control to act in altruistic behaviors (Eisenberg et al., 1998; Grecucci et al., 2013). Therefore, self-control is another factor that mediates the relationship between negative emotions generated by empathy and altruistic behavior (Krueger and Hoffman, 2016; Bellucci et al., 2017). Other studies found moral emotions are also the motivation for altruistic behavior (de Oliveira-Souza et al., 2016). Moral emotions will surface when a person, acting as an observer, notices that others are being treated unfairly. At this moment, individuals need to adjust their moral emotions through self-control to decide whether to make altruistic behaviors or not. In lesion studies employing economic games as surrogates of moral emotions like guilt and envy, participants' decisions to punish or donate reflected moralistic punishment and generous response inclinations. Unquestionably, their decisions to punish or donate are regulated by self-control (Krajbich et al., 2009). That is to say, the moral emotions aroused by the violations of others will predict the following punishment behavior. If the individual does not want to be retaliated against by others or does not want to lose profits, in that case, it is paramount to control themself to not punish the violator. In addition, from the perspective of the viewer (or witness), the dorsomedial prefrontal cortex integrates representations of intent with the agent's actual behavior (completed harm vs. no harm at all) to come up with a final condemning or exculpating judgment (Young and Saxe, 2008). It is universally acknowledged that the dorsolateral prefrontal cortex is a crucial brain area for self-control (Miller and Cohen, 2001; Delgado et al., 2005; Knoch et al., 2006), which indicates that self-control modulates an individual's moral emotions to determine whether to act altruistically. As empathy is one of the moral emotions, self-control should also play a moderating role between empathic concern and altruistic behavior in theory.

Based on the literature review, we propose the following hypotheses: First, compared with non-pre-service teachers, pre-service teachers exemplify more altruistic tendencies and empathic concern; second, empathic concern mediates the relationship between study fields and altruistic tendency; and third, self-control mediates the relationship between empathic concern and altruistic tendency (**Figure 1**).

Materials and methods

Participants

A total of 841 undergraduate and graduate students whose study fields include pedagogy, psychology, literature, sociology, engineering, and science from five universities in China participated in this study. The 4-year undergraduate education system provides sufficient time for pre-service teachers to systematically learn professional theories and cultivate their practical technical ability (Hu et al., 2021). Therefore, these undergraduates whose study field is pedagogy and who are students that are willing to become teachers in future were grouped as pre-service teachers. Participation in the present study was entirely voluntary, and no compensation was given to the participants for their participation. To abide by local government policies, the study questionnaire was distributed to potential participants electronically *via* Wen Juan Xing. This platform provides functions equivalent to Amazon Mechanical Turk (Changsha Ranxing Science and Technology, Changsha, China), and no face-to-face contact was made. All participants consented to participation, and data were anonymized. People younger than 18 years or older than 26 years who did not completely fill out the demographic section or whose answers were all the same were exempted from the analyses. To ensure the validity of the data, we also eliminated the scores of each questionnaire according to three standard deviations. Of the remaining 741 participants, 58.4% were women (M_{age} = 21.44, *SD* = 2.06, range = 18–26). Descriptive statistics of specific demographic variables are given in **Table 1**.

Questionnaire

Interpersonal reactivity index-C questionnaire

The Interpersonal Reactivity Index-C (IRI-C) Questionnaire, which was revised by Zhang et al. (2010) based on IRI (Davis, 1980), was used to measure the empathic ability of Chinese participants. The revised questionnaire consisted of 22 questions divided into four subscales: perspective taking (PT, the tendency to adopt the point of view of other people), empathic concern (EC, the tendency to experience feelings of warmth, compassion, and concern for other people), personal distress (PD, one's own feelings of personal unease and discomfort in reaction to the emotions of others), and fantasy (FS, an exciting and unusual experience or situation you imagine happening, but which will probably never happen). Individuals rated each item on a five-point Likert scale, with 0 indicating "very inappropriate" and 4 indicating "very appropriate," with higher scores indicating higher empathy. Cronbach's alpha of IRI-C was 0.80.

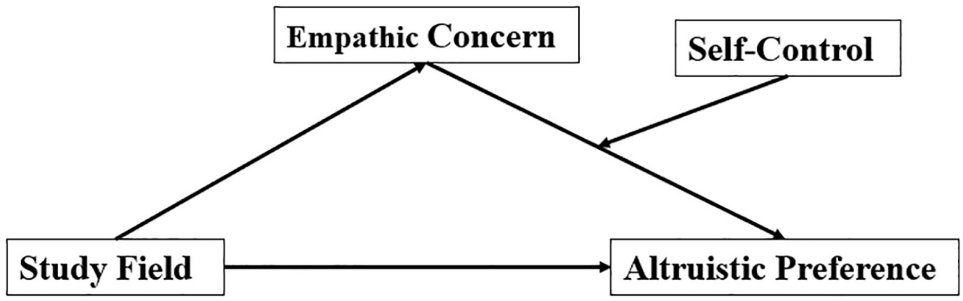

FIGURE 1
The proposed theoretical model.

Self-control scale

The present study adopted SCS to measure the self-control ability of Chinese participants, which is based on Tangney et al. (2004) Self-Control Scale. Nineteen items were preserved in view of cultural differences and reliability (Tan and Guo, 2008). The scale still was divided into five subscales: controlling impulses (six items, such as "I am too prone to lose my temper"), keeping healthy habits (three items, such as "I am lazy"), resisting temptation (four items, such as "I can resist the temptation"), focusing on work (three items, such as "I can't concentrate"), and controlling entertainment (three items, such as "I do something that will give me pleasure but do harm to myself"). All items were measured on a five-point Likert scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree," with higher scores indicating greater self-control. Cronbach's alpha of SCS was 0.87.

Chinese self-report altruism scale

The Chinese Self-Report Altruism Scale (Li, 2008), which researchers in mainland China frequently use, was adopted in the current study to accurately describe the altruistic behavior of young people in mainland China. There were 22 questions in the Chinese Self-Report Altruism Scale, broken up into five subscales: Responsible Altruistic Behavior, Respect and Care for Others, Care and Focus on Yourself, Altruistic Behavior Performance and Fantasy, and Egoistic Behaviors and Perceptions. Higher scores indicated greater altruism. Participants rated each item on a seven-point Likert scale, with 1 denoting "very inappropriate" and 7 denoting "very appropriate." Cronbach's alpha of the Chinese Self-Report Altruism Scale was 0.87.

TABLE 1 Descriptive statistics of specific demographic variables.

Variable	Options	Frequency	Percentage
Gender	Men	308	41.6%
	Women	433	58.4%
Grade	Freshman	134	18.1%
	Sophomore	133	17.9%
	Junior	120	16.2%
	Senior	91	12.3%
	1 Master	181	24.4%
	2 Master	50	6.7%
	3 Master	32	4.3%
Study fields	Pedagogy	309	41.7%
	Non-pedagogy	432	58.3%

Common method biases test

The current study's data were gathered using Interpersonal Response Index Inventory (IRI-C), the Self-Control Scale, and the Chinese Self-Report Altruism Scale (Li, 2008). As a result, there might be widespread method biases at play here. To achieve this, the questionnaire design and the response procedure must be strictly controlled, and the data must also undergo a single-factor test for statistical analysis. Specifically, the results of the unrotated principal component analysis were examined by conducting exploratory factor analysis on all items, and a serious common method bias was determined if only one factor or a common factor had particularly high explanatory power (Eby and Dobbins, 1997; Livingstone et al., 1997; Podsakoff et al., 2003); if multiple factors with eigenvalues greater than 1 are obtained and the amount of variation explained by the first factor does not exceed 40%, then the common method bias is not severe (Ashford and Tsui, 1991). According to the test results, there are 15 factors with eigenvalues greater than 1 in unrotated principal component analysis, and the first factor accounts for 18.48% of the variance. Therefore, the current study's common method bias issue is not major.

Data analysis

The objectives of this research were to see whether empathic concern played a mediating role between study field and altruistic tendency in undergraduate and graduate students and, if so, whether self-control played a moderating role in the latter path between empathic concern and altruistic tendency. These research questions were tested in three steps. First, the

descriptive statistics and bivariate Pearson's correlations were calculated. Second, the mediating effect of empathic concern was examined by using PROCESS macro for SPSS (Model 4) (Hayes, 2017). Third, the analyses of the moderating effect of self-control on the latter links between empathy and altruistic tendency were constructed by applying the PROCESS macro (Model 14). All study continuous variables were standardized, and the models utilized 5,000 resamples through bootstrapping confidence intervals (CIs) to determine whether the effects in PROCESS Model 4 and Model 14 were significant (Hayes, 2017).

Results

Correlation between study field, altruistic tendency, empathic concern, and self-control

The Pearson correlations are presented in **Table 2**. The study field was positively correlated with altruistic tendency and empathic concern. Altruistic tendency was positively associated with empathic concern and self-control. Empathic concern was also positively correlated with altruistic tendency.

Analysis of empathic concern as a mediator

To test the mediating effect of empathic concern, we used Model 4 of the SPSS macro PROCESS complied by Hayes (2017). The regression results for testing mediation are reported in **Table 3**. After controlling for gender and age, the results indicated that study field was positively related to empathic concern ($b = 0.16$, $p < 0.05$); in addition, study field and empathic concern were positively associated with altruistic tendency ($b = 0.14$, $p < 0.05$; $b = 0.61$, $p < 0.001$). As the direct predictive effect of the study field on altruistic behavioral tendency was significant ($b = 0.24$, $p < 0.01$), empathic concern partially mediated the association between study field and altruistic tendency. The bias-corrected percentile bootstrap analyses further showed that the mediation effect accounted for 42% of the total effect of the study field on altruistic tendency; the mediating effect was 0.10, with a 95% CI of [0.0148, 0.1894].

TABLE 2 Pearson's correlation coefficient.

Variables	1	2	3	4
1. Study field	—			
2. Altruistic tendency	0.14**	—		
3. Empathic concern	0.12**	0.62**	—	
4. Self-control	0.03	0.32**	0.17**	—

Study field was dummy coded as 0 = non-pedagogy; 1 = pedagogy.
**$p < 0.01$.

Analysis of self-control as a moderator

To examine whether the latter indirect relationships between study field and altruistic tendency *via* empathic concern would be moderated by self-control, we used Model 14 of PROCESS macro developed by Hayes (2017). The regression results for testing the moderator are reported in **Table 4**. The results showed that self-control positively interacted with empathic concern in predicting altruistic tendency. The interaction effect is visually plotted in **Figure 2**. Simple slope tests revealed that empathic concern had a significant positive effect on altruistic tendency in high- and low-level self-control. The effect of empathic concern on altruistic tendency was weaker for college students with high levels of self-control ($b_{simple} = 0.50$, $t = 12.53$, $p < 0.001$) than for those with low levels of self-control ($b_{simple} = 0.62$, $t = 18.34$, $p < 0.001$), and the mediating effects of self-control at different levels are reported in **Table 5**.

Discussion

The current study aimed to investigate the relationship between study field and altruistic tendency. In addition, it is of paramount importance to check whether empathic concern mediates the relationship between study fields and altruistic tendency and whether self-control moderates the relationship between empathic concern and altruistic tendency. The results revealed that study fields were negatively correlated with empathic concern and altruistic tendency, while empathic concern was positively correlated with altruistic tendency. Pre-service teachers show more altruistic tendencies and empathic concern than non-pre-service teachers. More importantly, empathic concern mediates between study fields and altruistic tendencies. Moreover, we found that self-control moderates empathic concern and altruistic tendency.

In terms of study field differences in altruistic tendency, pre-service teachers have a higher altruistic tendency than non-pre-service teachers, which is consistent with previous studies (Bostic, 2014). First, some studies found that teachers have a high sense of professional identity (Zhang et al., 2016; Wang et al., 2017; Weinberg et al., 2021). According to social identity theory, professionals will identify with both their occupation and their organization at the same time (Dutton et al., 1994; Tajfel and Turner, 2004), and further studies found that employees' professional identity can promote the generation of their organizational identity (Meixner and Bline, 1989). The term "organizational identity" refers to an individual's perceptual cognition and emotional sense of belonging to the organization to which they belong. This psychological foundation underscores their preference for altruistic behaviors, such as upholding the organization and assisting its members (Ashforth et al., 2008). Gaziel (1995) found that teachers'

TABLE 3 Analysis of empathic concern as a mediator.

Regression equation		Fit index			Regression coefficient		
Dependent variable	**Independent variable**	***R***	***R^2***	***F***	***B***	***SE***	***t***
Empathic concern	Study field	0.24	0.06	15.35	0.16	2.19	7.43*
Altruistic tendency	Study field	0.62	0.39	116.83	0.14	0.06	−2.28*
	Empathic concern				0.61	0.03	20.41***

*$p < 0.05$ and ***$p < 0.001$.

TABLE 4 Analysis of self-control as a moderator.

Regression equation		Fit index			Regression coefficient	
Dependent variable	**Independent variable**	***R***	***R^2***	***F(df)***	***B***	***t***
Altruistic tendency		0.66	0.44	96.07***		
	Empathic concern				0.56	19.02***
	Self-control				0.22	7.82***
	EC × SC				−0.06	−2.61**

EC is empathic concern and SC is self-control.
**$p < 0.01$ and ***$p < 0.001$.

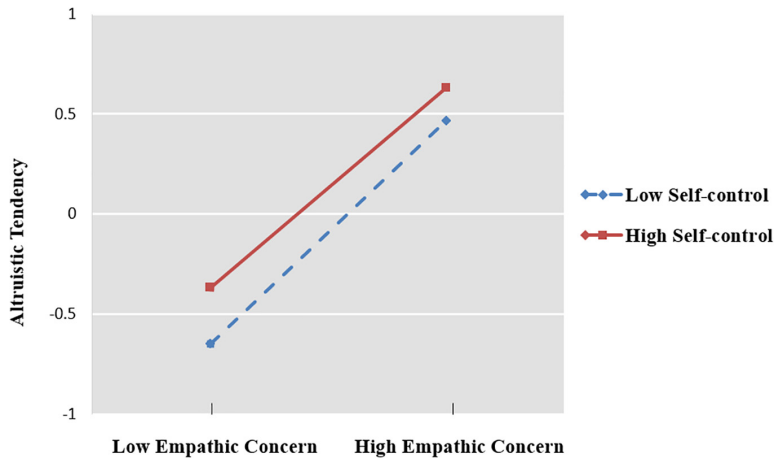

FIGURE 2
Interaction graphs.

TABLE 5 Mediating effects of self-control at different levels.

	Self-control	Effect	Boot SE	Boot LLCI	Boot ULCI
Level of self-control	47.79 (*M*-1*SD*)	0.62	0.034	0.55	0.68
	58.03 (*M*)	0.56	0.030	0.50	0.61
	68.27 (*M* + 1*SD*)	0.50	0.040	0.42	0.58

professional identity was significantly negatively associated with their willingness to leave the workplace and their jobs. So teachers' professional identity will affect their organizational identity. In addition, individuals' organizational identity is positively related to good interpersonal relationships between individuals and their colleagues (Morgan, 1986). Because of the good internal relationship among pre-service teachers, they are more willing to regard their classmates or colleagues as in-group individuals. According to the in-group favoritism theory (Tajfel et al., 1971; Vermue et al., 2019), people are more likely to assist those who share their identity. Hence, pre-service teachers have a more significant concern for empathy than non-teachers. Second, social desirability refers to the internal psychological tendency of individuals to try their best to make

their behaviors and ideas meet the needs of society and the masses, expect to be recognized by society, and maintain their self-image (Perinelli and Gremigni, 2016). From ancient times, Chinese society has expected teachers to be proactive and to go out of their way to help students. According to the social desirability theory, excellent interpersonal desirability will promote individuals' careers to shape the corresponding self-belief and self-requirement (Carlo et al., 1991; Braun et al., 2001; Lalwani et al., 2006; Wanat et al., 2020; Lanz et al., 2022). Consequently, the expectation of Chinese society that teachers should actively assist students will motivate teachers to meet and maintain this social expectation throughout their academic and professional careers (Xuan, 2006; Li, 2017).

In terms of study field differences in empathic concern, pre-service teachers have higher empathic concern than non-pre-service teachers. Certain emotions always accompany students' learning. Teachers with high empathic concern can timely pay attention to students, empathize with students' emotional changes, and adjust their teaching methods simultaneously (McAllister and Irvine, 2002). Coffman (1981) found that teachers with a high empathic concern could communicate with their students in a way that made them feel understood and that their emotions were felt. Students were inspired to change their attitudes toward learning, encouraging them to take the initiative to learn and facilitating their academic success. When teachers pay good emotional and empathic attention to their students during the teaching process, it enables students to develop in the long run. This is another way that teachers' empathy can enable the students to socialize (Peart and Campbell, 1999). Moreover, to meet pre-service teacher's own developmental needs, empathic skills are also trained in their daily courses that include experiential training (Kolb et al., 2001), skills training (Redman, 1977), video training (Barone et al., 2005; Liu, 2012; Shin, 2017; Innamorati et al., 2019; Liu and Ren, 2019), and practice mindfulness (Kabat-Zinn, 1990). Pre-service teachers are trained in these daily courses during their academic career, so their empathic attention skills are high compared with other study fields.

Regarding the mediating role of empathic concern, the results showed that empathic concern mediated the relation between study field and altruistic tendency. Previous studies have looked into the effect that affective empathy has on altruism by making predictions about it (Batson and Coke, 1981; Batson and Toi, 1982; Batson, 1997; Cialdini et al., 1997; Lahvis, 2017; Crockett and Lockwood, 2018; Canevello et al., 2021; Miyazono and Inarimori, 2021). In the group of pre-service teachers, empathic concern is a desirable trait for their professional development. They can be trained in empathy through courses and by watching empathy videos (Liu, 2012; Shin, 2017; Innamorati et al., 2019; Liu and Ren, 2019). Eventually, they are easily motivated to perceive others' emotions and feelings, which makes them more willing to help others and thus demonstrates a stronger altruistic tendency than students of other study fields. Cialdini et al. (1997) ever suggested empathic concern for another result in selflessness and true altruism. Batson et al. (2007) also proposed that empathic concern arises when (a) another person's welfare is valued terminally, not as an instrumental means to self-benefit and (b) that person is perceived to be in need. Accordingly, the emergence of empathic concern will enable teachers to perceive students' emotions and feelings to assist students more effectively when they want to help them actively. Compared with pre-service teachers, non-pre-service teachers are not professionally trained in empathy, and empathy is not a necessary trait and ability for them. Consequently, their empathic attention ability is relatively low, and it is not easy for them to empathize with others' unfortunate circumstances, so their altruistic tendency is low. Previous studies showed that empathy is a crucial mediating variable between individual's negative emotions and altruistic behavior (Davis and Kraus, 1997). Individuals with high empathic concern are more likely to feel the negative emotions of others and thus are more inclined to help others (Cialdini et al., 1981; Cialdini et al., 1987; Cialdini and Trost, 1998; de Waal, 2008; Hu et al., 2015; Decety et al., 2016). Therefore, pre-service teachers not only have higher altruistic tendencies but also understand and enter into others' feelings through empathic concern, thereby enhancing their altruistic tendency.

Regarding the moderating role of self-control for empathic concern, the results demonstrate that, for individuals with high empathic concern, the lower the self-control, the greater the altruistic tendency, whereas for individuals with low empathic concern, the higher the self-control, the greater the altruistic tendency. According to previous studies, the factors influencing altruistic behavior include negative emotions (Cialdini et al., 1981; Cialdini et al., 1987; Cialdini and Trost, 1998; Darley and Pittman, 2003; Blair and Mitchell, 2009; Kimonis et al., 2019; Thielmann et al., 2020) and selfishness (McAuliffe et al., 2015; Yang et al., 2018). In the process of altruistic decision making, individuals face a cognitive conflict. That is, the negative emotions that individuals generate when they observe others in unfavorable situations will drive them to make altruistic behaviors, but altruistic behavior requires sacrificing their interests simultaneously. Therefore, individuals need self-control to resolve the conflict between self-interested motives and emotional impulses (McAuliffe et al., 2015; Yang et al., 2018). According to previous studies, negative emotions and motivations to help others aroused by empathy will surpass selfish motivation, so individuals with higher empathy are more inclined to help others (de Waal, 2008; Hu et al., 2015). Therefore, for individuals with a high empathic concern, the lower their self-control ability, the less they are capable of repressing the negative emotions they experience when witnessing the suffering of others and the greater their willingness to engage in altruistic behavior. However, individuals with strong self-control can control their negative

emotions and consider their interests rationally when deciding whether or not to engage in altruistic behavior. In contrast, for individuals with low empathic concern, others' misfortune does not evoke strong negative emotions, and whether or not to help others at that time is primarily influenced by selfish motivations; that is, individuals with low self-control ability are unable to control their selfish motivations, so they are hesitant to engage in altruistic behavior. Individuals with high self-control can control their selfishness, make rational cognitive decisions, and engage in more altruistic behavior. Other studies suggested that moral emotions are also predictors of individual altruistic behaviors (de Oliveira-Souza et al., 2016). Moral emotions motivate individuals to behave altruistically when they notice others being treated unfairly. Nevertheless, whether they will help the victim next is modulated by self-control (Young and Saxe, 2008; Krajbich et al., 2009). If the individual does not want to be retaliated against by the offender or does not want to lose his interest, then he needs to control himself and not punish the offender.

It is essential to be aware of some restrictions on this study. First, in conjunction with previous research, perspective taking, personal distress, and fantasy are also predictors of altruistic behavior (Oswald, 1996; Tusche et al., 2016; Pan et al., 2022). However, in the present study, we did not find a significant role for perspective taking, personal distress, and fantasy in the altruistic behavior of the pre-service teachers. Therefore, it is well worth further exploring the role of perspective taking, personal distress, and fantasy in different groups of study fields in future. Second, in the training courses for normal students in a normal Chinese university, pre-service teachers will be taught how to accurately perceive students' emotions and feelings to take appropriate measures to help students overcome difficulties. Notwithstanding, this can easily lead to a question: Does learning a particular study field affect empathic concern? The present study did not provide a satisfying response to this question, but future research might examine changes in teachers' empathic concerns. Third, the cross-sectional design of this study failed to confirm causal relationships between study fields, altruistic tendency, and empathic concern. Therefore, future longitudinal research is required to establish the causal relationship. Fourth, the current study collected data through questionnaires, which may have reduced the results' reliability. Accordingly, future research could recruit students from different study fields to explore the relationship between study fields, empathic attention, and altruistic behavior through altruistic punishment games. Finally, the sample was limited to college students from a university in the Midwest. Therefore, it is conceivable that the sample does not adequately represent the majority of pre-service teachers in China.

Meanwhile, it should be noted that the current study allows us to discover the relationship and mechanism between empathic concern and altruistic preference in this particular sample. Hopefully, it can also provide some guidance for the future curriculum setting of teacher education.

Data availability statement

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

Ethics statement

This study was carried out in accordance with the recommendations of the Ethics Committee of the Institute of Brain and Psychological Sciences, Sichuan Normal University. The protocol was reviewed and approved by the Ethics Committee of the Institute of Brain and Psychological Sciences, Sichuan Normal University (approval no. SCNU-210602). Written informed consent was obtained from all participants for their participation in this study.

Author contributions

ML was responsible for the current study's design, data collection, interpretation of data for the work, manuscript writing, and revising. WL contributed to the data collection and data analysis. QY and LH contributed to the revision of the manuscript. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

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Preference for ugly faces? —A cognitive study of attentional and memorial biases toward facial information among young females with facial dissatisfaction

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Dissatisfaction with facial appearance is one of the strongest contributors to body image disturbance among young Chinese females and leads to a series of psychological and behavioral disorders. By conducting behavioral and ERP experiments, this study illustrates how young females in China with facial dissatisfaction process different levels of facial attractiveness. Experiments 1 and 2 are behavioral experiments in which the dot-probe paradigm was used to explore the participant's attentional bias to facial attractiveness. The results showed that regardless of whether the face image was presented above or below the threshold, young females with facial dissatisfaction exhibited attentional orientation toward lowly attractive faces and attentional avoidance to both lowly and highly attractive faces, while the control group showed difficulty in attentional disengagement from highly attractive faces. In experiment 3, the learning-recognition task was used to examine mnemonic bias toward facial attractiveness among females with facial dissatisfaction, and EEG data were also recorded during the encoding and retrieval phases. The study found that young females with facial dissatisfaction exhibited a mnemonic preference for lowly attractive images at both the encoding and retrieving stages, with higher P1, N170, P2, and N300 induced by lowly attractive faces, while the control group preferred highly attractive faces. In conclusion, young females with facial dissatisfaction tend to exhibit attentional orientation and mnemonic bias toward lowly attractive faces.

KEYWORDS

young females, facial dissatisfaction, cognitive bias, behavioral experiments & ERP experiments, facial attractiveness

Introduction

Individuals with facial attractiveness have more advantages in job hunting, mate selection, and interpersonal communication. Facial dissatisfaction, compared with other image dimensions, can more easily develop into body image disorder, which is defined as negative cognition, negative emotional experience, and corresponding behavior regulation

related to one's own appearance (Jackson and Chen, 2008a). In other words, facial dissatisfaction can be considered the epitome of body image disturbance to some extent. A large number of studies have found that individuals with body image disturbance have a cognitive bias toward body-related information (Mitchison and Mond, 2015; Aktar et al., 2019), suggesting that individuals with body image disturbance will selectively pay attention to (Maner et al., 2006; Shafran et al., 2008; Nijs et al., 2010; Veenstra and de Jong, 2012; Folkvord et al., 2015; Cass et al., 2020), evaluate (Levine and Piran, 2004; Chen and Jackson, 2005; Chen et al., 2006; Jackson and Chen, 2008a; Glashouwer et al., 2016), and remember negative information consistent with negative body images, such as obesity information (Williamson et al., 2000; Smeets et al., 2011; Brockmeyer et al., 2018; von Spreckelsen et al., 2018). Additionally, they resist positive information that is inconsistent with negative body images such as slim figures (Rieger et al., 1998; Dobson and Dozois, 2004; Smeets et al., 2008). Research of this type mostly focuses on the problem of body image disturbance from the perspectives of body and weight, while research on the dimension of facial appearance is rather rare. Compared with young American females, who pay more attention to body shape, Asian females, especially Chinese young females, believe that beautiful faces are more important (Chen and Jackson, 2005; Chen et al., 2006; Hua, 2009; Luo, 2013). Highly attractive (HA) pictures are considered to be more advantageous for health (Shackelford and Larsen, 1999; Henderson and Anglin, 2003; Little et al., 2011), spouse selection (McNulty et al., 2008; Ma-Kellams et al., 2017; Arnocky, 2018), career trajectory (Halford and Hsu, 2020), and decision-making (Kowner, 1996; Chen et al., 2012; Atari et al., 2017; Kramer et al., 2020). Chen and colleagues' research on physical dissatisfaction among Chinese adolescents found that facial appearance is one of the main sources of negative body images among Chinese female adolescents, and dissatisfaction with facial appearance is one of the most important predictors of negative physical self-image among young females. A negative physical self-image can predict eating disorders (Chen and Jackson, 2005, 2006; Chen et al., 2007; Jackson and Chen, 2008a), and is highly related to a series of psychological and behavioral disorders, such as anxiety, depression, blind dieting, and plastic surgery, as well as diseases, including diet disorders and anorexia nervosa (Chen and Jackson, 2006; Verplanken and Velsvik, 2008; Jackson and Chen, 2008b; Pawijit et al., 2019). Therefore, studying the cognitive processing features of facial information in young females with facial dissatisfaction is the basis for understanding, preventing, and correcting their potential psychological and behavioral problems.

Most cognitive neuroscience and clinical psychology studies have found that threatening stimuli tend to capture individuals' visual attention (Massar et al., 2011; Cho and Lee, 2013; Richards et al., 2014; Gupta et al., 2019). In recent years, many studies have found that individuals have attentional biases toward different types of threat stimuli after classification (Rinck and Becker, 2006; Shafran et al., 2008; Vrijsen et al., 2009). For example, Shafran et al. (2008) employed the traditional dot-probe paradigm to study the attentional bias of patients with eating disorders toward food, bodies, and other stimuli. Patients with eating disorders responded faster to the probe when it was in the same location as the negative body-shape stimuli (consistent condition) than when it appeared in the opposite location (inconsistent condition), indicating attentional vigilance to the negative body-shape stimuli. Related studies have revealed components of attentional bias by comparing the differences in response time, which functioned as the reflection of attention vigilance and attentional avoidance, between the two distinctive conditions (Wade and Lowes, 2002; Koster et al., 2005; Dong et al., 2017). During the latter part of the experiment, the researchers modified the dot-probe experimental paradigm, adding neutral stimulus pairs (neutral conditions), and distinguished facilitation and difficulty in attentional disengagement by comparing the difference in response time between inconsistent conditions and neutral conditions. For instance, a study on the attentional bias of patients with anxiety found that participants with anxiety had difficulty in attentional disengagement when confronted with threatening information (Koster et al., 2004; Rinck and Becker, 2006; Smeets et al., 2008). Based on this paradigm, researchers controlled the stimulus presentation time at approximately 20 ms and accompanied by front−/back-masking, which can examine the features of attentional processing below the threshold of consciousness. For example, Mogg and his colleagues employed the visual dot-probe with masking to examine the subliminal attention processing of negative faces in highly anxious participants and found that highly anxious participants showed attentional vigilance for threat faces relative to neutral faces, while lowly anxious participants showed attentional vigilance for happy faces relative to neutral faces (Mogg and Bradley, 1999; Mogg et al., 2005). Tobacco-deprived smokers had attentional vigilance to subliminal tobacco-related stimuli (Leventhal, 2010; Leventhal et al., 2010). Therefore, studies have compared the specific components of attentional bias to explain the cognitive processing mechanism of special information by illustrating the source and performance of this bias. However, a large number of study results proved that attention bias is not consistent, thereby indicating the need for further clarification. In addition, the cognitive bias of individuals with body image disturbance toward body information is also manifested in the selective memory for negative body information in the retrieving stage. For example, patients with eating disorders and obesity were able to recall more food and weight-related information in a study comparing their difference in the amount of recall of food and weight-related information (Ogden et al., 2017). Researchers used the word classification judgment-retrieving task to investigate the memory features of body words in Chinese and American young females with fat group and found that compared with females in the control group, the fat group forged fat as a more negative impression on fat-body words and was better in remembering these words (Chen and Jackson, 2005). Some researchers have also examined the attentional bias of face dissatisfied women to face-related stimuli based on the dot-probe paradigm combined with eye tracking technology (Kou et al., 2016). It revealed that women

with facial dissatisfaction had attentional orientation and maintenance, at least initially, toward unattractive faces but showed overall attention maintenance to attractive ones. Using facial words as experimental materials, researchers found that women who were not satisfied with their facial attractiveness showed initially attentional orientation and maintenance to negative faced-related words, and also showed a speeded attention orientation to positive face-related words (Kou et al., 2015). However, few studies have combined attentional and memorial processes to explore the processing mechanism of different types of face-related stimuli among individuals with body dissatisfaction. Considering the limited research of this type and the information processing mechanism remaining unclear, refinement and perfection are urgently needed.

Some studies have focused on the neural basis of cognitive processing of negative body images, merely focusing on brain imaging research of food information for individuals with eating disorders. For instance, a study on word processing among patients with anorexia nervosa by using food and body words as experimental materials found that when the word 'Thin' appears, the medial frontal cortex, insular lobe, temporal lobe, occipital area, and frontal lobe of patients with anorexia nervosa are rather active; when the word 'Fat' appears, the left prefrontal cortex, middle frontal gyrus and superior parietal lobule of normal participants are significantly activated (Redgrave et al., 2008). After being exposed to more detailed negative body features, it was found that the left amygdala and parahippocampal gyrus were more activated (Jastreboff et al., 2013; Carnell et al., 2014). Researchers believe that activation of the amygdala is related to the fear caused by negative body words and the detection of threat information in the environment (Uher et al., 2004; Yokum et al., 2011; Spangler and Allen, 2012; Sweet et al., 2012; Frank et al., 2013; Jastreboff et al., 2013; Carnell et al., 2014; Sweitzer et al., 2018). The left prefrontal cortex is related to emotion processing, involving attention, evaluation, judgment, and adjustments of emotional stimuli. Event-related potential (ERP) research in this area is mostly used on clinical participants, involving changes or impairment of cognitive function and investigating changes in P300 (Otagaki et al., 1997; Dodin and Nandrino, 2003; Hachl et al., 2003). However, for nonclinical participants, P300 is not sensitive enough. A difference in both N2 and P2 instead of P300 was detected in the research conducted by Yi et al. (2008). They found that, compared with normal pictures, fat body pictures induced greater N2 and P2 in the group with weight dissatisfaction. The researchers believe that P2 and N2 reflect the spatial attentional bias at the early stage and function as the primary processing of visual stimuli. It shows that in the early stage of attention processing, negative body image will affect the allocation of attentional resources, resulting in attention processing bias toward negative body-related information. Compared with clinical participants, nonclinical participants may exhibit an earlier attentional bias toward negative body-related information.

During face processing, attractive faces can capture attention and make it difficult to disengage (Maner et al., 2007; Sui and Liu, 2009; Ma et al., 2019). Studies have shown that when faces are presented, participants will quickly direct their attention to the attractive face area instead of the unattractive one, indicating a faster attention orientation towards the attractive face area (Leder et al., 2010, 2016; Mitrovic et al., 2016). A large number of ERP studies have found that faces can induce early ERP components even in the early processing stage, such as P1, N1, and N170, and these early components are relatively stable for face processing (Ackles and Cook, 1998; Hillyard et al., 1998). P1 is commonly considered to be related to the processing of low-level physical attributes or the classification of stimuli. It is believed that P1 may reflect the early stage of face processing and perhaps the comprehensive representation and encoding of simple facial attributes, which was consistent with the idea of Itier and Taylor (2002, 2004). N170, a specific component of face processing, is mainly distributed in the temporal-occipital area of the brain (Bentin et al., 1996). It usually has the largest amplitude at electrodes such as P8 (T6) or PO8 or O2 and often has a right-hemisphere dominance, which represents the processing of face structure and the processing of the spatial relationship of face parts or expression (Rossignol et al., 2012, 2013; Tanaka, 2018). Mariz et al. found that HA faces induce stronger N170 on the occipital and temporal electrodes than lowly attractive (LA) and unattractive faces (Marzi and Viggiano, 2010). In conclusion, researchers have found features of dynamic changes in early and late ERP components induced by attractive faces. Whether young females with facial dissatisfaction process different-level facial attractiveness with bias and whether there are any differences in the preference for HA faces between young females with facial dissatisfaction and those without facial dissatisfaction are issues that need to be further explored.

This study adopts a modified dot-probe paradigm and a learning-recognition paradigm to explore the features of attention and memory processing of faces among young females with facial dissatisfaction by subliminally and supraliminally presenting HA, mediumly attractive (MA), and LA face pictures. We assume that females with facial dissatisfaction have a bias in attention and memory processing toward LA pictures. The LA faces evoke larger amplitudes of ERP components, which are not proven in the control group.

Materials and methods

Measurement and experimental materials

Measurement

The Facial Negative Physical Self Scale (NPSS-F) was used to categorize participants. The NPSS-F contains 11 items, and each item is rated on a 5-point Likert scale from *1 = not at all like me* to *5 = very much like me*. Individuals with an average score of 2.5 or more are defined as the facial dissatisfaction (FN) group (hereafter

referred to as the FN group), and individuals with an average score of less than 1 are defined as the control group (Chen et al., 2006). The Cronbach alpha coefficient was 0.88 in this study.

Experimental materials

Female face images with neutral emotional expressions were collected from the open access database of Google that was processed uniformly by Photoshop and evaluated with unified standards. We collected 828 pictures of Chinese female faces (approximately 20–30 years of age) on the internet and used Photoshop to process the face pictures uniformly, balancing the differences in the physical attributes of each level of the pictures and removing the external features of the face such as hair, ears, and neck. All face pictures are grayscale with a size of 15 × 15 cm and pixels of 425 × 425. There are no familiar characters, such as the faces of celebrities. Then, the attractiveness, arousal, pleasantness, dominance, and emotional valence of the face pictures were evaluated. First, 10 female students were asked to initially classify the pictures into HA pictures, MA pictures, and LA pictures (just for now). A total of 628 pictures with the highest assessing consistency were selected for the next stage. Eighty female college students were asked to assess the facial attractiveness, emotional valence, arousal, pleasantness, and dominance of these faces. Then, 160 HA pictures, 160 MA pictures, and 160 LA faces were selected with neutral facial expressions, moderate dominance, and arousal. One-way ANOVA showed that there were significant differences in the attractiveness and pleasure scores between the HA ($M = 7.77$, SD = 0.79), MA ($M = 4.54$, SD = 0.73), and LA pictures ($M = 1.99$, SD = 0.80), $F(2, 477) = 1125.12$, $p < 0.001$; $F(2, 477) = 859.89$, $p < 0.001$. The differences in arousal and dominance between the three types of faces were not significant ($p = 0.400$; $p = 0.347$).

Participants

Female undergraduates at a Chinese university were recruited to complete the NPSS-F and telephone interviews. Females with an average score of at least 2.5 on the NPSS-F were assigned to the FN group, and females with an average score of 1.0 or below on the NPSS-F were assigned to the control group. The exclusion criteria were as follows: chronic illness, mental illness, smoking and alcohol abuse in the last 2 years, and being normal visual acuity or corrected visual acuity right-handed.

In experiments 1 and 2, 80 participants were included in the FN group, with an average age of 18.32 ± 0.56 years old, and another 80 participants were included in the control group, with an average age of 19.17 ± 1.11 years old. The age difference between the two groups was not significant ($p = 0.867$), but the difference in the NPSS-F scores was significant ($F(1, 158) = 18.342$, $p < 0.001$). Participants in both groups were right-handed and were compensated after the experiment.

In experiment 3, 30 participants were included in the FN group, with an average age of 20.12 ± 0.44 years old, and another 30 participants were included in the control group, with an average age of 19.09 ± 1.21 years old. The age difference between the two groups was not significant ($p = 0.657$), but the difference in the NPSS-F scores was significant ($F(1, 58) = 28.35$, $p < 0.001$). There was no history of brain injury or mental disorders in the two groups. After the experiment, the participants were awarded corresponding guerdon (see Table 1).

Procedure

The research contains 3 experimental tasks. Experiments 1 and 2 used a modified dot-probe paradigm by presenting face stimuli subliminally and supraliminally to examine the attentional biases towards faces in young females with facial dissatisfaction. At the beginning of each trial in experiment 1, a white fixation point (+) was presented in the center of the black screen for 800–1,000 ms, followed by a blank screen for 100 ms, and then paired images (HA-neutral pictures, LA-neutral pictures, neutral-neutral pictures; hereinafter referred to as H-N, L-N, N-N) were displayed in the left and right boxes of the screen for 500 ms. One hundred milliseconds after the paired pictures disappeared, a black dot with a diameter of 0.3° was presented in the box on the left or right of the screen for 200 ms, and the participants were asked to judge where the black dot appeared. In experiment 2, the paired pictures were displayed for 20 ms, and then masking stimuli appeared for 100 ms to make sure that the paired pictures were presented subliminally, with the rest of the process the same as in experiment 1. In experiments 1 and 2, the participants were required to judge the position of the dot after it appeared, which would disappear after the participant responded, after which the experiment entered the next trial. In this experiment, if the dot appeared on the left side of the screen, the participant was asked to press the 'Q' key or the 'P' key if it was on the right. The experiment was divided into four blocks, and each block contained 60 pairs of paired pictures (HN, LN, NN every 20 pairs), for a total of 240 trials. Before the formal experiment, 12 trials were administered for practice. All participants rested for 2 to 3 min after each block.

TABLE 1 Demographic data of experiments FN group and control group ($M \pm SD$).

Experiment number	Grouping	*N*	Age	NPSS-F score
Experiment 1 and Experiment 2	FN group	80	18.32 ± 0.56	2.74 ± 0.47
	Control group	80	19.17 ± 1.11	0.77 ± 0.14
Experiment 3	FN group	30	20.12 ± 0.44	2.63 ± 0.75
	Control group	30	19.09 ± 1.21	0.78 ± 0.22

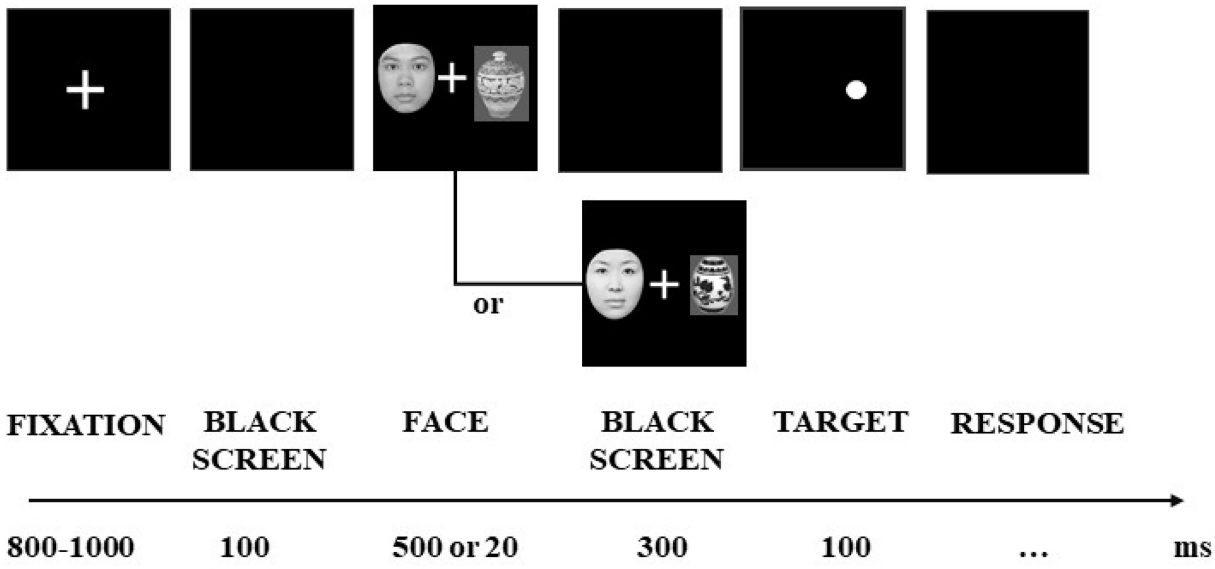

FIGURE 1
Sample of experimental procedure in experiment 1.

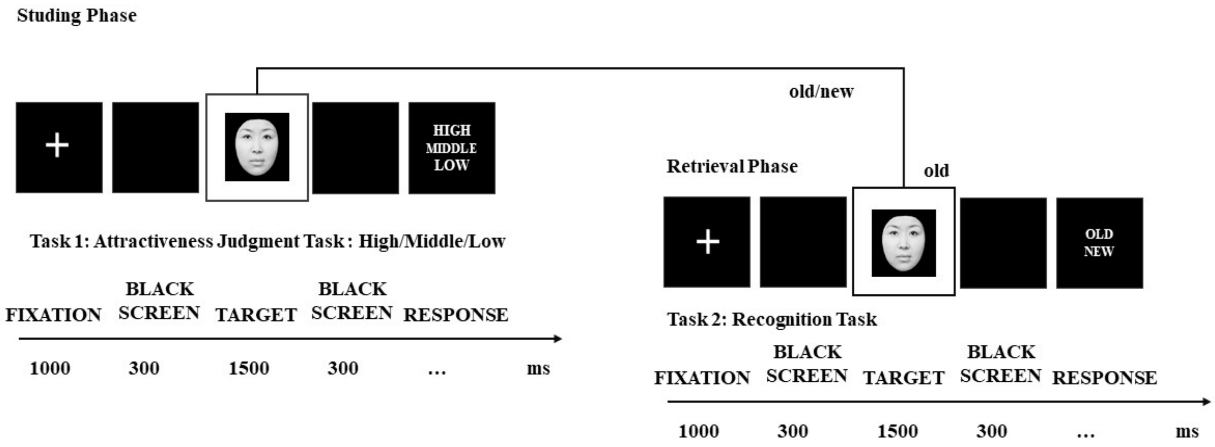

FIGURE 2
Sample of experimental procedure in experiment 3.

In experiment 3, the learning-recognition paradigm was employed to examine mnemonic bias toward facial attractiveness among females with facial dissatisfaction, and EEG data were also recorded during the encoding and retrieval phases. In the learning phase, at the beginning of each trial a white fixation point was presented in the center of the black screen for 1,000 ms, followed by a blank screen for 300 ms, and then followed by a face for 1,500 ms. Participants were required to complete the judging task of the attractiveness of faces. At last, a blank screen was presented for 500 ms, and then, the next trial began. In the learning phase, there were 240 pictures of female faces, including 80 HA pictures, 80 MA pictures, and 80 LA pictures. The learning phase had 2 blocks, and each block contained 120 face pictures, for a total of 240 trials. The participants rested for 2 to 3 min after each block. In the retrieving phase, the procedure was consistent with the learning phase, but participants were required to judge whether the face was old or new (Figure 1). The order in which the faces were presented was random to control the sequence effect. There were 480 female face pictures in the retrieving phase, including 160 HA pictures, 160 MA pictures, and 160 LA pictures, and we mixed half of the pictures that had been learned with those that had not been learned. The retrieving phase had four blocks, and each block contained 120 face pictures, for a total of 480 trials. The participants rested for 2 to 3 min after each block. Before the formal experiment, 12 practice trials were performed (see Figure 2).

Devices and recording

Experiments 3 adopted recording and analysis systems developed by Brain Products (Germany) to record EEG in accordance with the International 10–20 system extension of 64 conductive pole caps. The referring electrodes were placed on the right and left mastoids, and the average value of the bilateral mastoids was used as a reference for offline analysis. The ground electrode was at the midpoint of the line connecting Fpz and Fz in the forehead. Horizontal electrooculography (HEOG) was recorded by placing electrodes approximately 1.5 cm outside both eyes, and vertical electrooculography (VEOG) was recorded by placing electrodes at the upper and lower sockets of the left eye. The scalp resistance at each electrode was kept below 5 kΩ. The filtered bandpass was 0.05 to 80 Hz, and the sampling frequency was 500 Hz/channel. After completing the continuous recording of the EEG, the data were processed offline, and electrooculography was automatically corrected by automatically eliminating wave amplitudes greater than ±80 μV as invalid records. The correct EEG responses were superposed by counting the participants' responses according to the type of task, and the number of superpositions was greater than 60. The analysis window was fixed from −200 to 800 ms, with −200 to 0 ms serving as the baseline for correction.

Data analysis

In experiments 1 and 2, 3 (Picture type: H-N, L-N, and N-N) × 2 (Consistency: the dot was presented in the same/different position of the target face) × 2 (Group: FN group and control group) repeated measure ANOVAs were conducted on the accuracy rate and response time of the two groups of participants.

In experiments 3, 2 (Group: FN group/control group) × 3 (Picture type: HA, MA, LA) repeated measure ANOVA was conducted on the accuracy rate and the reaction time of the two groups of participants during retrieving phase. ERP data may include the peak value and latency of ERP components during the learning and retrieving phases. According to the average EEG chart and EEG brain map, electrode points were used to analyze P1 (100 ~ 150), N170 (150 ~ 200), P2 (200 ~ 250), and N300 (250 ~ 300): P1 (PO7, PO8, O1, O2, Oz); N170 (PO7, PO8, P7, P8, O1, O2, Oz); P2 (CP5, CP3, CP1, P5, P3, P1, PO3, POz); and N300 (TP7, TP8, PO7, PO8, P7, P8, O1, O2, Oz). 2 (Group: FN group/control group) × 3 (Picture type: HA, LA MA) × 2 (Electrode position: left and right) repeated measure ANOVAs were conducted on the peak and latency of the above components. When analyzing the left and right effects, the midline electrode points were not included. The p value in the variance analysis was adjusted by the Greenhouse Geisser correction, and the pairwise comparison was corrected by the Bonferroni correction. The EEG brain maps were derived from 64-lead data.

Results

Behavioral results

The 3 × 2 × 2 repeated measure ANOVAs for the accuracy rate in experiments 1 and 2 did not reveal any significant main effects and interaction effects (Ps > 0.05). The participants involved in the behavioral experiments all had a correct rate of at least 95%, so all participants were retained. When there were participants with 4–11 errors ($M = 7.4$, SD = 2.86), only correct responses were collected (excluding response times data beyond plus or minus three standard deviations).

Attentional orientation

The 2 (Group: FN group and control group) × 3 (Experimental conditions: H-N, L-N, N–N) repeated measurement ANOVAs were conducted on the reaction time under the consistent condition in experiments 1 and 2, respectively. It revealed a significant interaction in experiments 1 and 2 ($F(2, 316) = 12.898$, $p < 0.001$; $F(2, 316) = 15.425$, $p < 0.001$). Simple effect analysis found that the response time of the L-N pictures in the FN group was significantly shorter than that of the N–N pictures in experiments 1 and 2 ($F(1,158) = 11.152$, $p = 0.028$ and $F(1,158) = 11.807$, $p = 0.017$, respectively), but there was no significant difference in response time between the three conditions in the control groups (Ps > 0.05), indicating that the FN group showed an attentional orientation to LA faces. All main effects were not significant (Ps > 0.05).

Attentional avoidance

The 2 (Group: FN group, control group) × 3 (Experimental conditions: H-N, L-N, N–N) repeated measurement ANOVAs were conducted on the reaction time under the consistent condition in experiments 1 and 2, respectively. The Group × Experimental conditions had a significant interaction effect in experiments 1 and 2 ($F(2, 316) = 3.059$, $p = 0.047$; $F(2, 316) = 12.099$, $p < 0.001$). Simple effect analysis found that reaction times in the H-N consistent condition of the FN group were significantly longer than that in the N–N condition ($F(1,158) = 33.292$, $p < 0.001$; $F(1,158) = 33.292$, $p < 0.001$), but there was no significant difference in response time between the three conditions in the control group (Ps > 0.05), indicating that the FN group showed an attentional avoidance to HA faces. All main effects were not significant (Ps > 0.05).

Difficulty in attentional disengagement

The 2 (Group: FN group, control group) × 3 (Experimental conditions: H-N, L-N, N–N) repeated measurement ANOVAs were conducted on the reaction time under the inconsistent condition in experiments 1 and 2, respectively. It revealed that the interaction effect was significant ($F(2, 316) = 3.059$, $p = 0.047$; $F(2, 316) = 12.099$, $p < 0.001$). Simple effect analysis found that there was no significant difference in response time between the three conditions in the FN group (Ps > 0.05), but reaction times in the H-N inconsistent condition of the control group were significantly longer than that in the N–N condition ($F(1, 158) = 9.458$, $p = 0.002$;

$F(1, 158) = 6.425$, $p = 0.011$), indicating that the control group had difficulty in attentional disengagement from HA faces. All main effects were not significant (Ps > 0.05).

Facilitation in attentional disengagement

In experiments 1 and 2, the 2 (Group: FN group, control group) × 3 (Experimental conditions: H-N, L-N, N–N) repeated measurement ANOVAs for the response times under the inconsistent condition were conducted. There were significant interaction effects ($F(2, 316) = 3.059$, $p = 0.047$; $F(2, 316) = 12.099$, $p < 0.001$). In the FN group, reaction times in the L-N consistent condition were significantly shorter than that in the N–N condition ($F(1, 158) = 33.292$, $p < 0.001$; $F(1, 158) = 33.292$, $p < 0.001$), but there was no significant difference in response time between the three conditions in the control group (Ps > 0.05), indicating that the FN group showed facilitation in attentional disengagement from LA faces. All main effects were not significant (Ps > 0.05).

Attractiveness judgment in the encoding phase

In experiment 3, the classification results of the participants and the classification criteria of HA, MA, and LA faces obtained by standardizing the face materials were analyzed by repeated measures ANOVA. The results showed that the difference between the participants' classification criteria for the three types of faces in the pre-experiment and the correct judgment rate was not significant (Ps > 0.05), indicating that the participants' judgments are highly consistent with the standardized results, according to which the statistics of correct rate and response time of the participants toward the three types of faces were collected. There was no significant difference between the two groups in the accuracy of the judgment of facial attractiveness (Ps > 0.05). There was an interaction effect of Group × Picture type in response time ($F(2, 58) = 6.214$, $p = 0.006$), and the FN group responded significantly slower to HA pictures relative to MA pictures and LA pictures ($p = 0.04$, $p = 0.01$). The difference in reaction time between the MA pictures and LA pictures was not significant ($p = 0.08$). The difference in the reaction time of the control group to the three types of attractive faces was not significant (Ps > 0.05). All main effects were not significant ($p = 0.109$; $p = 0.242$).

Mnemonic bias in the retrieval phase

The 2 (Group: FN group/control group) × 3 (Picture type: HA, MA, LA) repeated measurement ANOVAs on accuracy and reaction time did not reveal any significant main effects (Ps > 0.05), but the interaction effect was significant ($F(2, 58) = 5.69$, $p = 0.016$; $F(2, 58) = 98.091$, $p < 0.001$). The accuracy and reaction time between the picture types in the FN group were significantly different ($F(2, 58) = 5.67$, $p = 0.024$; $F(2, 58) = 4.18$, $p = 0.05$), and they exhibited the highest accuracy rate and the fastest response for LA pictures, while there was no significant difference between HA pictures and MA pictures (Ps > 0.05), indicating the FN group showed mnemonic bias towards LA faces. The control group had no significant difference in the accuracy rate and response time between the three types of pictures (Ps > 0.05).

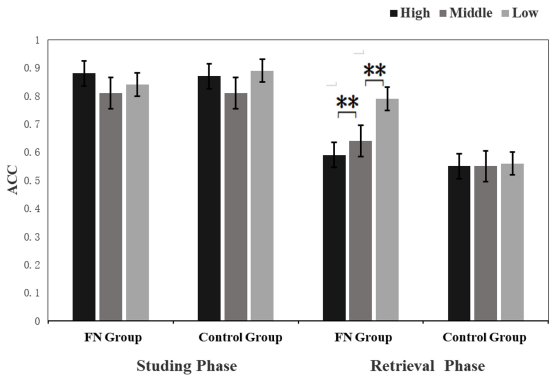

FIGURE 3
Percentage of correct accuracy (ACC) to attractive faces in the learning phase and retrieval phase. **$p < 0.05$.

ERP results

P1 The 2 (Group: FN group/control group) × 3 (Picture type: HA, LA MA) × 2 (Electrode position: left and right) repeated measure ANOVAs were conducted on the peak and latency of P1. In the retrieving phase, the main effect for Group on the P1 latency period was significant ($p = 0.047$), and the FN group had a shorter P1 latency period relative to the control group. The interaction effects between Group and Picture type on the P1 peak in both the encoding and retrieval phases were significant ($F(2, 58) = 50.91$, $p = 0.001$; $F(2, 58) = 3.87$, $p = 0.048$). Simple effect analysis revealed that there was a significant difference in the FN group between the three types of pictures, and the P1 peak amplitude of the LA pictures was the largest (Ps < 0.05), with no significant difference between HA pictures and MA pictures ($p = 0.285$) In contrast, the control group had the highest P1 amplitude evoked by HA pictures in the learning phase, compared with MA pictures and LA pictures ($p = 0.032$, $p = 0.034$). However, there was no significant difference between MA pictures and LA pictures ($p = 0.949$). There was no significant difference in the task types' impacts in the control group in the retrieving phase (Ps > 0.05). It indicated that the FN group exhibited early processing bias towards LA faces in both the encoding and retrieval phases, while the control group had early processing bias towards HA faces only in the learning phase. The other main effects and interaction effects were not significant (Ps > 0.05) (see Figures 3–6).

N170 The 2 × 3 × 2 repeated measure ANOVAs were conducted on the peak and latency of N170. In the retrieving stage, the main effect of Group on the N170 latency period was significant ($F(1, 29) = 5.99$, $p = 0.028$), and the latency period of N170 in the FN group was shorter than that in the control group. The interaction effects between Group and Picture type on the peak of N170 in both the learning and retrieving phases were significant ($p = 0.001$, $p < 0.001$). In the learning stage, the FN group had the largest peak of N170 for LA pictures, but there was no significant difference between HA pictures and MA pictures ($p = 0.803$). The pairwise comparisons between HA pictures, MA pictures, and LA pictures of this group were significantly different

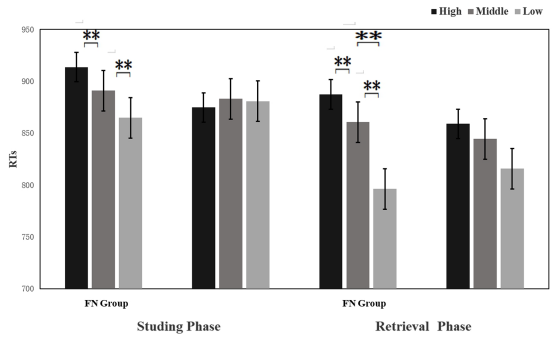

FIGURE 4
Reaction times (RTs) in response to attractive faces in the learning phase and retrieval phase. **$p < 0.05$.

in the retrieving stage with $p = 0.041$, $p = 0.066$, and $p < 0.001$, respectively, in which LA pictures evoked the largest peak of N170, MA pictures the second, and HA pictures the lowest. In contrast, the control group in the learning phase had the largest N170 amplitude evoked by HA pictures, but there wasn't a significant difference between MA pictures and LA pictures ($p = 0.909$). The pairwise comparisons between the FN, MA, and LA pictures in the retrieving stage were not significant. The other main effects and interaction effects were not significant (Ps > 0.05).

P2 In the retrieving stage, the main effect of Picture type on the P2 latency period was significant ($F(2, 58) = 3.97$, $p = 0.045$). The P2 latency period of the HA pictures was shorter than that of MA pictures and LA pictures ($p = 0.037$, $p = 0.014$), and the difference between MA pictures and LA pictures was not significant ($p = 0.524$). At the peak, the main effects of Group were significant in the two stages ($F(1, 29) = 5.12$, $p = 0.041$; $F(1, 29) = 17.10$, $p = 0.001$), and the P2 peak in the FN group was larger than that in the control group. The main effect of Picture type was significant ($F(2, 58) = 4.01$, $p = 0.046$; $F(2, 58) = 11.19$, $p = 0.001$), and HA pictures evoked the highest P2 amplitude, and LA pictures evoked the smallest P2 amplitude.

N300 In the retrieving stage, the main effect of Picture type on the N300 latency period was significant ($F(2, 58) = 4.58$, $p = 0.031$), and the latency period of the HA pictures was shorter than that of the LA pictures ($p = 0.011$). The main effect of Picture type on the N300 peak was also significant ($F(2, 58) = 39.08$, $p < 0.001$), and the N300 amplitude evoked by HA pictures was significantly larger relative to MA pictures and LA pictures (Ps < 0.001), while there was no significant difference between MA pictures and LA pictures ($p = 0.724$). The other main effects and interaction effects were not significant (Ps > 0.05).

Discussion

In experiments 1 and 2, the attentional biases of young females with facial dissatisfaction towards faces of different levels of attractiveness were examined. The results revealed that the FN group responded to the LA pictures significantly faster in the consistent condition than in the neutral condition, indicating that they showed an attentional orientation to the LA pictures. They reacted significantly faster to the LA pictures in the inconsistent condition than in the neutral condition, showing facilitation in attentional disengagement from LA pictures. For the HA pictures, the reaction times of the FN group in the consistent condition were significantly longer than in the neutral condition, showing that they exhibited attentional avoidance of the HA faces. The control group reacted more slowly to the HA pictures in the inconsistent condition than in the neutral condition, indicating that they had difficulty in attentional disengagement from the HA pictures. Therefore, regardless of whether faces are presented subliminally or supraliminally, females with facial dissatisfaction show attentional orientation to LA faces, facilitation in attentional disengagement from LA pictures, and attentional avoidance of HA faces. The control group exhibited difficulty in attentional disengagement from HA pictures.

As a sensitive stimulus, the LA face has an attention superiority effect, and females with negative face image will first direct their attention to LA faces. In this study, females with facial dissatisfaction show attentional orientation to LA pictures, which is consistent with the conclusions of previous research. Young females with facial dissatisfaction are more sensitive to negative face-related stimuli, resulting in faster detection of negative face-related stimuli. But then they avoided LA pictures manifested as facilitation in attentional disengagement from LA faces, partly inconsistent with previous studies. For example, in a study on attentional bias toward body words, females with obesity were found to be vigilant about body words but not attentional avoidance (von Spreckelsen et al., 2018). The reason may be the low arousal intensity of body words and the simplicity of the task, which required few cognitive processing resources. However, this study used highly stimulating pictures that can fully activate negative body images and further attentional avoidance. The attentional "vigilance-avoidance" model in the study of anxiety disorders would function as evidence for the above conclusion(Caldwell and Newman, 2005; Mitchison and Mond, 2015; Jacoby et al., 2016). The model supposes that anxious individuals will notice threatening stimuli sooner at first and then disengage to avoid further detailed processing(Koster et al., 2004). This information processing mode will maintain anxiety because anxious individuals identify threat information faster. However, without precise processing, the participants failed to evaluate the authenticity and objective threats of the information. Consequently, their estimation of threats comes from self-overestimation. Therefore, their anxiety was maintained. Additionally, avoiding facts cannot ease but maintain this state. Accordingly, females with facial dissatisfaction may also have such a vigilance-avoidance cognitive mechanism. They detect low-attractive face information faster and then avoid it and further detailed processing. Additionally, they also avoid HA pictures. This processing mode maintains the anxiety state of facial dissatisfaction about appearance and prevents the conduction of objective evaluation toward stimuli. This vigilance-avoidance cognitive mechanism may

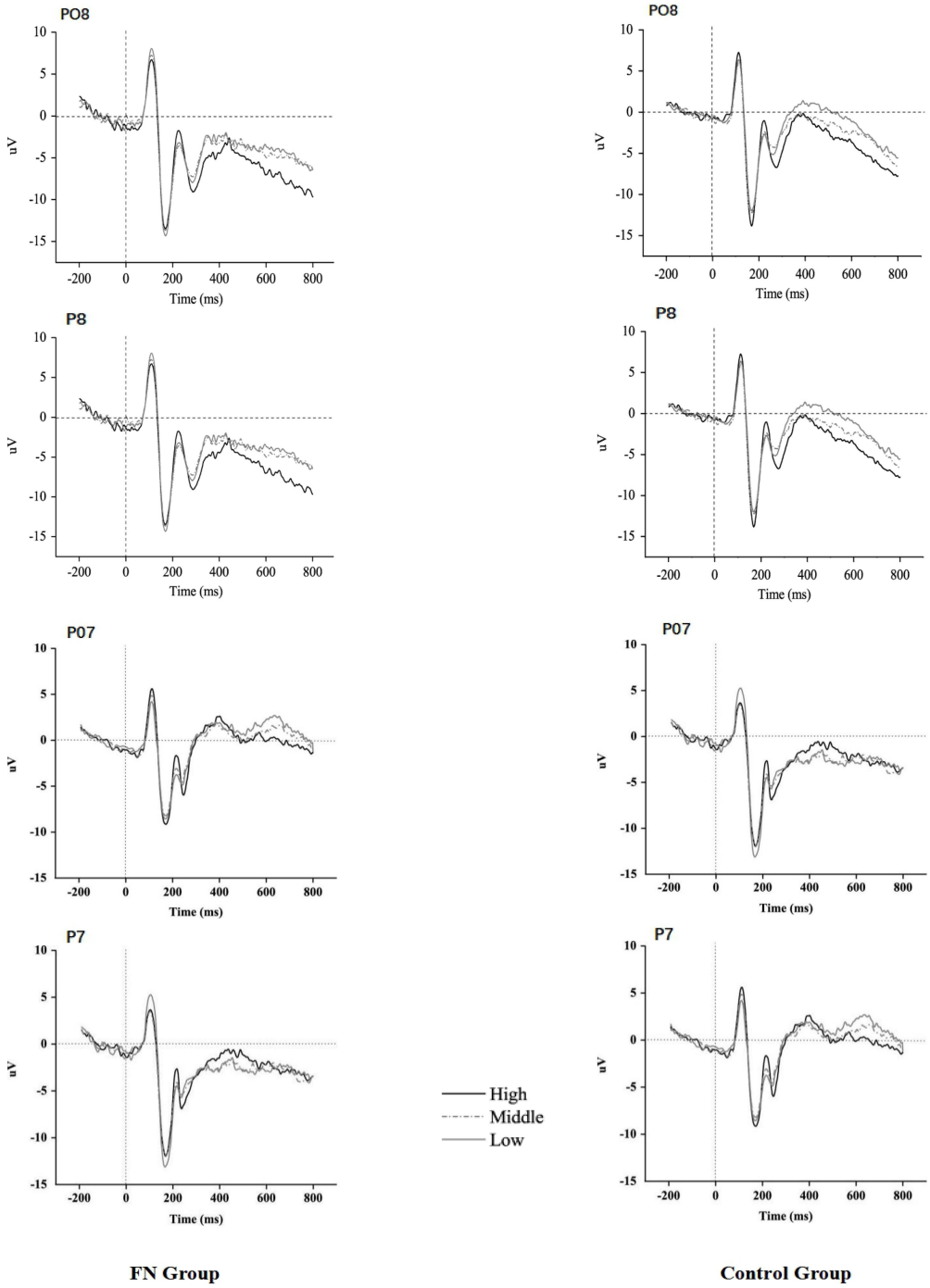

FIGURE 5
ERPs response recorded during the retrieval phase.

also be one of the reasons why females have negative emotional experiences and then conduct or maintain problem acts.

Participants in the control group only showed the difficulty of attentional disengagement from HA pictures, which was consistent with the conclusions of previous studies and reflected their beauty bias. Some studies have found that as a reward (Rhodes, 2006; Marzi and Viggiano, 2010), beautiful faces contain greater reward value (Ishai, 2007; Sui and Liu, 2009; Halford and Hsu, 2020) and are favored by individuals (Luo, 2013; Ma-Kellams et al., 2017). In this study, it may be that the greater reward value triggered longer glance and slowed down the reaction time.

Experiments 3 used the learning-retrieving test paradigm to compare the differences in learning-retrieving behaviors and ERPs between the two groups on HA, MA, and LA pictures. Behavioral

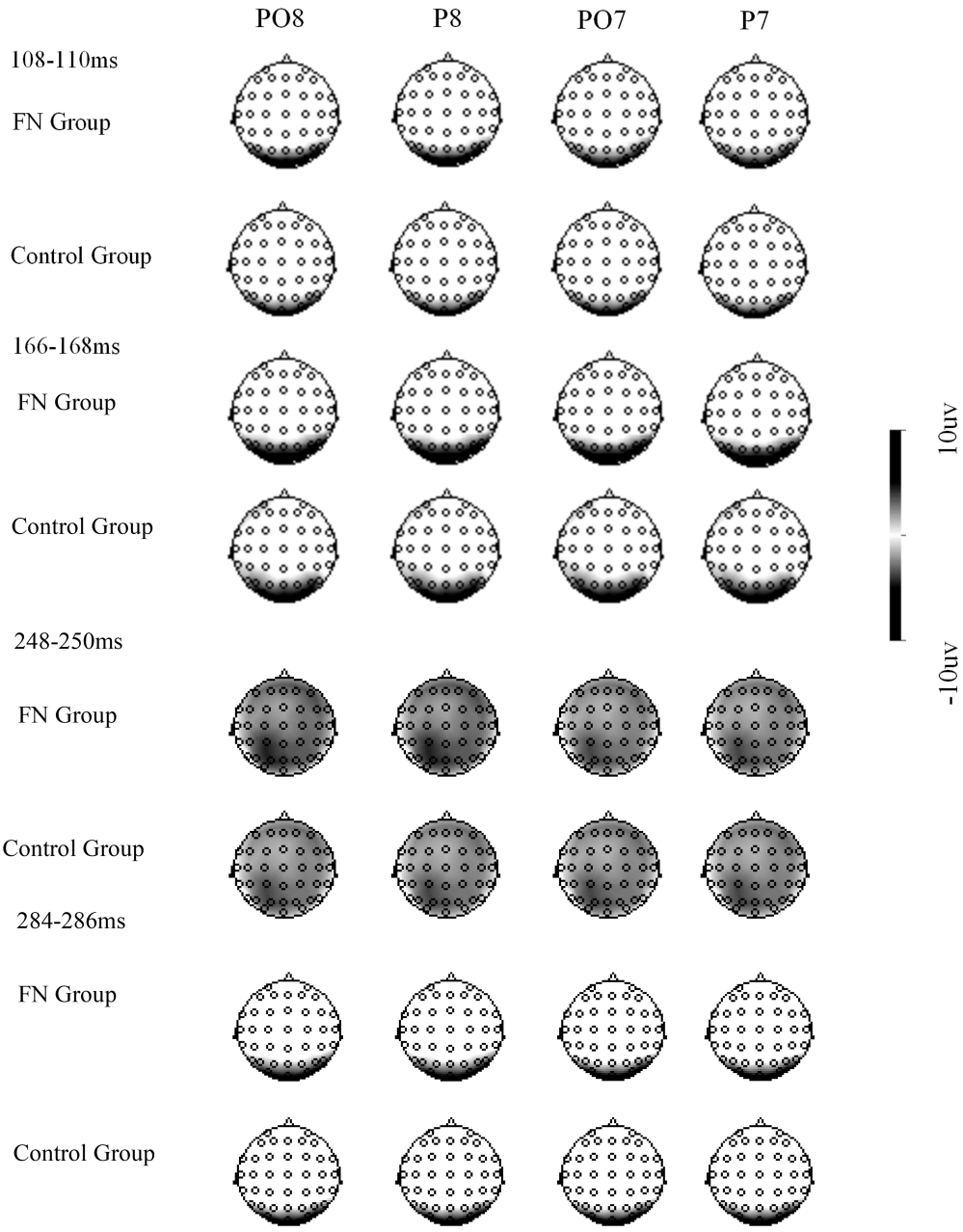

FIGURE 6
Differential topographical maps.

data show that, compared to MA pictures, only the FN group completed judging LA pictures in a shorter reaction time and at a higher retrieving rate, while there was a longer reaction time and lower retrieving rate for HA pictures. There were no significant differences in the response time or retrieval rate among the three types of pictures in the control group. This result is consistent with our hypothesis, which aligns with the influence of negative body images on the cognitive processing of information. The processing of body information impacted negative body images. When information related to the negative schema (such as weight, body shape, and food information) appears in the presentation or environment, the negative schema will be activated, thereby facilitating the processing of schema-consistent information, inhibiting or contradicting the processing of schema-inconsistent information(Levine and Piran, 2004; Chen and Jackson, 2005). Consequently, the participants pay attention to, judge, and store information selectively in different information processing stages (Chen and Jackson, 2006; Cho and Lee, 2013), which is similar to the fat negative schema conclusion. Females with facial dissatisfaction rate their faces as lowly attractive and selectively process LA pictures that are consistent with their schema, which enables them to process LA pictures faster and more intensively,

TABLE 2 ERPs amplitude in study phase ($M \pm SD$).

Type	P1(uV)		N170(uV)		P2(uV)		N300(uV)	
	FN group	Control group	FN group	Control group	FN group	Control group	FN group	Control group
High	6.64 ± 0.75	8.16 ± 1.16	−10.40 ± 1.11	−12.604 ± 1.03	4.50 ± 0.99	1.13 ± 1.02	−8.83 ± 0.63	−5.90 ± 0.75
Middle	6.31 ± 0.80	6.66 ± 1.19	−10.20 ± 1.01	−12.511 ± 0.97	3.82 ± 0.72	0.64 ± 0.87	−7.52 ± 0.62	−4.37 ± 1.00
Low	7.83 ± 0.80	6.64 ± 1.19	−12.08 ± 1.00	−10.571 ± 1.04	3.53 ± 0.95	0.03 ± 0.96	−6.91 ± 0.79	−4.14 ± 0.95
Total					3.98 ± 0.87	0.56 ± 0.94	−7.75 ± 0.66	−4.81 ± 0.87

so the retrieving rate is better. In contrast, their contradiction to schema-inconsistent information on HA pictures contributes to a lower rate and a slower speed of retrieval.

The ERP results showed that during the learning phase, the LA pictures induced the highest P1 and N170 amplitudes in the FN group, and HA pictures were the lowest. While the control group was the opposite, participants had a preference for HA pictures, and HA pictures induced the highest P1 and N170 amplitudes. In the retrieving phase, the LA pictures of the FN group induced the highest P1 and N170 amplitudes, and the HA pictures caused comparatively lower amplitudes of P1 and N170, but there was no such difference in the control group. This shows that participants in the FN group exhibited a preference for LA pictures in both the learning and retrieving stages. They learned and remembered LA pictures better, while neutral participants preferred HA pictures.

P1 is considered to be the reflection of the early stage of face processing, the rough facial representation and the retrieval of the simple facial features (Itier and Taylor, 2004; Kranz and Ishai, 2006). A study employed real and virtual faces to compare the processing differences between sad and neutral facial expressions and found that sad expressions cause stronger P1 than neutral expressions within a time window of 80 ~ 110 ms (Kramer et al., 2020). In attention-oriented research, P1 is often considered to be related to early attention and low-level physical classification of stimuli (Itier et al., 2007). Early studies believed that only physical features of complex visual stimuli were processed in low-level brain regions within 100 ms after presentation (Pizzagalli et al., 2002), while specific processing occurred at the later stages. However, recent studies on psychophysiology and electrophysiology have shown that visual stimulus classification and processing may begin approximately 100 ms after the stimulus is presented (Thorpe et al., 1996; Kranz and Ishai, 2006). For example, in the experiment of Thorpe et al., the participants were required to determine whether a series of pictures contained animal pictures swiftly and found swift visual classification may occur 100–150 ms after the stimulus was presented (Thorpe et al., 1996). Liu and his team captured a greater P1 amplitude induced by faces than that induced by other image stimuli, which is supposed to prove a greater involvement of attention resources in face processing (Sui and Liu, 2009) (see Table 2).

N170 is a unique component in face processing that is usually captured in the temporal-occipital region, representing the retrieval of face processing and the spatial relationship between facial parts (Hinojosa et al., 2015). The study of facial feature coding found that facial features affect the latency period and amplitude of the N170 (Eimer and Williams, 2000). Faces with expressions (sadness, fear, disgust, anger, surprise, happiness) induced a shorter latency period and greater N170 than neutral expressions. The N170 latency period induced by positive expressions was shorter than that induced by negative expressions, and the N170 amplitudes induced by fear expressions were greater than those induced by neutral and surprised expressions (Hinojosa et al., 2015). The amplitude of the N170 component is also affected by the attractiveness of the face. Some studies present participants with high, medium, low, and unattractive faces, and it is found that compared with medium and low-attractive faces, the N170 latency period induced by high-attractive faces is shorter and the amplitude is greater (Joyce and Rossion, 2005; Tanaka, 2018). A new study also found that compared to medium and unattractive faces, the N170 component of both genders posed an electrophysiological bias toward attractive faces (Tanaka, 2018). The more attractive individuals are, the smaller the electrophysiological bias toward unattractive faces in the environment, indicating a smaller involvement of attentional resources.

The components of P1 and N170 reflect the situation of the early processing stage of faces. At the early stage, the FN group has a cognitive bias toward LA pictures. The ERP effect induced by LA pictures in learning and retrieving tasks is the strongest, and that induced by HA pictures is the weakest. This reflects the information processing features of schema participants from the perspective of brain mechanisms. Young females with facial dissatisfaction believe that their faces are less attractive, and LA pictures as schema-consistent information involve more cognitive processing resources and a greater degree of processing. On the other hand, they cognitively reject HA pictures, which leads to less involvement of face processing resources. Therefore, FN will show a cognitive bias toward different facial stimuli in the early stage. They invest more resources in LA pictures that are consistent with the negative schema, resulting in greater processing intensity and better memorization. This feature is similar to the result of Smith's research on persons with body image disorders. They found that individuals with body disorder pay more attention to unsatisfactory body parts, while normal participants pay more attention to satisfying parts. The degree of attention of individuals with body image

disorder to unsatisfactory parts is related to their subsequent dietary regulation acts (Massar et al., 2011; Gupta et al., 2019). In addition, some attentional bias studies on anxiety schema and diet disorder participants found that schematists rapidly avoid threatening information, which is manifested by individuals' attentional avoidance of threatening information. To avoid information refinement to reduce or combat the anxiety or negative emotional experience that threatening information may induce. This avoidance strategy prevents individuals from objectively evaluating the threat of stimuli, which leads to the continuation of the original state (Boon et al., 2000; Rinck and Becker, 2006; Vrijsen et al., 2009; Hollitt et al., 2010; Wilson and Wallis, 2013). Therefore, those with a negative appearance schema overprocess LA pictures in the environment and avoid HA pictures as threatening information. Such cognitive overprocessing of the consistent information of the negative schema may lead to the overestimation of information threat. Their resistance to inconsistent information and avoidance strategy lead to their insufficient awareness of objective information and exacerbate their dissatisfaction with their appearance, which further enhances the schema so that the negative schema is consolidated and maintained, which in turn leads to the continuation of some problematic behaviors.

Participants in the control group exhibited a preference for HA pictures in the judgment task, which is consistent with previous research results on attractive faces and may reflect that the activation of the reward value of beautiful faces is more popular (Atari et al., 2017; Ma-Kellams et al., 2017; Arnocky, 2018). In addition to analyzing individuals' preference for beautiful faces from the perspective of internal reward value, we can also explain it from the perspectives of evolutionary psychology and cognitive processing psychology. Evolution-oriented theories believe that facial beauty is related to better environmental adaptation and evolution. This better adaptation and evolutionary ability have also been defined as the reasons for a better reproduction success rate and good genes in the long evolutionary history of mankind (Shackelford and Larsen, 1999; Henderson and Anglin, 2003). According to the good genes theory, the higher the attractiveness of an individual's face, the stronger the individual's body immunity, the healthier the genes, and the better the reproductive ability. In addition, those individuals with lower attractiveness leave us with the a similar impression as bad food, making us feel unhealthy and immature. Individuals with low attractiveness also seem to be associated with poor health, low survival rates, and a threat to the continuity of race, eventually being disfavored by others. Cognitive orientation suggests that the preference for attractive faces may merely be the preference for familiar stimuli.

During the retrieving stage, participants in the control group exhibited no difference in retrieving the three types of pictures, indicating that they did not pose a memory preference for attractive faces. Some studies have reported differences in retrieving attractive faces (Eimer and Williams, 2000; Joyce and Rossion, 2005; Liu et al., 2016), which may come from the mixed participants of both genders. Such research mostly arranges mixed male and female participants and applies stimulates faces of mixed genders. Studies have shown that for observers of different genders, faces have different internal reward values (Joyce and Rossion, 2005; Tanaka, 2018), and gender differences can cause differences in face processing and memory. Therefore, compared with the settings of single-sex participants and face pictures in this study, mixed-sex experiments will be interfered with by more irrelevant variables, which affects the early components in the retrieving phase. This study selected only female participants and facial stimuli, thereby controlling the influence of irrelevant variables to minimize the experimental error.

The P2 component amplitude is attributed to the main effect of grouping and task type. The FN group has a higher amplitude than the control group, the high attractiveness images draw the highest amplitude, and the low-attractiveness images draw the smallest amplitude. The N300 amplitude is attributed to the main effect of task type, and HA pictures induces a significantly larger amplitude than MA pictures and LA pictures. P2 reflects the early processing of visual stimuli by the brain and is a sign of perceptual processing (Ralph-Nearman et al., 2019; Carlson, 2021). Some studies have found that the amplitude of P2 is related to attention involvement (Frenkel and Bar-Haim, 2011; Kanske et al., 2011). The larger the amplitude, the more attention involvement there is (Massar et al., 2011; Rossignol et al., 2012; Schindler and Bublatzky, 2020), indicating that once entering the perceptual processing stage, the two groups of participants have the same cognitive bias toward faces, and both groups are more involved in HA pictures. We speculate that this reflects the difference in the processing mechanism affected by the schema.

Specifically, for those with a negative appearance schema, reports have pointed out that individuals with a negative schema also have an implicit self-esteem effect (Chen and Jackson, 2006; Chen et al., 2007). Research on individuals with depressive schema has found that their cognitive basis consists of disavowal and negative schema (Chen and Jackson, 2005; Verplanken and Velsvik, 2008; Pawijit et al., 2019), such as encoding schema-related neutral stimuli as negative stimuli. As a result, individuals with a negative appearance schema are dissatisfied with their looks and suppose their faces are low-attractive. Their cognitive basis is the identification of LA pictures. HA pictures are contrary to this and are regarded as threatening stimuli to be processed. In other words, when entering the perceptual stage, individuals with a negative appearance schema process HA pic as threat stimuli. From the perspective of evolutionary psychology, compared to neutral information, stimuli containing emotions can indeed be highlighted in the environment and can attract individual attentional resources (Ohman et al., 2001; Batty and Taylor, 2003; Massar et al., 2011; Veenstra and de Jong, 2012). In the process of biological evolution and adaptation, negative stimuli, especially those containing threatening or survival-related information, attract more attention. Putting more attentional resources on threatening information manifests biological adaptability as well.

Individuals with a negative self-image may regard HA pictures as a kind of threatening information contrary to their schema. After entering the perception stage, HA pictures, as threatening information, can quickly attract more processing resources and greater attentional involvement. Therefore, the ERP effect is greater.

The activation of the right occipital lobe of those with negative physical self-image in the retrieving stage found on the EEG may represent the process of self-information processing (Levine and Piran, 2004; Morita et al., 2008; Pitcher et al., 2011). This likely indicates that the activation of the right occipital lobe is related to the processing of self-image information, which is consistent with the results of this study. This may also indicate that the brain area is related to a negative body schema.

Limitations

Pictures were the only stimuli used in the current study, which cannot comprehensively reflect the cognitive processing approach of females with facial dissatisfaction toward different stimuli. Further research would involve word and sound stimuli to explore the information processing features of females with facial dissatisfaction. This research activated the negative body image of appearance from the perspective of explicitness (attractiveness judgment) and discovered the processing and memory preferences of the negative body image among participants, but it is still unclear whether this preference exists when body information is implicitly activated. Therefore, further research can also focus on exploring how preference is expressed when body information is implicitly activated.

Conclusion

1. Young females with facial dissatisfaction exhibit attentional orientation and attentional avoidance toward LA pictures and attentional avoidance toward HA pictures.
2. Young females with facial dissatisfaction identify and retrieve LA pictures in a faster and more accurate way.
3. The P1, N170, P2, and N300 amplitudes induced by LA pictures are higher, reflecting the difference in the processing mechanism.
4. Young females with facial dissatisfaction tend to pay attention and conduct memory processing when encountering LA pictures.

Data availability statement

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

Ethics statement

Subjects gave written, informed consent, and our procedures and protocols were approved by the Academic Committee of School of Education and Psychology, Southwest Minzu University (Experiment number: 20200911–023). 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

LZ, HZ, XW, XM, and QL contributed equally to the conception of the idea, implemented and analyzed the experimental results, wrote the manuscript, and read and approved the final manuscript. All authors contributed to the article and approved the submitted version.

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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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Reflections on the battle against COVID-19: The effects of emotional design factors on the communication of audio-visual art

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Fighting against the epidemic is an arduous and prolonged battle where many artists hope to inspire people with the power of art through cultural creativity. To explore the effects of emotional design factors on the communication of audio-visual art and the audience's perceptive experience, this research takes the original anti-epidemic song and the film *China Braves Headwind* as the research object. The research also uses such methods as questionnaires, Structural Equation Models, and dependent samples *t*-tests to conduct statistical analysis. The results are as follows: First, the emotional design evaluation matrix based on the emotional communication model is reasonable, and the scales of this research are feasible. Second, the emotional design of audio-visual works can significantly affect the audience's emotional experience and further improve sharing intention. Third, Attribute A2 (Artistic style, Thematic perception) and attribute C3 (Emotional resonance, Spiritual sublimation) serve as common factors affecting the emotional experience in terms of both musical works and film and television works. Fourth, compared with musical works, film and television works are likely to resonate with the audience. The combination of music and visual sensation can help open up the conception of artistic works and convey their meanings to viewers. Therefore, it's necessary to explore the emotional communication mode between audio-visual artists and the audience. It helps artists think about how to create works innovatively and is conducive to marketizing works and stimulating cultural consumption demand.

KEYWORDS

COVID-19, emotional design, emotional experience, audio-visual arts, communication effects

Introduction

As many countries around the world went into a frenzy of cultural creativity at the beginning of the 21st century, humanistic aesthetics has been placed high on the agenda in the design community. Developing an "aesthetic economy" with cultural characteristics has been an inevitable trend. In terms of creative cultural design, the key lies in extracting cultural elements and fostering a taste of lifestyle to finally transfer a wholly new aesthetic meaning to the audience through emotional content (Hsu and Lin, 2011; Yeh et al., 2011; Yang et al., 2022). Norman (2004) pointed out that emotional factors were the key to designing. A successful cultural and creative product can definitely arouse the inner desire of its audience. A high-quality design thus must be creative, culture-rooted, and human nature-centered from stem to stern.

The COVID-19 pandemic at the start of 2020 has brought heavy damage to countries worldwide in the aspect of economy, politics, and culture (World Health Organization, 2020). Individuals with a high fear of COVID-19 may experience negative emotions and cognitions (Brooks et al., 2020; Rettie and Daniels, 2020). Meanwhile, fighting against the epidemic is an arduous and prolonged battle where many artists hope to inspire people with the power of art through cultural creativity (Larissa et al., 2021; Lydia, 2022). The studies suggest a potential role for mixed emotions in pandemic-related outcomes, which can promote complex thought processes and eudaimonic well-being (Berrios et al., 2018; Oh and Tong, 2021). Some findings emphasize the importance of emotional experience and emotion regulation for self-efficacy, subjective wellbeing, and positive coping during the pandemic (Cattelino et al., 2021; İme and Ümmet, 2022). The results showed optimism as a protective factor against the psychological impact of the COVID-19 pandemic which can increase confidence, motivate individuals to achieve goals, and increase positive affect and well-being through its effects on perceived stress and infection stress anticipation (Brosschot et al., 2005; Puig-Perez et al., 2022). Art language is composed of codes, which is a well-organized and understandable information system. When artists have the same code system and code perception as their audience, the truth that their artistic creations can be deeply perceived makes art an emotion transmitter without frontiers. Philosopher Dewey (1964) also put forward that in a shared world full of divides and walls that limit people's experience, artistic works serve as the only means of communication between people, completely without barriers. As a branch of the cultural and creative industries, audio-visual art has a unique form of artistic expression and is also an important way of emotional expression. Art creators, through their understanding, design situations and artistic conceptions for emotional communication. Artists with creative ideas intrinsically create artistic works, by which their desires and fantasies can be realized. In turn, the audience who enjoy these works can release their inner depression and can feel a sense of pleasure (Winner, 1982). The dissemination of art can relieve stress and negative emotions, which has a significant effect on fighting against COVID-19 (Lydia, 2022; Niels et al., 2022). Therefore, it is an issue worth exploring how artists express their creative ideas and inner feelings, and how viewers can grasp the essence of creativity and gain emotional experience during the COVID-19 pandemic.

During the epidemic, China's economy has been hit severely, and the people's normal life and production have been disrupted. The COVID-19 pandemic has caused new patterns of behaviors that differ from previous ones in terms of responses and emotions to external stimuli (D'Uggento et al., 2022). Online access to cultural activities could sustain the educational and entertaining demands of diverse groups during mass confinement (Samaroudi et al., 2020; Ginzarly and Srourb, 2022). Cultural and artistic activities online, such as virtual museums, virtual Concerts, art galleries, and live theaters, created more opportunities for people to experience the arts and achieve artistic consumption (Choi et al., 2020). Studies found a remarkable increase in the consumption of digital cultural offerings (e.g., music, film, literature, and theater) during COVID-19-related restrictions (Gotthardt et al., 2022). Internet-based digital cultural consumption has seen its main consumers shifting from offline to online, which has become an important factor in driving economic recovery. Some scholars have pointed out that cultural and creative products should focus on consumers' inner feelings and spiritual experiences (Gao et al., 2018; Radermecker, 2021). Therefore, cognitive engineering has been widely used in the sectors of creative design in recent years. And cognitive engineering has been combined with information dissemination theory to help people deeply understand the communication methods of artists and their audiences. All these shifts are conducive for art to be closer to our life and humanity, thus bridging the barriers and gaps caused by the creation and expanding new possibilities of cultural consumption. Digital audio and video, animation games, webcasting, etc. are all important parts of the digital cultural industry based on mobile smart terminals, mobile Internet technology, and network big data. With audio and video works as the medium, this research will study the effect of emotional design factors on the communication of audio-visual art. The specific research purposes are as follows: to explore how art creators influence the audience's perception and dissemination through audio-visual art; to understand the key factors that audio-visual art affects the audience's emotional experience; to deeply analyze the differences in the audience's perception of the emotional design of musical works and film & television works.

Literature review

The emotional design and emotional communication mode of audio-visual art

Audio-visual artistic works can stimulate the audience's perceptual system through certain design factors, thereby triggering emotional responses, generating emotional connections, and arousing their inner desires. People's heartstrings are touched mainly by such works' attributes as artistic styles, story plots, audio-visual structures, and thematic connotations (Schmetkamp, 2017). With the help of the fantasy world expressed by the screen, the audience can gain pleasant sensations intertwined with curiosity, desires, and overlapping emotions aroused by dramatic conflicts, thus obtaining some spiritual comfort (Mulvey, 1975). Bourdieu (2017) also mentioned that an artistic work would be meaningful to viewers with a cultural sensibility and arouse their interest, and people's emotional projection would be manifested through the color, line, rhythm, style, form, or purpose of works. As coders of interpretation of artistic works, audio-visual artists are good at establishing an interdependent relationship between themselves and their works by integrating emotions into works. In this case, emotional design refers to the design in audio-visual art that can mobilize the audience's perceptual system and generate their emotional interaction (Nicoló et al., 2022). Nowadays, with the rapid development of science and technology, design has gone beyond the realization of functional purposes, into a reflection of emotional and cultural values (Flores and Roldo, 2012). Emotional involvement is also central to the immersive experience, especially driven by auditory and visual stimuli in a virtual environment (Sangkyun, 2012; Jan et al., 2020; Salselas et al., 2021). Studies by some scholars indicated that the use of standardized visual and auditory emotional stimuli could induce different emotional states, thereby affecting the interaction process between the audience and the works, both on physiological and psychological levels (Ashby and Johnson, 2003; Zhou et al., 2013; Ding, 2021). The emotional design of art can finally penetrate the spiritual world of its audience, excavate their purest emotion, and empower them to understand the works' deepest meaning, by which the audience can reach a higher realm of realizing the sublimation from sensory appreciation to spiritual reflection.

The audience's perception and appreciation of audio-visual works represent the first stage of emotional communication between people and art objects. In this process, the audience is required to combine their knowledge, experience, and perception to decipher and decode (Formilan and Stark, 2021). Evoking attention by showing audio-visual artistic works activates the motor system and embodiment as the emotional–motivational state is linked with cognitive processes in human–environment interactions from a sensory-cognitive structure (Izard, 2013; Sakhaei et al., 2022). Mcluhan (2000) proposed that the medium was an extension of human beings, and audio-visual media had a strong influence on people's touch, and thus made people's perception a three-dimensional structure. Langer (1957) once said that any kind of art was an external manifestation of inner essence, an objective representation of subjective reality. In other words, the measurement standard of emotional design in audio-visual art includes the objective scope, and the latter's internal structure can be reflected through correlation hierarchy. In the past few decades, many scholars have proposed evaluation criteria that affect the audience's emotional perception. For example, Norman (2004) believed that high-quality design must take into account both aesthetics and usability, which could be evaluated through such attributes as aesthetics, attractiveness, fun, and usability. Research launched by Khalid and Helander (2004) indicated that the information value or utility, functionality and semantics, familiarity, and usability of cultural and creative products would affect the demands and preferences of the audience. These factors showed that the function of their abilities played an important role in emotional perception. Creativity comes from the yearning for a certain lifestyle, from which the symbolic meaning is extracted, transformed into a visual consumption symbol, and finally integrated into artistic works (Hsu and Lin, 2011). Works with the added value of cultural creativity, such as image code, pattern type, and modeling composition, can satisfy the emotional demands of the audience from external signs to connotation. From what has been suggested above, artists are good at integrating the three dimensions of beauty, functionality, and creativity, as well as conveying potential or implied emotions and meanings, which is also of vital importance in the construction of emotional design.

Speaking of the emotional communication of audio-visual art, it holds creative connotation based on the emotional design of the artists and reflects the audience's perceptive feelings with the aim of their emotional experience, both of which work to build a bridge of communication connecting artists and the audience. As the composer Cage John (2013) said, art was not the act of an artist to create well-connected works, but a place for the audience to interact with artistic works (a.k.a. art medium). In this case, artistic works become an interactive medium that the artists encode and the audience decodes. The procedural school among communication theories believes a successful encoding needs the artist to take account of three aspects, namely the technical level, the semantic level, and the effectiveness level (Jakobson, 1987; Craig, 1999; Fiske, 2010). The technical level means that the code creator sends messages that convey his intention so that artistic work can be perceived by the code recipient graphically; the semantic level means that the code sender expresses his meaning of an artistic work, which can be well understood by the code recipient authentically; the effectiveness level means that the code sender has an effective influence on the code recipient on his expectant behaviors

according to the original meaning (Lin and Li, 2015; Fang et al., 2018). The audience's emotional experience of an artistic work involves their decoding process. At the level of the body's instinct, the audience will be attracted by the external senses of an artistic work; at the level of the mind's behavior, they will understand and feel the meaning beyond the perception of artistic works. Eventually, they will return to the level of spiritual reflection where the audience will be touched deeply in their hearts and the artistic work will be evocative of their memories of emotion in their lives. Given that, this research combines the relevant communication and cognitive theories to give a conclusion about the emotional communication mode of audio-visual art, as shown in **Figure 1**.

Emotional design evaluation matrix of audio-visual art

On the theoretical basis of the emotional communication mode of audio-visual art, this research establishes the emotional design evaluation matrix of audio-visual art to better understand the classification of evaluation attributes and provide a reference for the measurement of subsequent research structures, as shown in **Table 1**. The aesthetic dimension created by the artist using logical conception can condense the audience's aesthetic experience into a profound aesthetic experience. To resonate with the audience in such three dimensions as beauty, function, and creativity, artists should make endeavors in these three aspects: technique, meaning, and effect. At the technical level, Expression techniques (A1-1) and Audio-visual language (A1-2) can be summarized as two attributes of the aesthetic dimension. Expression techniques refer to the application of techniques, such as film composition, shooting techniques, lens using, tune arrangement, and singing styles, which are the most basic design elements for expressing beauty; Audio-visual language can be generalized as an effect being represented by the internal organizational structure of an artistic work, which specifically includes the fluency of scenes switching, the richness of melody, and the vividness of the singing. Both the above attributes emphasized the technical methods that artists use to convey aesthetic feelings with the measurement reference of beauty representation. At the semantic level, the aesthetic dimension includes Rhythm and melody (B1-1) and Harmonious coexistence (B1-2). Rhythm and melody have an overlapping or interlaced effect which is similar to a sparse or dense arrangement of characters according to different meaning rules. Given that, the sense of beauty is more like insight beyond agreeable sensations; Harmonious coexistence means that all elements integrate subtly as one to create an aura of graceful harmony. So these two attributes can reflect the inside beauty of the artwork through the subtle organization with the measurement reference of beauty enjoyment. At the effectiveness level, Artistic charm (C1-1) and Aesthetic value (C1-2) can be extracted from the aesthetic dimension. Artistic charm actually reshapes the relationship between artists and their works, both of which exist because of art, the original third party that gives people a unique perceptive feeling of artistic events (Heidegger, 2011); Aesthetic value contains imagination, expression, emotion, motivation, transformation and many ways to realize the beauty of an artistic work, and it is a reproduction of beauty of the aesthetic creation (Langer, 1957).

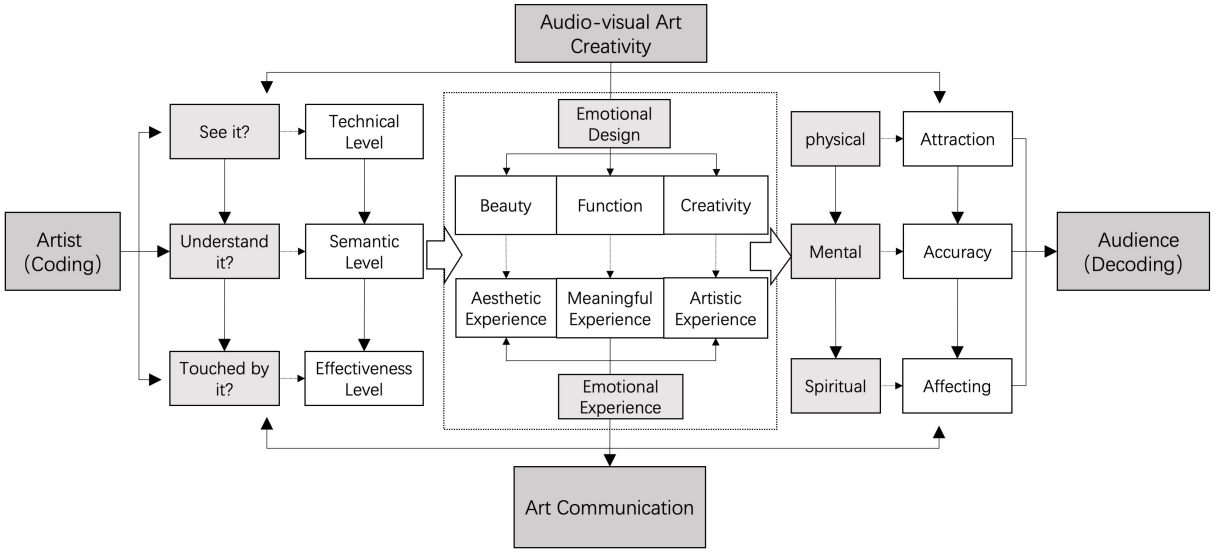

FIGURE 1
The emotional communication mode of audio-visual art.

TABLE 1 Emotional design evaluation matrix of audio-visual art.

Artist				
Code\Measurement indicators	**Beauty**	**Function**	**Creativity**	
Technical Level (See?)	A1-1 Expression techniques A1-2 Audio-visual language	A2-1 Artistic style A2-2 Thematic perception	A3-1 Content conception A3-2 Scene creation	Physical (Attraction)
Semantic Level (Understand?)	B1-1 Rhythm and melody B1-2 Harmonious coexistence	B2-1 National culture B2-2 Spirit of times	B3-1 Emotion presupposition B3-2 Imagination stimulation	Mental (Accuracy)
Effectiveness Level (Touched?)	C1-1 Artistic charm C1-2 Aesthetic value	C2-1 Implication and connotation C2-2 Thought promoting	C3-1 Emotional resonance C3-2 Spiritual sublimation	Spiritual (Affecting)
	Aesthetic experience	**Meaningful experience**	**Artistic conception**	**Emotional experience\Decode**
Audience				

In general, these two attributes are the objective expression of the audience's inner essence of aesthetic experience.

The functional value of audio-visual artistic works is to create emotions through pure forms of expression, such as virtual images or musical notes, to draw forth the audience's certain sentiments and make them taste the deepest connotation of artistic works. Therefore, in terms of the functional dimension, different attributes are based on such levels as technique, meaning, and effect. At the technical level, the functional dimension can be divided into Artistic style (A2-1) and Thematic perception (A2-2). Artistic style is an exceptionally expressive way of indicating the interconnection of space, time, and events in the audio-visual world; Thematic perception means that an artistic work profoundly expresses its purpose and meaning through external forms and thus reveals its theme. As Goodman (1990) said in Languages of Art, creating an artistic work was a process of building its structure where existed the abstraction and expression of its style, the establishment and modification of its purposes, and the distinction and connection of its thematic elaborating methods. At the semantic level, two main attributes of the functional dimension are National culture (B2-1) and Spirit of times (B2-2). The National culture in a video embodies national feelings and cultural deposits, basically, with the use of symbolism, regional customs, linguistic structure, etc.; the social environment where art attaches and maintains its status empowers artistic works with the Spirit of times, which can be described as a core value philosophy under specific circumstances. These two attributes provide the audience with a deep interpretation of audio-visual artistic works at the functional level. At the effectiveness level, two main features are Implication and connotation (C2-1) and Thought promoting (C2-2). Art is a reflection of people's desire for knowledge, and researches on its production, nature, and audience are of better help for people to understand its potential order and value (Grosse, 1987). Therefore, on the one hand, Implication and connotation are likely to be a unity of artistic works' artistry and ideology, and an implication of possibilities of being understood deeply; On the other hand, an artistic work will lead people to think based on recognizing its meaning, which is called Thought promoting effect. Just as a literary critic Bryson (1983) put forward, art was a composition of various cultural symbols whose symbiosis relationship between connotation and denotation was highlighted by art in turn. Art tends to represent universal truths about things, not only in the way as it was and as it is thought to be, but also as it ought to be (Aristotle, 1989). So the functional dimension of audio-visual artistic works is to realize the expected effect of the works' meaning as they ought to be, based on the technical and meaning-express levels, as well as to deliver the true content of art.

The essence of art is artists' sentimental illusion, a reaction to some ideas, and the audience will obtain artistic conceptions beyond the outside from the independent existence of this kind of illusion and the space with certain forms (Langer, 1957). At the technical level of the creative dimension, the two attributes of Content conception (A3-1) and Scene creation (A3-2) are summarized. Content conception means that the ingenious structure of artistic works makes people feel touched and then internalizes this feeling into an almighty tension. In other words, the diversity, complexity, and infinity inside artistic works will create an invisible force to be attractive and intriguing; Scene creation refers to the unique scenes and atmosphere of artistic works where the audience can be personally on the scene and immerse themselves in the emotions. Given that, both two attributes are objective conditions for creative performances of audio-visual artistic works. In the semantic level of the creative dimension, the two attributes are Emotion presupposition (B3-1) and Imagination stimulation (B3-2). To realize the design of artistic conception conforming to normal logic, Emotion presupposition will be used to combine the creative rules of

artistic works with their texts; Imagination stimulation becomes the key to developing the audience's spiritual feeling. Under the narrative structure, the audience will have associations with individuals, society, and culture and imagine an infinite space with the symbols of music and scenes. These two attributes are semantic-level strategies artists use to give play to their creativity. In the effectiveness level of the creative dimension, there are also two attributes, which are Emotional resonance (C3-1) and Spiritual sublimation (C3-2). To imagine an artistic work is to imagine the way of life it works. Only by reconstructing the relevant system of meaning like an artist can people grasp the emotions conveyed by art (Danto, 2007). That is why Emotional resonance becomes an inner purpose of realizing aesthetic creativity; At the same time, what becomes the result is Spiritual sublimation, which arouses the audience's latent desires after their perception of art. As Nietzsche (1872) stated in The Birth of Tragedy, that the art could save people could not be put down to its moral connotations but could be put down to the Dionysian spirit. People would have an eternal spiritual bailment after the Dionysian spirit making them realize the pain and cruelty of life. It can be seen from this that the essence of creative audio-visual art is the emotional comfort and the purification of the soul through aesthetic forms.

The dialectical relationship between audio-visual emotional design, emotional experience, and sharing intention

Audio-visual emotional design and emotional experience

Audio-visual art needs to take the audience's emotional feelings as the priority. Empathy is one of the design factors that artists take into account and only artistic works with the ability to reflect this kind of empathy can remind the audience of their life experience, thus realizing a sense of identity and empathy. Arnheim (2003) proposed that people's psychology, including feelings, perception, and memory, could be conceptualized as a hierarchical feedback network by which everyone could have the same reference from a different branch of the network. In other words, the emotional design provides a basis for this reference, establishing emotional tone with abstract audio-visual language, and then constructing a psychological situation from various dimensions to achieve the goal of emotional description. As a psychological phenomenon, the emotional experience usually includes joy, passion, movement, excitement, happiness, etc. An event (i.e., a stimulus) triggers one of several stereotyped responses in the brain and body (Wilson-Mendenhall et al., 2013). The emotions are experienced primarily as structures of feeling which give meaning to relational experience (Burkitt, 2014). Given that, a high-quality design, as a stimulus, must be able to arouse the audience's inner feelings and a certain emotion, so the emotional design is highly related to emotional experience.

Audio-visual emotional design and sharing intention

From the perspective of sociology, Arnold (1987) believed that art could not realize its value without sharing functions, or it could only be defined as some simple words, symbols, or pictures. True art is a form of communication more than expression. As far as the semantic school of communication theory is concerned, an artistic work successfully expressed through a symbolic system must embrace three functions: signification, impression, and communication (Barthes, 1967; Jakobson, 1987). Art can satisfy people's spiritual needs. To fully convey emotional expressions, art language needs to convey emotional meaning through an independent structure based on the functions of signification and impression. As a result, the communication function will be achieved by experience sharing between artistic works and the audience. In this process, how emotions are organized in art becomes the key to satisfying the audience's emotional needs and is also an important factor for information dissemination. Given that, the motivation of audio-visual emotional design is based on the audience's demands, and the main approach of its spread is the audience's sharing intention. Besides, artists' creation of emotional design aims at great communication.

Emotional experience and sharing intention

The audience, or consumers of audio-visual artistic works, can be seen that their inner feelings and potential needs have a positive influence on their actions and decisions. In the process of enjoyment of artistic works, they play an active role, which is that they gain an experience of interaction when they have a perception during the conversation with artistic works. This process indicates that the audience participates in the creation and subsequent sharing of emotional experience they obtain from artistic works is exactly the behavioral result. This is so in everyday life where perception, emotion, action, cognition, and the world tend to fuse (Crippen, 2021). Fictional emotions evoked by art can motivate actions of various kinds (Werner, 2020). As art is complete only after being accepted by people, the connection between the audience and audio-visual artistic works illustrates the completion of appreciation activities. Barthes (2002) stated that the birth of readers must be at the expense of the author's death. Once the audience obtained the ability of independent thinking about art, they could fill in the blanks of the artistic works themselves, only leaving an opportunity for the production of some kind of relationship between artistic works and the audience. The study finds that emotional experience has a significant and positive effect experience symbolic consumption (Tangsupwattana and Liu, 2018). A better understanding of the interrelations between the emotional experience and the

sharing intention can become an important reference for the audience's art consumption. Meanwhile, artists can activate the audience's unconscious and in-depth emotions by using the orientation, methods, and strategies of creation and can influence communication behavior and life orientation.

Methodology

Research structures and presuppositions

This research explores the audience's emotional experience and sharing intention of audio-visual artistic works from the perspective of emotional design. The emotional design consists of three measurement dimensions, namely the aesthetic dimension, the functional dimension, and the creative dimension. The structure of this research is also designed with the use of relevant theories, document analysis (**Figure 2**), and emotional experience as an intermediate variable. The purpose of this design is to discuss whether emotional design can affect the audience's sharing intention. According to the NO.1 research purpose listed in chapter one, the research come up with the following presupposition: Ha1 (Emotional design has a significant influence on emotional experience in musical works); Ha2 (Emotional experience has a significant influence on sharing intention in musical works); Ha3 (Emotional design has a significant influence on sharing intention in musical works); Ha-1 (Emotional experience has an intermediate effect on emotional design and sharing intention in musical works); Ha-2 (Emotional design has an impact on emotional experience and then promote people's sharing intention in musical works); Hb1 (Emotional design has a significant influence on emotional experience in film & television works); Hb2 (Emotional experience has a significant influence on sharing intention in film & television works); Hb3 (Emotional design has a significant influence on sharing intention in film & television works); Hb-1 (Emotional experience has an intermediate effect on emotional design and sharing intention in film & television works); Hb-2 (Emotional design has an impact on emotional experience and then promote people's sharing intention in film & television works). According to NO.2 research purpose, the research comes up with the following presupposition: there are different key factors affecting the emotional experience of musical works as well as film & television works. According to NO.3 research purpose, the research comes up with the following presupposition: Significant differences appear in the audience's evaluation of music, films, and television in the level of emotional design.

Research objects

In order to verify the evaluation matrix and the research structure of emotional experience in audio-visual artistic works, researchers make evaluations with two original works created by themselves as objects, which are an anti-epidemic song and a short film *China Braves Headwind*. The details of the lyrics are shown in **Table 2**.

Questionnaire design

The questionnaire is divided into two parts. The first part is the basic information of the subjects, including gender, age, academic degree, and educational background; The second part lists 22 questions on the evaluation matrix of emotional experience in the audio-visual artistic works, using the Likert scale (1 represents the lowest degree of agreement and 5 represents the highest degree of agreement). With the Likert scale, subjects are asked to rate the two objects, the music, and the short film both named *China Braves Headwind*. Questions 1 to 6 cover categories of aesthetics, which are based on six factors: expression techniques, audio-visual language, rhythm

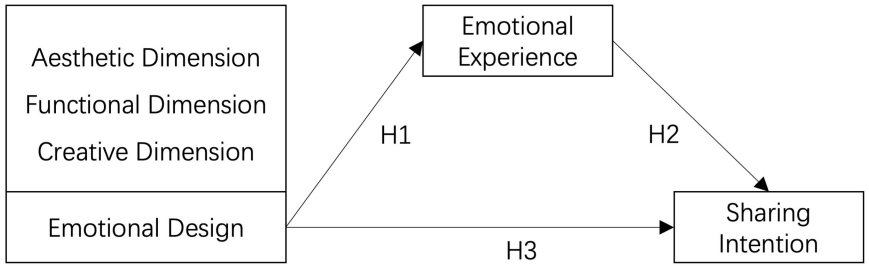

FIGURE 2
Research structure.

TABLE 2 The music *China Braves Headwind.*

Lyric	Mom says always remember	This year's extraordinary winter	People of all ethnic groups	We brave headwinds together
	Don't need to be scared of troubles	In the way of the national revival	As long as we stick as one	Success will come to all
	Medical workers are already in the field	They are Nightingales of the new era	We ride the waves freely with no fear	Under the shelters of their invincible will

and melody, harmonious coexistence, artistic charm, and aesthetic value; Questions 7 to 12 cover categories of function, which are based on six factors: artistic style, thematic perception, national culture, the spirit of times, implication and connotation, and thought promoting; Question 13 to 18 cover categories of creativity, which are based on six factors: content conception, Scene creation, emotion presupposition, imagination stimulation, emotional resonance, and spiritual sublimation. Questions 19 to 21 cover categories of emotional experience which are based on three factors: preference degree, moving degree, and inspiring degree; Question 22 covers the category of sharing intention which is based on the extent people are likely to share artistic works with others. Questionnaire star platform is used to produce such questions and the websites are https://www.wjx.cn/jq/65312477.aspx and https://www.wjx.cn/jq/65057119.aspx.

Experimental design

The research samples are teachers and students from various colleges and universities, ranging in age from 19 to 40 years. Among them, subjects participating in the questionnaire about music include 90 men and 284 women, and subjects participating in the questionnaire about films include 73 men and 253 women, who have undergraduate and postgraduate degrees and have various learning backgrounds, such as art, science and engineering, humanities, and social science, as is shown in **Table 3**. This research conforms to ethical requirements and respects the privacy of the subjects. There is no sex discrimination, racial discrimination, and other issues. The questionnaires are mainly distributed online where researchers ask for the subjects' agreement to fulfill the questionnaires. Researchers convene the subjects through Tencent Conference software as an online laboratory. At first, researchers elaborate on their purpose and the instructions for answering the questions in detail before playing the music *China Braves Headwind*. After the play of music, subjects are allowed to fulfill the first questionnaire in 10 min. Then, they have 10 min to fulfill the second questionnaire after watching the short film *China Braves Headwind*. After the questionnaires are submitted, researchers discard samples that cannot meet the conditions after reviewing them. The standard is that questionnaires with the same scores for too many questions are eliminated. Finally, 374 valid questionnaires for the music test and 326 for the film test are collected, with subjects 17 times more than the data. In the Structural Equation Modeling analysis, some scholars' research show that the demand for the number of samples is related to the length of the research scale, and the longer the research scale is, the more samples will be required. The ideal number of samples is at least five times more than the number of measurement variables, for which the number of samples should be between 200 and 400 (Ghiselli et al., 1981; Gorsuch, 1983; Hair et al., 1998; Wu and Tu, 2010). Therefore, the samples taken in this research meet the needs of the number of samples for research and analysis.

The questionnaire was subject to reliability and validity tests, regression analysis and dependent samples *t*-test with statistical tests using SPSS 22.0, as well as structural equation modeling (SEM) in AMOS 22.0. Whether the measurement scale is feasible can be confirmed by verification factors. And then through the path diagram of SEM, the presuppositions can be verified followed by multiple regressive analyses to explore the key factors affecting the audience's emotional experience. Finally, the research will study the audience's differences in emotional design

TABLE 3 Profile of the respondents.

Characteristics	Levels	Film and television works	Musical works
		Number	Number
Gender	Male	73	90
	Female	253	284
Age	19–30	315	363
	31–40	11	11
Education	Undergraduate	306	350
	Postgraduate	20	24
Academic degree	Arts	62	78
	Science and engineering	93	121
	Humanities and social science	171	175

in the music and the short film, using the dependent samples *t*-test.

Results

The analysis of structural model construction

Convergent validity and discriminant validity

At this stage, the research uses the method of measurement model analysis. Based on valid questionnaires on the music *China Braves Headwind*, the research launches the model construction analysis and deals with the structural relationship between the observed variables and latent variables through confirmatory factor analysis (CFA). And then, convergent validity and discriminant validity in the measurement model are tested. According to the findings through CFA, in terms of factor loadings, the beauty dimension ranges from 0.772

TABLE 4 The research model confirmatory factor analysis table.

Dimension	Items	Skewness	Kurtosis	Parameter saliency estimation				Factor loadings	Question reliability	Composite reliability	Convergent validity
		SK	KU	Unstd.	S.E.	t-value	P	Std.	SMC	CR	AVE
Beauty	A1-1	−0.502	0.081	1.000				0.800	0.640	0.919	0.653
	A1-2	−0.527	−0.213	0.996	0.058	17.095	***	0.798	0.637		
	B1-1	−0.685	0.007	1.056	0.060	17.538	***	0.814	0.663		
	B1-2	−0.486	−0.420	1.045	0.059	17.704	***	0.820	0.672		
	C1-1	−0.402	−0.426	1.193	0.065	18.397	***	0.844	0.712		
	C1-2	−0.348	−0.387	1.020	0.062	16.366	***	0.772	0.596		
Function	A2-1	-0.737	0.087	1.000				0.683	0.466	0.904	0.612
	A2-2	−1.121	1.011	0.979	0.075	13.105	***	0.747	0.558		
	B2-1	−0.942	0.480	0.949	0.071	13.318	***	0.761	0.579		
	B2-2	−0.886	0.357	1.024	0.071	14.488	***	0.838	0.702		
	C2-1	−0.760	0.150	1.151	0.079	14.553	***	0.843	0.711		
	C2-2	−0.941	0.898	1.012	0.072	14.049	***	0.808	0.653		
Creativity	A3-1	−0.628	0.101	1.000				0.735	0.540	0.925	0.675
	A3-2	−0.499	−0.485	1.245	0.074	16.874	***	0.866	0.750		
	B3-1	−0.615	−0.242	1.176	0.072	16.316	***	0.839	0.704		
	B3-2	−0.321	−0.668	1.252	0.079	15.856	***	0.817	0.667		
	C3-1	−0.863	0.342	1.208	0.073	16.486	***	0.847	0.717		
	C3-2	−0.679	0.079	1.115	0.070	15.902	***	0.819	0.671		
Emotional experience	D	−0.367	−0.377	1.000				0.831	0.691	0.897	0.745
	F	−0.458	−0.237	1.071	0.053	20.372	***	0.922	0.850		
	G	−0.596	0.052	0.923	0.049	18.897	***	0.833	0.694		
Emotional design	Beauty	/	/	1.000				0.924	0.854	0.956	0.879
	Function	/	/	0.896	0.062	14.548	***	0.910	0.828		
	Creativity	/	/	1.117	0.072	15.498	***	0.978	0.956		

***$p < 0.001$.

TABLE 5 Second-order model confirmatory factor analysis table.

Second-order CFA	χ^2 value	Degree of freedom (df)	χ^2/df	GFI	AGFI	CFI	RMSEA
1. Model 1: First-order Three-factor Model (There are correlates among these factors)	397.503	132.000	3.011	0.896	0.865	0.951	0.073
2. Model 2: Second-order Factor Model	397.503	132.000	3.011	0.896	0.865	0.951	0.073
The Advised Value	The smaller, the better	The larger,the better	<5	>0.8	>0.8	>0.9	<0.08

to 0.844; the function dimension from 0.683 to 0.843; the creativity from 0.735 to 0.866; emotional experience dimension from 0.831 to 0.922; emotional design dimension from 0.910 to 0.978. All factor loadings are more than 0.5, showing that the measurement model meets the standard, as shown in **Table 4**. What's more, the composite reliability (CR) of all dimensions in the research ranges between 0.897 and 0.956, and the average variance extracted (AVE) varies between 0.612 and 0.879. Both of them conform to the values 0.60 and 0.50 — advised ones in related research (Fornell and Larcker, 1981; Bagozzi and Yi, 1988; Hair et al., 1998). The data indicate the internal consistency in the model is acceptable and has convergent validity. When it comes to the verification analysis of discriminant validity, The value of the square root of AVE for every dimension in the research is 75% more than the proportion of the total number of correlation coefficients for every dimension of the total compared number. It shows there is desirable discriminant validity among the variables (Hair et al., 1998).

Analysis of second-order confirmatory factor analysis model fitness

The research can decide whether to use the first-order CFA or the second-order CFA based on the concept of the targeted factor (Marsh and Hocevar, 1985). According to the fitness related to the first-order model, this target factor is removed by the fitness of the second-order model. If the result is closer to 1, that indicates that the second-order model is more streamlined, and the second-order model can represent the first-order model. In the research, the research designs and compares the first-order three-factor model (there are correlates among these factors) and the second-order factor model (**Figure 3**). The result shows χ^2(Model1)/χ^2(Model2) = 1 and the target factor of the model is 1 (**Table 5**). Therefore, the research uses the result of the second-order CFA to analyze the model construction (Lai et al., 2010). The study indicates that there are correlates among three factors, such as beauty, function, and creativity. They are key factors in emotional design. It is reasonable to use the second-order CFA in the research.

The overall model fitness test

The structural equation model (SEM) assumed in this research tests its multivariate normality in two aspects. One is the normality of observed variables, and the other is the multivariate normality after observed variables integration. Some scholars put forward that when the absolute values of the skew coefficient and kurtosis coefficient of observed variables are less than 2, it can be determined that it has normality (Bollen and Long, 1993; Qiu, 2006; Yen, 2018). From **Table 4**, the research can figure out that the absolute values of the skew coefficient and kurtosis coefficient of all observed variables in the structural equation model in the research are less than 2. Therefore, the research can safely conclude that the observed variables have normality. What's more, the tested multivariate value is 42.448 > 5, which does not meet the multivariate normality standard (Barbara, 2016). When the data of SEM does not have multivariate normality, Bollen–Stine bootstrap can be used to correct standard errors and the statistics of fitness (Bollen and Stine, 1992; Enders, 2005; Fisher and King,

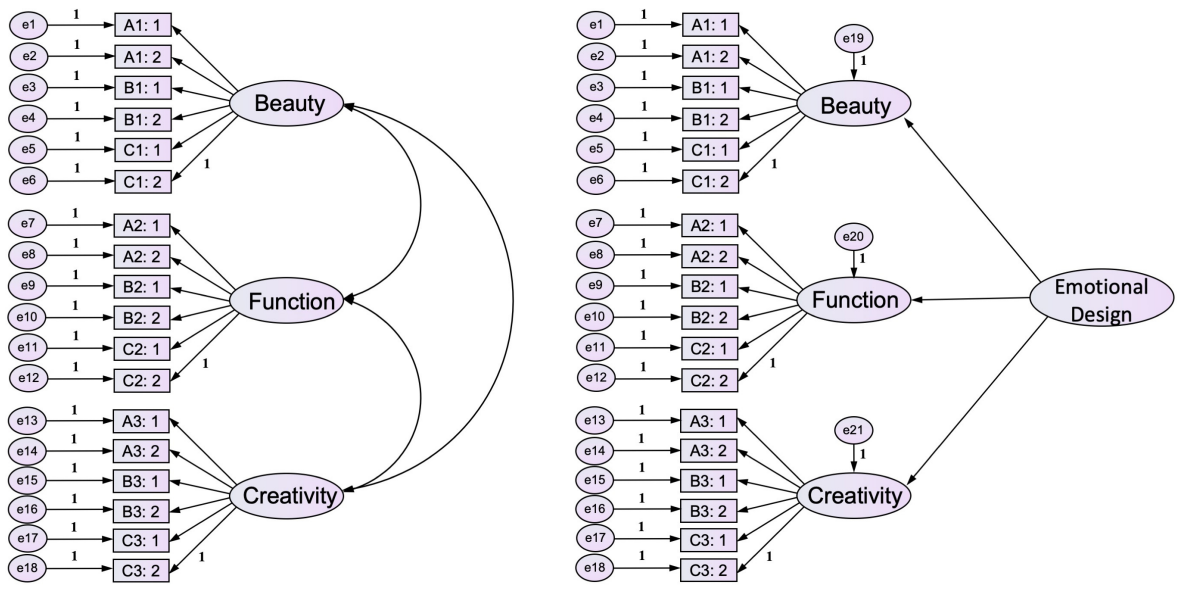

FIGURE 3
First-order three-factor model (There are correlates among these factors) and second-order factor model.

2010). After Chi-square correction, the research tests the model fitness. The results show that the ratio of chi-square value to degree of freedom range from 1 to 3 (χ^2/DF = 1.35), GFI = 0.962 > 0.9, AGFI = 0.95 > 0.9, RMSEA = 0.031 < 0.08, RMR = 0.041 < 0.08, TLI(NNFI) = 0.989 > 0.9, CFI = 0.99 > 0.9, IFI = 0.99 > 0.9, and Hoelter's N(CN) = 277.528 > 200. From what has been suggested above, the overall index of this model is acceptable (Doll et al., 1994; Baumgartner and Homburg, 1996; Hair et al., 2010; Chen and Wang, 2011). In the study, the theoretical structure of the overall structural model is well-matched with the empirical data and the model has desirable construct validity.

Model research hypothesis testing

In the research, the SEM is used to test the validation of research hypotheses. After the research and analysis, there are six dimensions and 22 measurement variables. Results of the path diagram of musical works structure model analysis are shown in Figure 4 and Table 6 — Ha1: emotional design in musical works has a notable influence on emotional experience; Ha2: emotional experience in musical works has a notable influence on sharing intention; Ha3: emotional design in musical works has a notable influence on sharing intention. Therefore, the above three hypotheses are true. Results of the path diagram of film & television works structure model analysis are shown in Figure 5 and Table 6 — Hb1: emotional design in film & television works has a notable influence on emotional experience; Hb2: emotional experience in film & television works has a notable influence on sharing intention; Hb3: emotional design in film & television works has a notable influence on sharing intention. Therefore, the above three hypotheses are true.

The research has shown that emotional design, emotional experience, and sharing the intention of audio-visual works are influenced by each other. The research can conclude that the hypotheses are true. Ha-1: in the musical works,

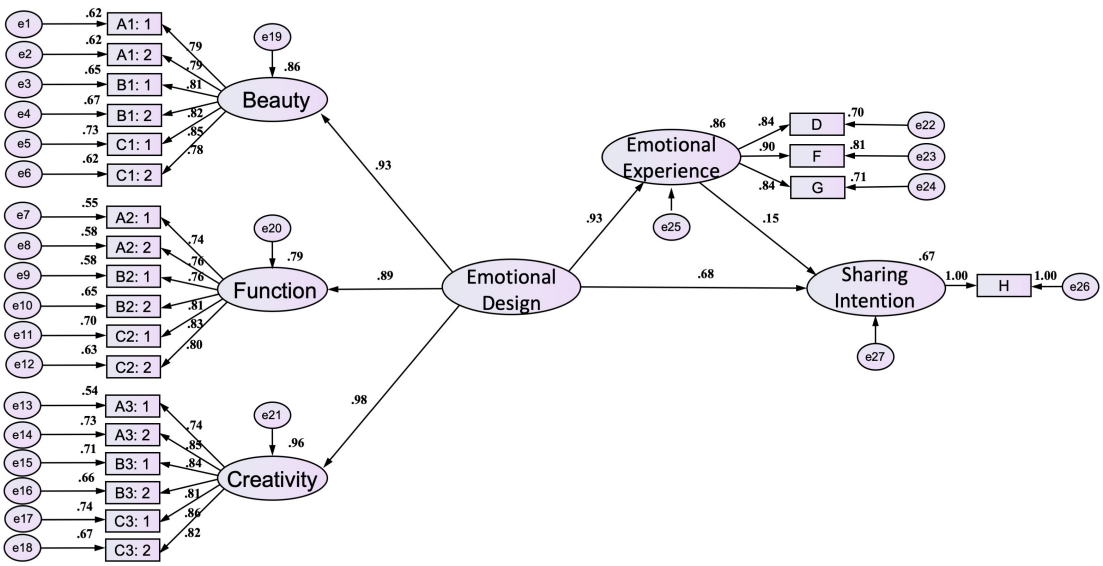

FIGURE 4
Path diagram of musical works structure model in the research.

TABLE 6 Path coefficient of structural statistical model.

Type	Path	Coefficient (Variant)			Standardized path coefficient	t-value C.R.	P	Decision
Musical works	Ha1	Emotional Design	->	Emotional Experience	0.930	17.384	***	Supported
	Ha2	Emotional Experience	->	Sharing Intention	0.150	3.342	***	Supported
	Ha3	Emotional Design	->	Sharing Intention	0.679	17.384	***	Supported
Film & Television works	Hb1	Emotional Design	->	Emotional Experience	0.875	14.299	***	Supported
	Hb2	Emotional Experience	->	Sharing Intention	0.187	3.897	***	Supported
	Hb3	Emotional Design	->	Sharing Intention	0.630	14.299	***	Supported

***$p < 0.001$.

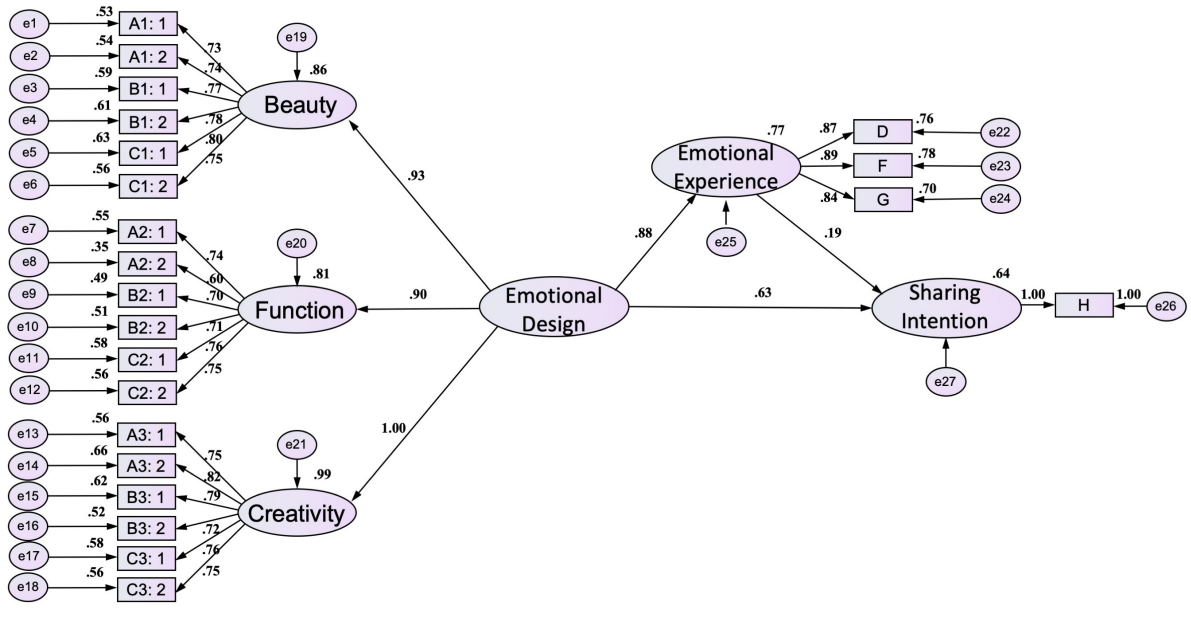

FIGURE 5
Path diagram of film & television works structure model in the research.

emotional experience plays a mediating role between emotional design and sharing intention; Ha-2: in the musical works, the emotional design will impact emotional experience, further improving sharing intention. Hb-1: in the film & television works, emotional experience acts as an intermediary between emotional design and sharing intention; Hb-2: in the film & television works, the emotional design will impact emotional experience, further improving sharing intention.

To test the indirect effect of emotional design on sharing intention and the mediating effect of emotional experience in musical works, the research uses the Sobel-Goodman tests. The results show that the Z value is 3.264, more than the standard value of 1.96, indicating the mediating effect is remarkable (Sobel, 1982, 1986). And then, The research uses the Bootstrap techniques for error estimation to continue the hypotheses test and re-estimate the confidence level, standard error, standardized coefficient, and significant level (Z value) of indirect effect (MacKinnon et al., 2007; MacKinnon, 2008; Taylor et al., 2008). The 95% confidence interval of the indirect effect path of emotional design on sharing intention does not contain zero. Its Bias-corrected (0.115, 0.337), percentile (0.110, 0.333), and $p < 0.001$ indicate the significance and the direct effect is not zero; the Z value of the indirect effect is 3.911, more than 1.96 and the results show the significance and there is the mediating effect, as shown in Table 7. In addition, the Z value of the direct effect is 16.400, more than 1.96, and the results show significance, indicating that the emotional design does have a direct effect on sharing intention (Table 7). Therefore, all results show there is a mediating effect and it plays the role of partial mediation, and they can prove the hypothesis Ha-1: in the musical works, emotional experience plays a mediating role between emotional design and sharing intention. From the standardized path coefficient in the model, the research can know that the influence path coefficient of emotional design on sharing intention (direct effect) is 0.68; the path coefficient of emotional design on sharing intention (indirect effect) is 0.140 (0.93*0.15); the total effects are 0.93*0.15 + 0.68 = 0.82 > 0.68 (total effects > direct effect). All data can prove hypothesis Ha-2: in the musical works, the emotional design will impact emotional experience, further improving sharing intention.

To test the indirect effect of emotional design on sharing intention and the mediating effect of emotional experience in film & television works, the research uses the Sobel-Goodman tests. The results show that the Z value is 3.7332, more than the standard value of 1.96, indicating the mediating effect is remarkable. And then, The research uses Bootstrap techniques for error estimation to continue the hypotheses test and re-estimate the confidence level, standard error, standardized coefficient, and significant level (Z value) of indirect effect. The 95% confidence interval of the indirect effect path of emotional design on sharing intention does not contain zero. Its Bias-corrected (0.102, 0.421), percentile (0.100, 0.420), and $p < 0.001$ indicate the significance and the direct effect is not zero; the Z value of the indirect effect is 3.229, more than 1.96 and the results show the significance and there is the mediating effect, as shown in Table 7. In addition, the Z value of the direct effect is 12.165, more than 1.96, and the results show significance, indicating that the emotional design does have a direct effect on sharing intention. Therefore, all results show

TABLE 7 The standardized indirect, direct, and total mediating effects in the musical works structural model.

Variants	Point estimation value	Product of coefficients		Bias-corrected 95% CI		Percentile 95% CI		Two-tailed significance
		SE	Z	Lower	Upper	Lower	Upper	
Musical works								
Standardized total effects								
Emotional design-> Sharing intention	1.285	0.067	19.179	1.169	1.428	1.165	1.426	0.000***
Standardized indirect effect								
Emotional design-> Sharing intention	0.219	0.056	3.911	0.115	0.337	0.110	0.333	0.000***
Standardized direct effect								
Emotional design-> Sharing intention	1.066	0.065	16.400	0.948	1.201	0.950	1.202	0.000***
Film and television works								
Standardized total effects								
Emotional design-> Sharing intention	1.302	0.090	14.467	1.131	1.502	1.130	1.501	0.000***
Standardized indirect effect								
Emotional design-> Sharing intention	0.268	0.083	3.229	0.102	0.421	0.100	0.420	0.000***
Standardized direct effect								
Emotional design-> Sharing intention	1.034	0.085	12.165	0.869	1.201	0.878	1.211	0.000***

***$p < 0.001$.

there is a mediating effect and it plays the role of partial mediation, and they can prove the hypothesis Hb-1: in the film & television works, emotional experience plays a mediating role between emotional design and sharing intention. From the standardized path coefficient in the model, the research can know that the influence path coefficient of emotional design on sharing intention (direct effect) is 0.63; the path coefficient of emotional design on sharing intention (indirect effect) is 0.167 (0.88*0.19); the total effects are 0.88*0.19 + 0.63 = 0.797 > 0.63 (total effects > direct effect). All data can prove hypothesis Hb-2: in the film & television works, the emotional design will impact emotional experience, further improving sharing intention.

The analysis of key factors affecting emotional experience with mediating effect

All the above research has proven that the emotional design both in musical works and film & television works has a significant effect on the audience's emotional experience. And, emotional experience with mediating effect serves as the emotional bond between the artists' creation and the audience's perceptions and their sharing intention. At this stage, the research will take the audience's emotional experience as a dependent variable and nine evaluation factors listed in the Emotional Design Evaluation Matrix of Audio-visual Art as indicators and predictive variables of emotional design in the works. Through these efforts, the research will carry on the multivariate regression analysis on the factors affecting the audience's emotional experience and further explore the impacts of nine factors on emotional experience.

As is shown in Table 8, from all predictive variables and the correlation between the audience and the intensity of emotional experience in the musical works, the research can know nine predictive variables and their correlation coefficients are 0.703, 0.740, 0.737, 0.720, 0.720, 0.602, 0.650, 0.721, 0.766, 0.820, meeting the significant level 0.001. From the multivariate regression analysis in Table 8, the research can find that the correlation coefficient R between overall prediction variables and dependent variables is 0.869. And the explanatory variance of nine predictive variables on the intensity of the emotional experience is 75.6% and the F value is 73.291, meeting the significant level, 0.000. According to the results, there are significant correlations between the nine attributes and the intensity of emotional experience, and these nine attributes have a considerable degree of joint explanatory power for the intensity of the emotional experience. Among these attributes, the more prominent ones in order are A1 (Expression techniques, Audio-visual language), B1 (Rhythm and melody, Harmonious coexistence), A2 (Artistic style, Thematic perception), B2 (National culture, Spirit of times), B3 (Emotion presupposition, Imagination stimulation), and C3 (Emotional resonance, Spiritual sublimation). All

TABLE 8 The regression analysis of emotional experience.

Type	Dependent variables	Predictive variables	Simple correlation	Regression coefficient	Standardized regression coefficient	T value	Significance level
Musical works	The Intensity of "Emotional Experience" (N = 374)	A1	0.703***	0.117	0.106	2.432*	0.015
		B1	0.740***	0.159	0.147	3.015**	0.003
		C1	0.737***	0.063	0.062	1.236	0.217
		A2	0.720***	0.130	0.116	2.577*	0.010
		B2	0.602***	−0.116	−0.093	−2.013*	0.045
		C2	0.650***	0.049	0.042	0.899	0.369
		A3	0.721***	0.053	0.050	1.003	0.316
		B3	0.766***	0.128	0.129	2.548*	0.011
		C3	0.820***	0.425	0.410	8.240***	0.000
		Invariable	−0.237				
		R = 0.869	Rsq = 0.756	F = 125.175	SigmfF = 0.000		
Film and Television works	The Intensity of "Emotional Experience" (N = 326)	A1	0.613***	0.073	0.068	1.341	0.181
		B1	0.687***	0.113	0.108	1.899	0.058
		C1	0.643***	0.016	0.017	0.312	0.755
		A2	0.664***	0.153	0.119	2.253*	0.025
		B2	0.522***	−0.071	−0.056	−1.169	0.243
		C2	0.608***	0.066	0.060	1.141	0.255
		A3	0.721***	0.208	0.199	3.308**	0.001
		B3	0.711***	0.114	0.110	1.837	0.067
		C3	0.743***	0.350	0.325	6.102***	0.000
		Invariable	−0.220				
		R = 0.822	Rsq = 0.676	F = 73.291	SigmfF = 0.000		

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

these attributes represent key factors affecting the intensity of emotional experience in musical works.

From all predictive variables and the correlation between the audience and the intensity of emotional experience in the film & television works, the research can know nine predictive variables and their correlation coefficients are 0.613, 0.687, 0.643, 0.664, 0.522, 0.608, 0.721, 0.711, 0.743, meeting the significant level, 0.001. From the multivariate regression analysis in Table 8, the research can find that the correlation coefficient R between overall prediction variables and dependent variables is 0.822. And the explanatory variance of nine predictive variables on the intensity of "emotional experience" is 67.6% and the F value is 73.291, meeting the significant level, 0.000. According to the results, there are significant correlations between the nine attributes and the intensity of emotional experience, and these nine attributes have a considerable degree of joint explanatory power for the intensity of the emotional experience. Among these attributes, the more prominent ones in order are A2 (Artistic style, Thematic perception), A3 (Content conception, Scene creation), and C3 (Emotional resonance, Spiritual sublimation). All these attributes represent key factors affecting the intensity of emotional experience in film & television works.

Analysis of difference in perception of emotional design

At this stage, to explore the audience's perception of evaluation attributes in different types of works with the same theme, the research employed the dependent sample t-test to test the evaluation factors of musical works and film & television works. The analysis is shown in Table 9. Among nine evaluation factors, significant differences between musical works and film & television works are seen in attribute C1, attribute C2, affection level, touch level, inspiration level, and sharing intention. The comparative analysis of the average score of these evaluation factors shows that the average score of the film & television works is higher than that of the musical works. Specifically, there is a notable difference in the two types in attribute A1 and attribute B1 ($P < 0.05$), with the significance level of 0.012 and 0.028, respectively; there is a notable difference in the two types in attribute B2, attribute A3 and attribute B3 ($P < 0.01$), with the significance level of 0.003, 0.005, and 0.006; there is a well-significant difference in in the two types in attribute A2, attribute C3, element D, element F, element G, and element H ($P < 0.001$), with the significance level of 0.000.

TABLE 9 The table of analysis of differences in testers' perception of emotional design.

Items	Type	Number	M	SD	t value	Significance level	Difference comparison
A1	Music	374	3.930	0.7890	−2.531*	0.012	Music <
	F & T	326	4.075	0.7123			F & T
B1	Music	374	4.003	0.8080	−2.202*	0.028	Music <
	F & T	326	4.132	0.7345			F & T
C1	Music	374	3.822	0.8585	−1.464	0.144	Music <
	F & T	326	3.914	0.7925			F & T
A2	Music	374	4.186	0.7703	−4.446***	0.000	Music <
	F & T	326	4.416	0.5947			F & T
B2	Music	374	4.326	0.6951	−3.027**	0.003	Music <
	F & T	326	4.474	0.5962			F & T
C2	Music	374	4.218	0.7476	−0.979	0.328	Music <
	F & T	326	4.271	0.6911			F & T
A3	Music	374	3.957	0.8265	−2.818**	0.005	Music <
	F & T	326	4.124	0.7279			F & T
B3	Music	374	3.890	0.8779	−2.747**	0.006	Music <
	F & T	326	4.058	0.7388			F & T
C3	Music	374	4.068	0.8389	−3.718***	0.000	Music <
	F & T	326	4.288	0.7101			F & T
D: Affection level	Music	374	3.626	0.9927	−5.027***	0.000	Music <
	F & T	326	3.975	0.8482			F & T
F: Touch level	Music	374	3.786	0.9588	−3.945***	0.000	Music <
	F & T	326	4.058	0.8663			F & T
G: Inspiration level	Music	374	3.939	0.9140	−3.579***	0.000	Music <
	F & T	326	4.169	0.7878			F & T
H: Sharing intention	Music	374	3.703	1.0837	−3.581***	0.000	Music <
	F & T	326	3.975	0.9279			F & T

F & T refers to the film & television works, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Discussion

The model construction analysis in the research shows that the construct validity is desirable, the scales of the research are feasible, and the Emotional Design Evaluation Matrix of Audio-visual Art is reasonable. The research explained the emotional design and demonstrated the way of coding by artists from three dimensions, such as beauty, function, and creativity. There are nine evaluation factors in three dimensions, measuring the effects and experience of these dimensions from the levels of techniques, semantics, and effects. Through these efforts, the research has found that the emotional design will attract the audience, help them perceive the creation, and touch them.

According to the structural equation model survey, the emotional design of musical and film & television works will have an impact on the audience's sharing intention. Specifically, the emotional design has a significant positive effect on the emotional experience; the emotional experience has a significant positive effect on the sharing intention; the emotional design has a significant positive effect on the sharing intention; the emotional experience serves as a partial mediator between emotional design and sharing intention. The emotional design of both musical and film & television works has a significant effect on the audience's emotional experience, further improving their sharing intention. It has been suggested digital cultural offerings increased optimism indirectly through an increase in aesthetic experience, perceived autonomy, and relatedness (Koehler and Neubauer, 2020; Gotthardt et al., 2022). As two kinds of creative activities, musical and film & television works have their unique text processing modes. Barthes (2005) puts forward that artistic works include extension information and connotation information. The emotional design hides in connotation information through coding, which requires the audience to interpret it imaginatively. This process promotes emotion to occur. Kant (2002) believes the appreciation judgment is perceptual judgment. Through imagination, the audience will produce pleasant or unpleasant emotional connections with the subject of art. The emotional design in artistic works is the prerequisite for the audience to perceive and judge. Musical works create auditory sensual pleasure through musical notes, while film & television works stimulate emotional experience through the combination of pictures and sound. Therefore, the purpose and method of emotional design influence the audience's experience of artistic works. Furthermore, the audience's emotional experiences including such emotions as love, pleasure, satisfaction, excitement, and moving from the audio-visual works will positively drive their behavior and then impact how the works are communicated (Wieck et al., 2022). Sharing and communicating online during the lockdown promoted person-to-person virtual interaction which contributed to potentially social contact and cross-cultural communication (Fraser et al., 2021). After getting the

emotional experience, the audience will connect works with their values and judgments so that the way of sharing and communication will be decided by the perception and feeling of the audience.

The research, through multivariate regression analysis, explores the key factors impacting the emotional experience in musical works and film & television works. The results indicate key factors affecting the emotional experience in musical works represent the level of techniques (A1, A2) and the level of semantics (B1, B2, B3) in the Emotional Design Evaluation Matrix of Audio-visual Art. And key factors affecting the emotional experience in film & television works represent the level of techniques (A2, A3) only. Therefore, attribute A2 and attribute C3 serve as common factors affecting the emotional experience in both types of art. The music *China Braves Headwind* uses exquisite artistic expression techniques in composition, arrangement, and singing, and has a rich melody, reasonable tune, vivid singing, and graceful harmony. The style of the music is infectious and the main idea of anti-epidemic conveyed is clear. From what has been suggested above, musicians must take the audience's physical and psychological feelings into account during the COVID-19 pandemic. Only in this way, can the audience resonate with works. To present the emotional context in works, apart from the attributes in the level of techniques, creators must convey profound meanings to consumers in ways that resonate with them. During the pandemic, emotional resonance brought by music had a positive effect on the sense of happiness (Cabedo-Mas et al., 2021). As Langer (1986) said, music represents the highest level of reflection of life, that is, the symbolic expression of human emotional activities. In the short film *China Braves Headwind*, the application of various techniques like scene settings, plot arrangements, and styles produces a kind of fictional experience. They will touch the audience and make them emotional through the power of visual sense. The reason why attribute A2 (Artistic style, Thematic perception) serves as a key factor affecting the emotional experience in both musical works and film & television works is that it demonstrates works' features from the outside to the inside. The artistic style reflects the multivariate artistic phenomenon and abstract symbols represent the connotations of works, which meets the viewers' inner needs and further produces the empathetic effect. As for themes in works, only a clear intention can convey the creators' purpose and significance. Therefore, only when valid information both in musical works and film & television works is conveyed, will the audience get the emotional experience. C3 (Emotional resonance, Spiritual sublimation) at the level of effects will reach deep into the soul of the audience. The attribute shows that musical works and film & television works deeply probe into the essence of life, which gives viewers spiritual support and gives birth to some emotion. In this case, the emotional experience of social belonging, empathy, and kindness have been described as critical factors for boosting social cohesion, and fostering resilience, recovery, and development from the COVID-19 pandemic (Niels et al., 2022). Therefore, this attribute serves as the most important factor in evaluating the emotional experience in audio-visual works.

Through the dependent sample *t*-test, the research has found that there is a significant difference in seven attributes, emotional experience, and sharing intention among the audience in the musical and film & television works with the same subject. And the average score of film & television works is higher than that of musical works. Therefore, compared with musical works, film & television works are likely to resonate with the audience. Although there are differences in artistic forms between the two types of art, both of them boasts endless artistic attraction and aesthetic value. The short film *China Braves Headwind* is good at combining pictures and sounds, creating a virtual-and-real situation and narrative text, enhancing the interest of the audience, and making them enter a broad space for imagination. Especially, visual representation, with which meaning is constructed through the structuring of these elements (Cano-Martínez et al., 2022), is a recreation of social, cultural, and ideological mediation (Desai, 2000; Knochel, 2013). The music *China Braves Headwind* is more like the art of poetry. The image it outlines requires the audience to have a higher aesthetic taste to mobilize the emotional experience of life. Breaking the cultural barrier, the combination of music, lyrics, and videos amid the epidemic played a critical role in maintaining relationships and promoting emotional communication (Lydia, 2022). As a result, the emotional resonance relieved the sorrow and bitterness of individuals and society. Therefore, film & television works with high-quality musical works can help open up the conception of artistic works and convey their meanings to viewers, further promoting their dissemination. As Eco (2005) believes, the artistic works by artists remain to be finished, which will be done by recipients through their deductive dialogs. Film & television works are more open than musical works. Their multivariate structures mobilize the sense organs of the audience. Therefore, their awakening of self-consciousness and their interpretation after art decoding serve as important factors in art communication.

Conclusion

As the mediums and resources of communication update at a high speed, the audience has transformed from passive recipients to experiencers and even participants and producers that will select medium consumption actively and their demands for audio-visual works are improving. So it is of great significance to meet individuals' emotional needs during the pandemic. Based on the emotional communication mode of audio-visual art theoretically, the research explores the emotional design factors in the communication of audio-visual art and the audience's perceptive experience. The results of the research can offer some useful suggestions for the long-term

development of audio-visual art. The conclusions are as follows: (1) The emotional design evaluation matrix based on the emotional communication model is reasonable, and the scales of this research are feasible. The measurement tools in the research integrate emotional factors into the creation of audio-visual works and further analyze the audience's emotional experience and sharing intention. (2) The emotional design of audio-visual works can significantly affect the audience's emotional experience and further improve sharing intention. As a result, the emotional experience is essential to the connection between audio-visual works, artists, and the audience. Only when works stimulate viewers to produce special emotions, can their added value beyond their forms be seen and spread widely. (3) Attribute A2 (artistic style, thematic perception) and attribute C3 (emotional resonance, spiritual sublimation) serve as common factors affecting the emotional experience in terms of both musical works and film & television works. (4) Compared with musical works, film & television works are likely to resonate with the audience. The combination of music and visual sensation can help open up the conception of artistic works and convey their meanings to viewers.

The practical significances of the research are as follows: first, in terms of the design of audio-visual arts, having a deep understanding of the audience's psychological perception and emotional engagement with the art will help the artists think about how to create works innovatively and meet the marketization needs. Second, focusing on the needs of the audience's artistic perception is the prerequisite for forming an aesthetic economic climate. The endeavor will improve the cultural images of the audio-visual art industry, make it more competitive, and stimulate new cultural consumption demands during the COVID-19 pandemic.

Limitations and prospects

However, there are still some deficiencies in this study. First, as almost every area was hit by COVID-19 for a long time, the impact on testers of different ages varies greatly. Therefore, it should be discussed further evaluation factors constructed in the research and the difference in the perception of artistic works. Second, the research has not analyzed deeply the current audio-visual arts sharing and communication path. Follow-up research can be based on this study to explore the impact of audience participation behavior-related factors, and initiate an in-depth discussion on the culture, market, brand strategy, and other aspects of audio-visual art.

Data availability statement

The original contributions presented in this study are included in the article/**Supplementary material**, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving human participants were reviewed and approved by Shanghai Dianji University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

W-TF identified research ideas, designed and facilitated this research, wrote the draft, and made substantial revisions to this work. J-HS collected the data. Q-DL contributed to the conception and design of the study. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1032808/full#supplementary-material

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Can selfies trigger social anxiety? A study on the relationship between social media selfie behavior and social anxiety in Chinese youth group

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As modernization continues to advance the development of digital society, social media has become an important part of people's daily life and an extension and expansion of real social interactions. In this process, social media use and individual social psychology have increasingly become the object of academic attention, among which the relationship between selfie behavior, as an important interaction practice of youth group in social media, and social anxiety needs to be further explored and discussed. The purpose of this study is to investigate the current situation of selfie behavior, body image, and social anxiety among young people in China. Using a combination of qualitative and quantitative empirical methods, a questionnaire survey was conducted in Chinese mainland (n=920) to examine the mediating effects of social comparison and body image on social media selfie behavior and social anxiety, and found that there was a significant negative relationship between youth social media selfie behavior and social anxiety, while the sequence mediating effects of social comparison and body image were significant. The findings of the study provide new ideas and directions for exploring the intervention paths of youth social psychology in the era of image socialization.

KEYWORDS

selfie behavior, social anxiety, social comparison, body image, youth groups

Introduction

Along with the development of social media, social media has integrated a variety of information dissemination methods, changed the form of human interaction in interpersonal communication, and constructed a real online virtual space. Through the use of social media, more and more people have been given the opportunity to participate in culture, consume and produce, and in these opportunities, they have realized the construction of their self-image. For the youth group, their self-presentation in social media is accompanied by purpose and selectivity (Pang, 2020), "Selfie" is an important means of self-presentation and impression management for the youth group (Lee and Lee, 2019).

In the digital space, the digitized body is an important way of presenting individual body image, for example, individuals record their appearance, physique and behavior through selfie photos or videos, which is a common performance of digitized body in digital existence. The selfie image has become a new expression of their life and learning, social sharing, and leisure, reflecting the release of the desire for self-expression of the youth group in the social media environment, and a new social strategy of digital body participation in social interaction (Tiggemann et al., 2020). The so-called selfie refers to individuals taking pictures of themselves through devices with camera devices such as digital cameras, smartphones, and tablets, and the act of posting refers to individuals posting their selfie photos on social media for display, recording, or sharing, and receiving likes and comments, thus forming a selfie cycle. Some individuals also choose to make elaborate adjustments and retouch their selfies through digital editing technology in order to achieve a better presentation. Today, selfies have become a common and popular cross-cultural trend (Shir and Yair, 2017).

However, with the immersion, popularity and anxiety brought about by the phenomenon of selfies, the social problems resulting from the image of an individual's appearance and related body perceptions have proliferated, not only affecting the formation of immature esthetics and aberrant psychology in youth group, but also leading to reduced well-being among family parents and children, negative body satisfaction and negative social psychology, among others (Verduyn et al., 2015), which has sparked widespread concern in the community. According to the social comparison theory proposed by Festinger, the level of social media participation will cause individuals to have a high level of social comparison psychology, especially the self-representation behavior in social media will make individuals pay more attention to their appearance and others' evaluation of their body condition, and individuals with a high level of social comparison psychology will affect the formation of negative body image, and thus individuals' concerns about the negative evaluation given by others during the social process. This can lead to social anxiety due to concerns and fears about the negative evaluations given by others during social interaction (Festinger, 1954). In particular, the current global pandemic of Corona Virus Disease (COVID-19) that emerged in early 2020 is not over, with occasional outbreaks of various scales around the world, and the highly contagious nature of the virus has had a significant impact on people's daily social lives. The Chinese government implemented strict universal travel restrictions in early 2020, including measures such as home quarantine, stopping offline teaching, and implementing online teaching, which severely affected the psychological and emotional well-being of the youth population (Wang and Zhao, 2020). In this social context, where social activities are gradually shifting to online media and people's social connections are shifting from offline to online, it is common for people to feel nervous, anxious, or upset in the face of sudden lifestyle changes (Chen et al., 2020). Therefore, this study aims to investigate the social anxiety of a specific group of individuals online, to investigate the relationship between online specific self-representation behaviors and social anxiety, and to verify the serial mediation effects of social comparison and body image. By examining youth selfie behaviors and social anxiety, the relationship between individual social media selfie behaviors, body image, and social anxiety was clarified. The investigation of this study helps to theoretically clarify the underlying psychological mechanisms of how selfie behaviors affect social anxiety in youth group, and provides a theoretical basis for the prevention and intervention of adverse social emotions such as negative body perceptions in youth. The detailed discussion of the relationship between selfie behavior and social anxiety is an important issue of information communication effects in the post-industrial era, and this proposition is not only related to the development path of human mediated society, but also has its unique theoretical significance and practical value.

Literature review

Technologically mediated social anxiety: Research findings and controversies

Anxiety is a negative emotional state that arises when people anticipate something bad or threatening, often accompanied by nervousness and fear. The concept of social anxiety was originally thought to consist of evaluation anxiety and avoidance and distress, representing the individual's fear of negative evaluation by others and the individual's avoidance of social behavior in real social situations, respectively, (Watson and Friend, 1969). The emergence of social media has expanded people's social interactions and provided new opportunities for impression management and mutual communication. People can selectively express themselves by choosing photos and emoticons on social media, making self-reinvention possible. For impression management purposes, social media enables individuals to regularly present themselves in a variety of ways that enhance their sense of self-esteem (Pounders et al., 2016), is beneficial in helping individuals shape their self-identity and present a positive and desirable side of themselves (Verduyn et al., 2020), as well as providing fields for self-disclosure, positive interactions with peers and spread social connections (Verduyn et al., 2015), helping individuals to gain positive online social support (Antoci et al., 2015).

However, the more empirical findings of social anxiety research under social media are not promising. First of all, previous studies have demonstrated that social media is beneficial in enhancing individuals' self-efficacy in impression management, but it does not mean that social media use reduces social anxiety. A study that empirically investigated adolescents and young adults showed that social media engagement and behaviors, especially activities involving appearance comparisons and judgments, are more likely to lead to depression and social anxiety symptoms (Hawes et al., 2020).

Although social media can alleviate realistic stress, it can become a tool for people to escape from reality, impair the development of individual social skills, and can cause individuals to experience stronger anxiety in realistic interactions. Secondly, many individuals with high levels of social anxiety in reality are still wired with social anxiety characteristics during social media use, and online activities can make social anxiety more pronounced (Weidman and Levinson, 2015). Also browsing information in social media can make individuals overly concerned with the behavioral performance of the self in social situations, the more severe the tendency of social anxiety (Vannucci et al., 2017). Not only social media, but also time spent on games and social anxiety are positively correlated (Prizant-Passal et al., 2016). It has also been proven that frequent users of social media develop irrational beliefs such as others are better and happier than they are, and can have psychological emergence such as social comparison (De Vries and Kühne, 2015), and this leads to emotional experiences such as anxiety and depression (Shaw et al., 2015).

Current status of research on selfie behavior

According to the impression management theory proposed by Goffman, people want to control their image and identity-related information in social settings (Rodgers, 2016), and posting selfies is an efficient way to express themselves and manage their impressions (Bayer et al., 2020). Research exploring the motivations for posting selfies also suggests that people care about the opinions of others in social networks and will construct and manage impressions by presenting their positive selves (Sung et al., 2016). Impression management theory also suggests that managing an image often involves both "onstage presentation" and "behind-the-scenes preparation" (Goffman, 1959), and this is also true for selfies. Therefore, posting selfies on social media is not a single act, but a continuous process consisting of multiple acts. Specifically, in addition to the "pre-posting" act of posting selfies, there are also "behind-the-scenes" preparatory acts such as selecting and editing selfies before posting them (De Vaate et al., 2018). Three types of activities are commonly associated with selfies: taking selfies, posting selfies, and editing selfies (Dhir et al., 2016). It has also been noted that photo investment and photo manipulation are also two aspects of photo posting (Mclean et al., 2015). Among them, photo investment reflects one's concern about the quality of the photo and the effort in selecting self-photographs prior to relevant sharing, such as the time to select the photo. Photo manipulation, which is related to photo investment, refers to changing photo elements before sharing, such as the person's features, e.g., fixing oneself to be thinner. Previous research has found that information posting and information viewing behaviors on social media can have different psychological effects. Researchers have found similar phenomena in the context of selfies, for example, viewing selfies and posting selfies were negatively associated with body self-esteem (Chang et al., 2019).

The current academic research on selfies focuses on two aspects: on the one hand, the relationship between self-personality characteristics and selfie behavior, and on the other hand, people's perceptions and opinions about selfies. The existing studies mainly focus on the frequency of posting selfie photos on social media, with few relevant questions and single content, ignoring the degree of input of selfie individuals to the photos, and the current research on selfie behavior lacks precise and effective measurement tools. Foreign studies have also begun to focus on the adverse effects of selfie behavior on individuals, such as selfie addiction caused by excessive selfies (Starcevic et al., 2018), and the effects of female selfie behavior on self-objectifcation and mental health among others (Cohen et al., 2018). However, there is still a lack of systematic empirical research on selfie behavior and less involvement in the adverse effects of selfies on individuals. Therefore, the present study explores the mechanisms of influence related to selfie behavior and social anxiety, filling a gap in related research.

Related studies on social comparison

The social comparison theory was first put forward in 1954. It is believed that everyone has the viewpoint and ability to evaluate himself. This evaluation needs to be carried out under the condition that the outside world has certain reference systems and objective standards. If there is no such evaluation standard in the existing environment, individuals tend to compare with others in order to enhance the accuracy of their own evaluation (Festinger et al., 1954). Individuals pay more attention to the results of comparison between themselves and the outside world. Generally, after social comparison, if individuals are better than others and are better than others in terms of resources, wealth, appearance and conditions, they will feel satisfied and have a sense of well-being. On the contrary, their sense of well-being will be reduced, resulting in anxiety and depression (Smith et al., 1989). With the rise of social media, this kind of social comparison has also been transferred and extended to online. Social media provides a fertile soil for people to carry out online social comparison. Its powerful function of encouraging users to actively publish personal information and widely share it with others makes the object of social comparison available through an unprecedented mass scale, which intensifies the possibility of social comparison. The research shows that the social comparison intention generated by individuals online is stronger than that offline, partly because the social media platform can help people easily express their idealized image (Verduyn et al., 2020), which provides sufficient "preparation time" for individuals. Users can strategically take selfies or other photos that can show a good life experience, and then make them public after careful editing and careful selection. However, when people browse the dynamics carefully displayed by others, they will automatically generate the idea of comparison with others, and then induce a series of negative emotions such as jealousy,

loneliness and social anxiety, which seriously hinder the normal development of individual psychology (Rozgonjuk et al., 2019).

Related studies on body image

The concept of body image was first introduced in the middle of the last century and was initially considered to be the picture that individuals construct in their minds for their own forms (Schilder, 1936). Body Image refers to an individual's evaluation and perception of the self as a body, covering the physical features of the body and the individual's attitude toward these features. Body image can be divided into positive and negative body image, and negative body image develops when individuals hold negative evaluations of their bodies and experience high levels of dissatisfaction. A study conducted an exploratory validation of the Multidimensional Body Image Relationship Questionnaire (MBSRQ) and concluded that body image is a multidimensional concept in which an individual's perception and evaluation of appearance, control of thinking, emotional changes, and behavioral expressions are all manifestations of his or her body image (Cash and Fleming, 2002). The concept of "body image" is a multi-dimensional concept. Currently, scholars prefer the "multidimensional concept," which means that an individual's body image is formed gradually by physical, psychological, and social interactions, and the most recognized dimensions are cognition, emotion, and behavior. Generally speaking, physical appearance, body shape, functional health, emotions and feelings, and the resulting behaviors constitute body image. The complexity of the dimensions and structure of body image has given rise to many research terms related to different research directions, such as body satisfaction, positive body image, negative body image, body image disorder, etc.

Research questions and hypothesis

Selfie behavior and social anxiety

There is a lack of research on the impact of self-presentation behavior on social anxiety, but selfie behavior is closely related to social psychology. Some studies suggest that selfies are a way of building interpersonal relationships and gaining peer approval, and that the youth subculture is characterized by an emphasis on leisure, the importance of peers, and creativity, and that sharing selfies with peers and studying selfies is a way of building interpersonal relationships and gaining peer approval. According to the cognitive-behavioral model of social anxiety, the root of social anxiety is an individual's assessment of the possibility of negative evaluations in social situations, i.e., when an individual enters a social situation where negative evaluations may exist, social anxiety is experienced. Therefore, when there is a discrepancy between an individual's selfie picture and their real self, or an inflation of the mentality of social comparison, resulting in online self-presentation is associated with social anxiety (Verduyn et al., 2015). Based on this, this paper proposes the following research questions and research hypotheses.

> *Research question one (R1):* What is the relationship between social media selfie behaviors and social anxiety psychology among youth group?

> *Hypothesis one (H1):* Youth social media selfie behavior is positively associated with social comparison.

> *Hypothesis two (H2):* Youth social media selfie behavior is positively associated with social anxiety.

Mediating effects of social comparison

Individuals with a high degree of selfie behavior are accompanied by a high degree of photo editing behavior for a more desirable online self-presentation and to avoid receiving poor evaluations (Bell, 2019), and they are eager to seek more exposures and self-representation opportunities, and selfie photos are the key to individual impression management and self-image shaping, and they are usually more eager to obtain positive evaluations from others, and feedback from others is the key to influence self-evaluation (Wang et al., 2020). At the same time, selfies as a special self-representation behavior on social media will increase individuals' attention to themselves, and individuals who are overly concerned with information about their physical appearance will have the psychological tendency to compare themselves with others, which will reduce their body satisfaction and generate depression (Lee and Lee, 2019). In contrast, social comparison is a process in which individuals compare themselves with others based on two dimensions of opinion and ability in order to obtain objective and accurate self-evaluation (Festinger, 1954) and social comparison in real life has a great influence on individuals' body image and psychological mood (Gilbert et al., 1995). Based on this, the following research questions and research hypotheses are proposed in this paper.

> *Research question two (R2):* Does social media selfie behavior in youth group predict higher social comparison psychology, which in turn leads to individual negative body image and thus predicts social anxiety psychology?

> *Hypothesis three (H3):* Youth social comparison is positively associated with social anxiety. The higher the degree of social comparison the higher the degree of social anxiety.

> *Hypothesis four (H4):* The degree of social comparison plays a mediating role in the effect of social media selfie behaviors on social anxiety in the youth group.

The mediating effect of body image

Research in recent years has indicated that there is no association between total time spent on social media and greater levels of body image or dissatisfaction with looks, rather, it is behaviors in social media that involve appearance (e.g., selfies) that have an effect on individual body image or facial dissatisfaction (Cohen et al., 2017). Some studies have also argued for the conclusion that the more selfie activity, the more negative body image (Mclean et al., 2015). Also, related research has verified that individual body image is closely related to social anxiety. For example, individuals who are dissatisfied with the reality of their bodies produce more social avoidance behaviors (Maphis et al., 2013), and individual body monitoring predicts social anxiety (Teng and Poon, 2020). Negative body image is not a single one-sided construct, including body image dysregulation, negative body satisfaction, or distorted body image (Tylka and Wood-Barcalow, 2015), A recent study based on an empirical survey of young women concluded that negative image is positively associated with social anxiety (Bijsterbosch et al., 2020), but whether this conclusion can be extrapolated to the general youth population and whether it holds true in the Chinese context is a question that this study would like to explore further. Based on this, the following research hypothesis are proposed in this paper.

> *Hypothesis five (H5):* Youth body image is negatively correlated with social anxiety. The more negative body image of youth group, the higher the level of social anxiety.

> *Hypothesis six (H6):* Body image mediates the effect of social media selfie behavior on social anxiety in youth group.

Sequential mediation effects of social comparison and body image

At the same time, according to media body image theory, the content presented by the media is often idealized and biased (Manago et al., 2008). Similarly, people tend to choose idealized content in the process of self-disclosure on social media. Similarly, people tend to choose idealized parts and embellish their images to some extent in the process of self-disclosure on social media. Second, according to social comparison theory, people tend to choose individuals with similar conditions to themselves for comparison, such as the same social class, similar family and educational background. Studies have also shown that social comparison is significantly associated with negative body image, with more social comparison leading to more body dissatisfaction and affecting the formation of positive body image, and that there are significant gender differences, with women being more likely to be influenced by social comparison than men (Myers and Crowther, 2009). Combining these two theories, individuals unconsciously generate social comparisons when engaging in behavioral activities related to selfies on social media platforms, which in turn generate dissatisfaction with their appearance, which in turn triggers negative emotions such as social anxiety (Holland and Tiggemann, 2016). Based on this, this paper proposes the following research hypothesis.

> *Hypothesis seven (H7):* The degree of social comparison and body image play a sequence mediating role in the effect of social media selfie behaviors on social anxiety in youth group.

Research method and data collection

Research design

The study was based on the guidelines of the institutional ethics committee and met the ethical standards for relevant research. Prior to starting this study, participants were provided with information explaining the purpose of the study and after providing informed consent, they were allowed to proceed. This study used qualitative correlation method and questionnaire survey method. Firstly, in the qualitative analysis part, this study conducted participant observation and in-depth interviews on the social media selfie behaviors of the youth group to grasp their behavioral motivation and social psychology through the observation of their selfie behaviors and social behaviors. However, this observation could only provide a general understanding of their daily social behaviors and could not provide a deeper understanding of their psychological motivations. Therefore, in this paper, 20 participants with a high willingness to cooperate were selected for semi-structured in-depth interviews with research questions designed based on previous studies, and interviews were conducted both online and offline. The purpose of the qualitative study was to understand the deeper psychological motivations behind the youth group's selfies, body image perceptions, and related social psychology. The interviews also included their experiences of social media use, social comparison and deeper psychological mechanisms of social anxiety, combining empirical and theoretical material from superficial to deep.

Before the formal interviews, the research solidarity team conducted close contact and observation with some of the respondents, and focused on observing the respondents' selfie picture posting status on social media platforms, their online

based social relationships, and interactive comments on selfie postings, in addition to relevant discussions on their daily selfie behavior. A preliminary semi-structured interview outline was developed based on the existing literature and participant observations, and a pre-study was conducted. Based on the results of the pre-study, the relevant questions were adjusted and modified, and the content to be explored in the interview outline was finally determined: the motivation of individual selfie behavior; the psychological mechanism of participating in selfie behavior; and the impact of selfie on individual social psychology.

The formal interviews lasted for 6 months, and each participant's interview time was over 45 min. Due to the impact of epidemic prevention and control, most of the interviews were conducted through online voice calls or phone calls, and a small number of interviewees were interviewed offline by the author face-to-face. The interviews were recorded throughout and key questions were recorded based on the interviewees' answers. During the nearly 2 months of interviews, the author also regularly observed the posting of selfie pictures on the social media platforms of the 20 interviewees in order to get a more comprehensive understanding of the interviewees' relevant information. After completing the interviews with the 20 youths and the participatory observation on social media platforms, the researcher archived the interview materials for each interviewee in turn according to the interview time sequence, which included detailed transcripts of the interviews and the behavioral characteristics of sharing beauty photos on social media platforms. In the process of converting the audio recordings to text, the researcher carefully compared the original audio of the interviewees to ensure the accuracy of the research materials. Relevant coding and thematic analysis yielded findings in three areas of the study: selfie images as everyday social interaction, image beauty based on social comparison, and selfie-induced social anxiety.

Secondly, in the questionnaire part, the research subjects are young social media users aged 18–35 years old, because there is no unified standard for the age definition of youth group, according to WHO's age definition of youth, people aged 18–44 years old are considered as youth group, while referring to China's national conditions and previous related studies on youth group, the research subjects selected in this study are youth group aged 18–35 years old. The subjects selected for this study were consistent with the age range of the youth group. The study was distributed online through microblogs, WeChat, friend circles, and QQ communities, and the survey covered the entire Chinese mainland. Respondents were informed of the anonymity of the study in advance, and to ensure the semantic and structural rigor of the scale items and the convergent and discriminant validity of the items to be measured, 16 master's and doctoral students were invited to participate in the pre-survey process, and to discuss and adjust the questionnaire for any ambiguities and misunderstandings that might arise.

Measurement Tools

Selfie behavior measurement scale

The Selfie Behavior Measurement Scale was based on the frequency of individual selfies and the degree of posting by referring to the scale of posting behavior of physical appearance information in SNS compiled by scholar Lee (Lee and Lee, 2017), which measures the extent of participants' selfie posting behavior on social media, and also adapts the scale to the actual situation of Chinese youth's selfie posting behavior, compiling seven questions to measure individuals' selfie posting behavior, including the specific frequency of individuals' selfie posting behavior (e.g., the average number of selfies taken per day in the previous week, time spent on selfies), the extent of posting (e.g., posting a selfie photo, posting a visible photo at the waist and above, following others' comments on one's photo), the degree of integration of selfie posting behavior into one's life, and the degree of reliance on one's selfie. Each item was scored on a seven-point scale, and the mean value of the items was processed, with higher scores indicating higher levels of selfie posting behavior on social media. The internal consistency coefficient of this scale was also analyzed, and the α was 0.884, the results of exploratory factor analysis were good.

Social comparison measurement scale

In the present study, the questionnaire method is the most common way to measure social comparison, and the most frequently used questionnaire in the existing literature is the Social Comparison Tendency Scale proposed by Gibbons in 1999 (Gibbons and Buunk, 1999). At the same time, according to the research needs of this study, the upward appearance comparison dimension was added to the social comparison, and the Upward Appearance Comparison Scale developed by O'Brien et al. (2009), and supplemented and enriched it with relevant questions, (e.g., I compare myself to people who are better looking than me, not to people who are not as good looking as me). Each question was scored on a seven-point scale, and the mean value of the questions was processed, with higher scores indicating a higher degree of social comparison. The internal consistency coefficient analysis was also conducted for this scale, and the alpha was 0.823, with good results of exploratory factor analysis.

Body image measurement scale

The Multidimensional Body-Self Relations Questionnaire (MBSRQ), developed by the American psychologist Cash, is widely used in body image research, especially among young people (Flegal et al., 2007). This questionnaire is divided into appearance assessment and tendency (e.g., whether one is attractive in appearance, satisfied with one's looks), comfort assessment and tendency (e.g., one's feelings about physical and mental health, self-competitiveness, and stress assessment), health and illness assessment (e.g., self-judgment of one's health and the presence of illness), body satisfaction (e.g., satisfaction with body

parts and appearance assessment), overweight assessment and self-classification (e.g., perceptions of one's own weight and determination of one's body size as underweight or overweight). Each question item was scored according to a seven-level scale, and the mean value of the items was processed, with higher scores indicating a more positive level of body image. The internal consistency coefficients of this scale were also analyzed, and the MBSRQ had good reliability and validity for all dimensions. α was 0.781, with good results of exploratory factor analysis.

Social anxiety measurement scale

In this study, the social anxiety scale was first selected based on the Interaction Anxiety Scale (IAS) developed by Leary (1983), which measures the tendency to experience social anxiety subjectively and has been empirically tested to have good reliability and validity. In addition, Watson and Friend (1969) developed the Social Avoidance and Distress Scale (SAD; Watson and Friend, 1969), which contains two factors: social avoidance (the tendency to avoid social activities) and social distress (how individuals feel during social interactions). For the youth group, La Greca et al. (1988) designed the Social Anxiety Scale for Children (SASC; La Greca et al., 1988), which includes fear of negative evaluation, social avoidance, and distress dimensions (e.g., avoidance of social interaction; social interaction fatigue and avoidance; distress in social interaction, etc.). Each item was scored on a seven-point scale, and the mean value of the items was processed, with higher scores indicating higher levels of social anxiety. The internal consistency coefficients of this scale were also analyzed, and all dimensions of the SASC had good reliability and validity. α was 0.902, and the results of the exploratory factor analysis were good.

Data collection

A combination of convenience sampling and snowball sampling was used in this study to conduct semi-structured in-depth interviews with 20 youths. Respondents' occupations included teachers, students, doctors, farmers, etc. Respondents' age range was concentrated between 19 and 32 years old, with an average age of 26 years old, and they possessed good comprehension and expression skills and enjoyed taking and uploading selfies through social media. The age range of the respondents is consistent with the youth age standard, and the significant differences in individual backgrounds within the sample are more conducive to exploring the commonalities and patterns of selfie behavior and social anxiety. To protect the privacy of the respondents, the names of the respondents appearing in the text are replaced by initials. Respondents' specific information is presented in Table 1.

In addition, a total of 965 questionnaires were collected in this study, and 45 unqualified questionnaires were removed (e.g., messy answers and omissions, less time spent, inconsistencies, etc.), and finally 920 valid questionnaires were obtained, with a qualified rate of 95.3%. Among them, there were 347 male samples, accounting for 37.72%; 573 female samples, accounting for 62.28%. The age of the samples was concentrated between 24 and 29 years old, of which 286 were aged 18–23 years old, accounting for 31.09%; 419 were aged 24–29 years old, accounting for 45.54%; and 215 were aged 30–35 years old, accounting for 23.37%. The basic demographic variables table is shown in Table 2.

Data analysis

Variable measurements and reliability testing

This study used IBM SPSS Statistics 25 for data analysis, and reliability analysis was performed by calculating the Cronbach Alpha coefficient of the scale by the software to determine the stability of the scale. Validity analysis was performed mainly based on KMO values and Bartlett's sphere test. The reliability of the total scale was 0.847, and the reliability of the subscales were all higher than 0.7 and mostly concentrated above 0.8, indicating that the internal consistency of the scales in the questionnaire was high and the reliability of the scales was ideal. The KMO values of all variables were above 0.75 and the Bartlett sphere test sig values were all 0.000, indicating that the validity of the scales was high. Meanwhile, the data sources in this study were more diverse, so it was necessary to use Harman's one-way analysis of variance for common method deviation test, and the results showed that the eigenvalues of 17 factors were >1, and the variance explained by the first common factor was 29.87%, which was less than the standard value of 40%, so there was no common method deviation, and the findings were valid for subsequent data analysis, and the scales (excerpts) The results of the reliability and validity analysis are shown in Table 3.

Differences in demographic variables

In order to examine the differences in each variable in terms of gender, education level, and location of living, independent sample *t*-tests were conducted for social media selfie behavior, social comparison, body image, and social anxiety. On the variable of social media selfie behavior, there was a significant difference between the two groups of men and women ($T = 1.72$, $p < 0.05$), while the results of the mean comparison showed that the female youth group had a higher level of selfie behavior than men; on the variable of body image, there was a significant difference between the two groups of men and women ($T = -0.64$, $p < 0.01$), while the results of the mean comparison showed that men had a higher body image In the variable of social anxiety, there was a significant difference between the two groups ($T = -0.52$, $p < 0.05$), while from the results of the mean comparison, the level of social anxiety was higher in females than in males. There was no significant difference in the variables in terms of education level,

TABLE 1 Table of interviewers.

Number	Nickname	Gender	Age	Occupation
1	SXR	Male	27	Driver
2	WJL	Female	20	Student
3	WYW	Female	32	Dentist
4	LKT	Female	25	Dancer
5	ZJY	Female	31	Surgeon
6	FJS	Male	28	Journalist
7	SMH	Female	24	Nurse
8	WDN	Female	30	Attorney
9	FLW	Male	29	farmer
10	LGY	Female	22	Student
11	WYH	Male	19	Student
12	ZYZ	Female	26	farmer
13	QWW	Female	22	Student
14	ZSP	Female	20	Barber
15	NLH	Female	23	Clerk
16	CFY	Female	30	Engineer
17	ZZH	Male	26	Clerk
18	LQY	Female	28	Guide
19	ZJL	Male	31	Teacher
20	YMY	Female	21	Student

TABLE 2 Statistical table of basic information of effective samples.

Statistical items	Specific content	Statistical value	Percentage
Gender	Male	347	37.72%
	Female	573	62.28%
Age	18–23	286	31.09%
	24–29	419	45.54%
	30–35	215	23.37%
educational background	High School and below	62	6.74%
	Undergraduate	559	60.76%
	Master and above	299	32.50%
Living Location	Urban	618	67.17%
	Rural	302	32.83%

but in the analysis of variability in terms of location of life, there was a significant difference in the variable of social comparison between urban and rural groups ($T = -1.34$, $p < 0.01$), while the results of the mean comparison showed that the level of social comparison was higher in the urban youth group than in the rural youth group; in the variable of social anxiety, there was a significant difference between urban and rural groups In the variable of social anxiety, there was a significant difference between the urban and rural groups ($T = 0.75$, $p < 0.01$), while from the results of mean comparison, the degree of social anxiety was higher in the urban youth group than in the rural youth group. The specific results of the analysis are shown in Table 4.

Correlation analysis

The Pearson correlation coefficient is a measure of the linear relationship between a fixed-range variable and the dependent variable, which is also a fixed-range variable. The correlation coefficient ranges between −1 and +1, with positive values representing positive correlations and negative values representing negative correlations. The correlation analysis revealed significant correlations between the variables. According to the data in Table 5, social media selfie behavior ($M = 4.185$, SD = 0.835), social comparison ($M = 4.697$, SD = 3.772), body image ($M = 2.420$, SD = 0.829), and social anxiety ($M = 5.115$, SD = 1.475). The specific results of the analysis are shown in Table 5.

An examination of the mediating role of social comparison and body image

This study examined the mediating effect of social comparison and body image in the relationship between social media selfie behaviors and social anxiety using the bias-corrected percentile Bootstrap method. The effect sizes and 95% CIs of the mediating effects of social comparison and body image on social media selfie-related behaviors and social anxiety were estimated using the SPSS macro program developed by Hayes by taking 5,000 samples to estimate the 95% confidence intervals (95%CIs) of the mediating effects. Regression analysis showed that social media selfie behavior was a direct positive predictor of social anxiety ($\beta = 0.429$, $p < 0.01$); social media selfie behavior was a direct

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TABLE 3 Items and reliability and validity of the scale (Incomplete).

Variable	Code	Measuring project	Cronbach's Alpha	KMO
Selfie Behavior	A1	I like to take selfies in my daily life	0.884	0.708
	A2	I will post my selfies on social media		
	A3	I spend a lot of time choosing the right angle for my selfies		
	A4	I will spend a lot of time on photo editing behavior		
	A5	I take selfies alone		
	A6	I will take selfies with friends and family		
	A7	I have a hard time choosing my selfies		
	A8	I take selfies by learning to imitate the style of good selfies on the Internet		
Social Comparison	B1	In my daily life, I like to compare myself with people who do things better than I do	0.823	0.747
	B2	When considering whether I can do something well, I compare myself to people who are better than me		
	B3	When you follow other people's selfies in social media, you associate your appearance with your own		
	B4	When you follow other people's selfies in social media, you associate your own appearance (including body, face, etc.) with the photos. Face, etc. with the person in the photo		
	B5	I often compare myself to others in terms of social (social skills, popularity)		
	B6	I do not compare my social media posts with those of others		
	B7	When things get bad, I often think of people who are doing better than me in social media.		
	B8	I always want to know what others would do in a similar situation		
	B9	I always pay close attention to the differences between the way I do things and the way others do things		
	B10	I never compare situations in my life to others		
Body Image	C1	I am always worried about being too fat or gaining weight	0.781	0.704
	C2	I often need to control my diet to lose weight		
	C3	My body is sexy and attractive		
	C4	I like the way I look now		
	C5	I can control my health		
	C6	I am happy enough with my appearance		
	C7	I do not care what people think of me on the outside		
	C8	I always try to improve my appearance		
	C9	I do not care about the state of my health in my life		
	C10	I do not care how my clothes look on my body		
Social Anxiety	D1	I am shy when I am in the middle of strangers	0.902	0.816
	D2	I feel that people will talk about me behind my back		
	D3	I get nervous when talking to people I do not know well		
	D4	I am reluctant to ask people to do things with me because I am afraid of rejection		
	D5	I feel nervous when I am with certain people		
	D6	I always feel like people are making fun of me		
	D7	I want to feel more confident in social situations		
	D8	I do not feel nervous and uncomfortable in social situations		

TABLE 4 Analysis of differences among variables in gender, education level, and living location.

Test for differences in each variable on gender

Variables	Male ($n = 347$)		Female ($n = 573$)		t
	M	SD	M	SD	
Social media selfie behavior	3.02	0.87	5.41	0.42	1.72*
2. Social comparison	4.69	0.71	5.06	0.43	1.55
3. Body image	3.12	0.82	2.66	0.31	−0.64**
4. Social anxiety	4.17	0.58	4.76	0.67	−0.52*

Test for differences in educational attainment for each variable

Variables	High School and below ($n = 62$)		Undergraduate ($n = 559$)		Master and above ($n = 299$)		t
	M	SD	M	SD	M	SD	
Social media selfie behavior	4.02	1.07	4.41	1.18	4.01	1.31	0.62
2. Social comparison	3.79	0.84	4.36	0.86	5.01	0.92	1.28
3. Body imagery	3.05	0.71	2.78	0.31	2.14	0.90	1.45
4. Social anxiety	4.49	0.56	4.78	0.61	5.17	0.64	1.02

Test for differences in variables on living location

Variables	Urban ($n = 618$)		Rural ($n = 302$)		t
	M	SD	M	SD	
Social media selfie behavior	4.64	0.64	4.09	0.62	0.92
2. Social comparison	5.02	0.57	4.15	0.53	−1.34**
3. Body imagery	2.15	0.69	2.76	0.63	0.52
4. Social anxiety	4.59	0.75	4.03	0.70	0.75**

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

TABLE 5 Table of descriptive statistics results and variable correlations.

Variables	M	SD	1	2	3	4
1. Social media selfie behavior	4.185	0.835	1			
2. Social comparison	4.697	3.772	0.073**	1		
3. Body image	2.420	0.829	−0.152**	−0.213*	1	
4. Social anxiety	5.115	1.475	0.136**	0.537**	−0.049*	1

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

positive predictor of social comparison ($\beta = 0.190$, $p < 0.01$); social media selfie behavior and social comparison were negative predictors of body image ($\beta = -0.082$, $p < 0.05$; $\beta = -0.068$, $p < 0.01$); after all variables were included in the regression equation, social media selfie behavior directly positively predicted social anxiety ($\beta = 0.251$, $p < 0.05$), social comparison positively predicted social anxiety ($\beta = 0.537$, $p < 0.01$), and body image negatively predicted social anxiety ($\beta = -0.026$, $p < 0.01$).The specific results of the analysis are shown in Table 6.

The results of the bias-corrected percentile Bootstrap method mediated effect analysis showed that social comparison and body image mediated the relationship between social media selfie behavior and social anxiety, with a mediated effect value of 0.604, accounting for 42.29% of the total effect of social media selfie behavior on social anxiety. Specifically, the total mediating effect consisted of indirect effects of three pathways: indirect effect 1 (0.196) through the pathway of social media selfie behavior → social comparison → social anxiety, Bootstrap 95% CI did not contain 0, indicating that the mediating effect of social comparison in the relationship between social media selfie behavior and social anxiety was significant; The indirect effect 2 (0.073) through the social media selfie behavior → social

TABLE 6 Table of regression analysis of the relationship between variables.

Regression equation		Overall fit index			Significance of regression coefficients		
Result variables	**Predictive variables**	***R***	***R*²**	***F***	***β***	***t***	***p***
Social anxiety	Social media selfie behavior	0.029	0.040	12.035**	0.429	2.372**	0.004
Social comparison	Social media selfie behavior	0.305	0.261	9.506*	0.190	2.525**	0.007
Body image	Social media selfie behavior	0.226	0.035	7.264**	−0.082	−1.286*	0.03
Social anxiety	Social comparison				−0.068	−2.059**	0.002
	Social media selfie behavior	0.512	0.314	9.243**	0.251	3.259*	0.04
	Social comparison				0.537	4.407**	0.005
	Body image				−0.026	−1.319**	0.004

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

TABLE 7 Table of results of sequential mediated effects analysis.

	Indirect effect value	Bootstrap SE	Bootstrapping 95% CI		Relative indirect effects (%)
			Lower-bound	Upper-bound	
Total mediating effect	0.604	0.075	0.117	0.751	42.29
Indirect effect 1	0.196	0.037	0.071	0.147	12.08
Indirect effect 2	0.073	0.092	0.006	0.518	7.76
Indirect effect 3	0.335	0.048	0.035	0.077	22.45

comparison → body image → social anxiety pathway, Bootstrap 95% CI does not contain 0, indicating a significant mediating role of social comparison and body image in the chain between social media selfie behavior and social anxiety relationship; the indirect effect 3 (0.335) through the social media selfie behavior → body image → social anxiety pathway, Bootstrap The 95% CI did not contain 0, indicating that the mediating role of body image in the relationship between social media selfie behavior and social anxiety was significant. The three indirect effects accounted for 12.08%, 7.76%, and 22.45% of the total effects, respectively, and the results of the analysis are shown in Table 7.

Based on the analysis of the empirical data, hypotheses H1, H2, H3, H4, H5, H6, and H7 are supported and the adjusted model path coefficients are plotted as shown in Figure 1.

Research conclusion

Differentiated discussion of demographic variables

This study found that the female youth group had a higher degree of selfie behavior than males, males had a higher degree of body image evaluation than females, and females had a higher degree of social anxiety than males. Meanwhile, the urban youth group had higher levels of social comparison and social anxiety than the rural youth group. The contemporary empirical studies on selfie behavior focus on the female group because of the positive self-presentation behavior that accompanies women in social media, which also validates the previous studies on selfie in the female group, and the underlying reason is that they are more emotional and like to show and record themselves, and compared with boys, girls post more personal status on social networks and are more inclined to post information related to body image, such as selfies etc. They are more concerned about the image they present and how they are perceived by others, which is one of the manifestations of women's self-objectification. They are more prone to social comparison, and existing research demonstrates that repeated exposure to media sexual objectification causes women to habitually view themselves through the lens of a third party, frequently self-monitor their appearance, and be more sensitive to body-related information (Fredrickson and Roberts, 1997). At the same time, research has demonstrated that men have higher body image ratings than women, suggesting that there are gender differences in body image ratings, and that overall women show more weight concerns and body dissatisfaction than men, which may also validate previous findings of differences in body image ratings between men and women (Paxton et al., 2006). In addition, in the comparison between urban and rural youth, urban youth showed higher levels of social comparison and social anxiety than rural youth, analyzing the specific reasons, which may be related to the social development and urban–rural environmental development differences in China. The sample of this study was a population of youth aged 18–35, with a large age span, and different age groups

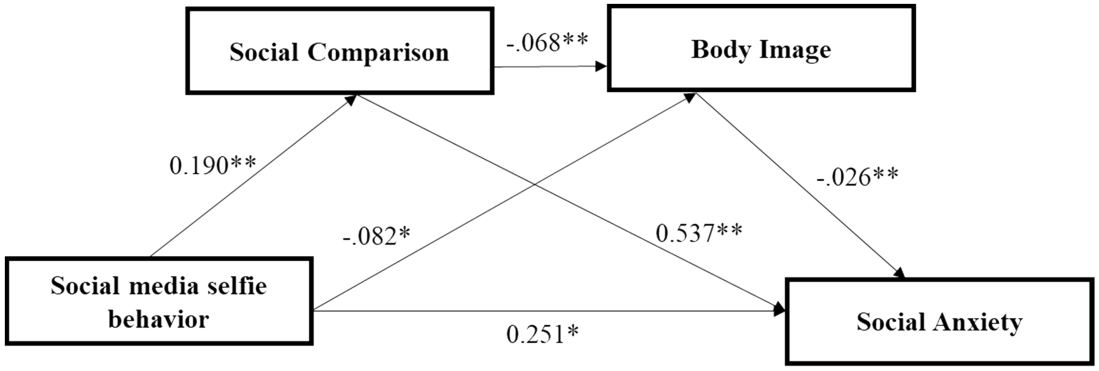

FIGURE 1
Process-conditional model of the association between social media selfie behavior and social anxiety. *$p < 0.05$; **$p < 0.01$.

were exposed to media technology either earlier or later, and urban youth and younger individuals would preferentially exposed to new things. In addition, there is a gap between the growing environment of urban youth and rural youth, as rural areas are relatively slower in the development of new things, and the population movement and new things change less than urban areas. Urban youths are relatively open-minded and have a higher pursuit of material conditions, and they have a higher social comparison mentality. Meanwhile, facing the huge pressure of survival in the city, social media and other media technologies become a haven for them to escape from reality and relax. In contrast, rural youths live in a rural society and must interact closely with their relatives, friends and neighbors in their daily lives, which may be an important reason why their social anxiety level is lower than that of urban youths.

Selfies trigger anxiety? The relationship between selfie behavior and social anxiety

The empirical findings prove that the degree of selfie behavior in youth group positively predicts social anxiety. Through the participant observation and interviews we found that image socialization has been integrated into our daily life, and selfies are considered an important form of online self-presentation and impression management. People upload selfies for three main purposes: to complete self-appreciation; to show the best self-image to others; and to get more likes, comments and attention. Therefore, people will often choose to take or post the most perfect image. The interviews revealed that usually a good selfie requires complex processing, and for those who like to take selfies, it is crucial to select and edit the selfie, and when the painstaking selfie posted to social media does not get the desired likes and comments, it means that the selfie taker does not get the desired attention and affirmation, and they may try to present the perfect self. They may retouch their selfies according to the socially acceptable "ideal beauty" in order to present a "perfect" version of themselves, thereby attracting the attention of others and gaining psychological satisfaction. In contrast, if the selfie taker receives praise and affirmation of his or her appearance, he or she may reinforce the selfie-taking behavior. In this regard, selfies are motivated in large part by the desire to put one's best self on display and obtain the best evaluation from others. But drastic selfies or retouching may lead to the viewer's perception that the publisher is acting insincerely online, thus failing to generate widespread approval and satisfaction of the selfie from others. This runs counter to the purpose of going to the trouble of retouching the picture in the first place, and it is clear that such selfies cannot serve the purpose of good identity impression management in social media, and individuals may experience reduced body satisfaction and anxiety due to the inconsistency of their online and offline images, which in turn can lead to adverse emotions such as social fatigue and social anxiety (Brown and Tiggemann, 2016). This finding answers the question posed in Research Question one (Q1).

Sequential mediation of social comparison and body image

The empirical data demonstrated that social comparison and body image have a sequential mediating role in the path of social media selfie behavior on social anxiety. This finding uncovered deep-seated psychological mechanisms of individuals in the process from social media behavior to social emotions. In the youth group's selfie behavior, "physical appearance" is the focus of their attention, and therefore their social anxiety is directed to their body image. This may cause youth to focus more on their lack of appearance when taking selfies and experience more appearance anxiety, which may lead to negative body image and social anxiety (Holland and Tiggemann, 2016). In addition, people tend to choose idealized parts of themselves and embellish their images to some extent as they engage in self-disclosure on social media. When individuals engage in behavioral activities related to

social media platforms, such as taking selfies, they unconsciously generate social comparisons, and the more likely they are to look at themselves with the harsh set of esthetic standards promoted on social media, the more likely they are to develop negative emotions such as dissatisfaction with their appearance (Tiggemann and Barbato, 2018).

At the same time, this study included measures of body information among the measures of social comparison, and such comparisons can lead individuals to hold negative evaluations of their body image, and then they may worry about their image and performance in social interactions, and thus experience social anxiety. This study confirmed the significant mechanism between social comparison and body image, which resulted in the emergence of social media selfies as a predictor of social comparison, and social comparison as an influence on body image, which in turn increases social anxiety in individuals. This finding answers the question posed in research question two (Q2). Taken together, the multiple mediating effects of social comparison and body image found in this study are empirically and theoretically meaningful.

Discussion

In this study, we found that young people have more negative body image and higher social anxiety. In fact, along with the rapid development of modern Chinese society, young people have left their hometowns for a long time and set out for the big cities to strive for greater personal development opportunities and growth space. Through observations and interviews, we found that most young people have a limited range of interpersonal activities, an inner emptiness, a lack of emotional comfort and companionship, a heavy pressure of life and work, and a negative social mentality with a strong sense of anxiety and loneliness. Facing the impact of the Corona Virus Disease on the work, study, socialization and life of the youth group, and the sudden isolation will make them more anxious and depressed (Brooks et al., 2020). However, the development of media technology provides a convenient channel for young people to escape from real life, and they are willing to immerse themselves in the Internet to relieve the anxiety and anxiety of real social interactions, and the Internet has become an important field for modern young people's emotional support and catharsis (Bennett et al., 2008). At the same time, in the process of seeking breakthroughs, young people are eager to seek social identity from new spaces such as the Internet. They freely transmit information in the online world, are willing to share and show themselves, and are empowered by social media to have the opportunity to show their bodies and construct gender temperament in the form of words, pictures and videos, actively participate in personal and other people's body practices and exchange their body experiences with each other. This inevitably has a tremendous impact on individuals' body constructions and psycho-emotions. Young people rely heavily on canonic binaries from utopian and dystopian interpretations of networked technologies to apply labels to themselves, they are deeply influenced by the online media, which can also reflect the dialectical struggle they are always experiencing in their daily lives, triggering their ambivalence and anxiety (Tiidenberg et al., 2017). Technological advances have provided more freedom of choice, but the flood of information has also thrown individuals into a state of uncertainty and anxiety, leading to a highly sensitive state of mind and a general group anxiety among contemporary youth (Fox and Moreland, 2015). In the present study, the causal relationship between social comparison and social anxiety more directly links group pressure to youth anxiety.

By examining the social media selfies, social comparison, body image and social anxiety of the youth group, this study demonstrates that the development of media technology has greatly influenced people's social interactions, and that social media selfies provide the means of expression and technological tools for the fictionalization and exhibition of the youth group's role identity. Through observation, we found that one of the important motives of individual selfie behavior is life logging, and at the same time, this kind of selfie image that expresses oneself in a given way focuses on performance or ideal self-expression, which enables the youth group to realize the mental world or emotional world in the virtual network space under the pressure of realistic anxiety and life pressure to achieve self-revelation, and present the self-expression with the help of media technology. Everyone has the right to record their life and show themselves, and the act of selfie image publishing and photo editing reflects the individual's creative life more, making information dissemination more diversified and autonomous (Weilenmann and Hillman, 2020). Individuals' image shaping in social media is graspable, and selfie photos become the key to individuals' self-shaping as well as forming good impression management, reflecting a higher degree of motivation in online interactions. In the online environment, both parties in the interaction have different degrees of role expectations for themselves and others, and when the real self and the ideal self-have large differences, the self-identity will fall into a state of dissonance, and although this dynamism gives individuals more choices, it directly affects the formation of the impetuous mentality of interaction thus leading individuals into anxiety (Boyraz and Kuhl, 2015). This can also explain the empirical findings of this study that social media selfie behavior triggers social anxiety to some extent.

This study found that social comparison and body image mediated significantly in the model pathway, and a high degree of social comparison mentality and negative body image was prevalent among the youth group. The interviewees indicated that when individuals posted selfies of their own image and status in the social media field, they formed an invisible interaction of "seeing" and "being seen" in the virtual social media, and by paying attention to the likes and comments of others on their own postings, they formed an objectified social comparison mentality. By following the interaction of others' likes and comments on one's own postings, an objectified social comparison psychology is formed, and individuals become dissatisfied with their own bodies by comparing themselves with acquaintances or strangers who have better physical appearance

than themselves (Moya-Garofano and Moya, 2019). Meanwhile, the ongoing epidemic has led to a dramatic shift in the way people communicate. In order to maintain daily contact with others, the public is increasingly using online meetings such as social media to keep in touch, and research has found similarities between online video calls and taking and posting "selfies" on social media. Because during video calls, individuals are required to look at their appearance for long periods of time as if they were looking in a mirror, the results of using video calls are the same as presenting selfies on social media, with negative effects on body image (Pikoos et al., 2021). In addition, the empirical findings of this paper show that image information in social media has become an indispensable component in communicating interpersonal relationships, and to a certain extent, it can also prove that individuals in digital existence will generate new social relationship needs, and with the support of media technology, non-verbal communication through image symbols has become a new trend. Through observations and interviews we found that the youth group spends too much time on social media, and the high degree of selfie behavior increases the individual's focus on self, triggers a higher social comparison mentality and negative body image, which leads to the emotion of social anxiety, so they reduce the offline activities of face-to-face socializing, and such social media behavior is harmful to people's emotional, psychological, and interpersonal relationships (Pawijit et al., 2019).

Strengths

There are still few studies on the potential influence mechanisms of selfie behaviors on social anxiety in youth group, and almost no articles in China have conducted systematic research demonstrating the influence and mechanism of action of selfie behaviors on social anxiety. It is of great significance to maintain social stability and harmony to understand the changes brought by technological innovation and institutional transformation to the society and even to the group itself, and then to treat these changes correctly and avoid the risks. This study explores the relationship between selfie behaviors and social psychology of youth group, and the existence of multiple mediating mechanisms, and explores the basic research framework of selfie behaviors-social comparison-body image-social anxiety from both theoretical and empirical perspectives. The research hypothesis and research model were empirically tested to further clarify the relationship between selfie behavior and social psychological motivation, and to lay the theoretical and empirical foundation for subsequent research.

Limitations

The empirical findings in this study have some value, but the scale design process only considered individuals as selfie information disseminators, while ignoring the perspective of information reception, the scope of the study group focused on the Chinese youth population, and there may be significant differences in selfie behavior and related social anxiety psychology among different populations, and also whether the empirical results can be adapted to the cultures of other countries needs further investigation and verification. In the future, the discussion on selfie behaviors needs to consider the identity of individuals as information receivers, increase the sample size of different age groups, and analyze the differences in how different groups face this issue, as well as further cross-cultural related studies to explore the similarities and differences in selfie posting behaviors and related consequences in different cultural contexts. In addition, the psychological motivation and behavior of selfies should be further refined in subsequent studies, and a detailed scale design and examination of social media selfie behaviors should be conducted. It is also necessary to consider the influence of media information technology and different publishing scenarios on individual self-construction. The empirical research related to selfies is still in its initial stage, and in future studies the causal relationship between selfie behavior and social psychology in the digital media era can be revealed more comprehensively, and more variables related to individual differences and psychological traits of youth group can be incorporated to explore the influence of selfie behavior on social psychology. In addition, experimental methods and more detailed and in-depth questionnaire items were attempted to make precise causal inferences, which need to be further explored and refined in future studies.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

YL, JZ, and JH contributed to the conception and design of the study. YL was responsible for the study design and framework, performed the statistical analysis, and wrote the first draft of the manuscript. JZ organized the database. JZ and JH wrote parts of the manuscript. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

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Influence of family cohesion on Chinese adolescents' engagement in school bullying: A moderated mediation model

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In this study, a total number of 1,026 Chinese adolescents were surveyed using the cohesion sub-scale of the Family Environment Scale, the Self-control Scale, the Parental Monitoring Questionnaire, and the revised Olweus Bully/Victim Questionnaire to explore the effects of family cohesion on adolescents' engagement in school bullying and the mechanisms of self-control and parental monitoring in the relationship between them. The results showed that: (1) family cohesion, self-control, and parental monitoring were significantly and negatively related to school bullying; (2) family cohesion directly influenced school bullying and also indirectly influenced school bullying through a mediating effect – self-control; (3) parental monitoring played a moderating role in the path of self-control affecting school bullying. Therefore, to reduce the occurrence of school bullying, it is necessary to strengthen the self-control ability of adolescents and improve the family cohesion environment and maintain a moderate level of parental monitoring. The results of this study revealed the effect of family cohesion on adolescents' engagement in school bullying and its mechanism of action, which can provide a theoretical basis for preventing and reducing the occurrence of school bullying incidents.

KEYWORDS

Chinese adolescents, family cohesion, school bullying, self-control, parental monitoring

Introduction

School bullying is a common phenomenon of continued global concern. According to the Global School Violence and Bullying Report released by UNESCO (2017), approximately 246 million children and adolescents worldwide are exposed to various types of school violence and bullying each year, and all children and adolescents are at risk of being involved in school bullying. School bullying refers to repeated instances of physical and psychological persecution and verbal aggression by one or more students against their peers over some time (Olweus, 1994), and it is characterized by disparities in power among

peers (Renshaw et al., 2016). Bullying can be divided into physical, verbal, relational, and cyber bullying (Stubbs-Richardson and May, 2020). Each type of bullying can cause multiple internalized and externalized physical and mental health problems for both the bully and the victim. A potential profile-based study explored the patterns of school bullying victimization among contemporary Chinese adolescents, finding that verbal bullying was the most common form of bullying (Xie et al., 2019). Even mild bullying victimization can have long-term adverse effects on the physical and mental health of the victim (Ng et al., 2022). Studies have found that victims of bullying are prone to psychological problems such as anxiety, depression, low self-esteem, suicidal ideation, and physical symptoms such as headaches and insomnia (Campbell et al., 2013). Moreover, adolescent victims of school bullying have shown a decreased positive psychological orientation and subjective well-being, with a higher incidence of emotional and behavioral problems than their peers who are not involved in school bullying (Arslan et al., 2021). For bullies, committing bullying behavior puts them at risk for antisocial personality disorder in the future (Klomek et al., 2009). Olweus (2011) found a longitudinal and prospective association between bullying and later criminal behavior. Bullies have also been found to suffer more psychiatric problems later in life, including depression and panic disorder in adulthood (Copeland et al., 2013; Liu et al., 2021). School bullying poses a huge challenge for school safety and crisis management. Therefore, it is important to explore the influencing factors and mechanisms of school bullying to ensure its prevention and management.

Ecosystem theory assumes that the system and the individual are mutually reinforcing, acting together and influencing the development of the individual, and the.

microsystem is an important part of social-ecological system (Müller, 1992). The microsystem plays an important role in an individual's development. Composed of family members, peer groups, schools, and neighborhoods, the microsystem is the environment which individuals most directly encounter (Tudge et al., 2009). However, various factors in the family environment can promote or hinder individual growth and adaptation. Family cohesion refers to the degree of emotional closeness between family members (Liu et al., 2014). Students who live in highly close families have fewer internal mental health problems and fewer externalized behaviors (Fosco and Lydon-Staley, 2019). Studies have shown that intimate family interactions have a protective power in relation to bullying, while negative family interactions increase the risk of students becoming involved in such situations (Oliveira et al., 2020). Family cohesion is positively correlated with gregariousness, emotional stability, liveliness, perseverance, and social boldness in personality factors, and negatively correlated with vigilance, apprehension, self-reliance, and tension (Li and Liu, 2012). Families with a high level of intimacy are conducive to the formation of positive personality traits in children. Cohesion in the family environment also promotes the healthy development of individuals' interaction skills (Liu et al., 2020). The higher the level of family cohesion, the more developed is an individual's pro-social behavior (Li L. et al., 2020). Since families with a high level of intimacy create a positive atmosphere, adolescents actively seek guidance from their families regarding the adoption of normative behaviors when making moral decisions (Roosa et al., 2011). In contrast, adolescents with a low level of family cohesion lack emotional communication with their parents, so experience interpersonal difficulties. When faced with conflict, they are more likely to respond negatively (Zhao et al., 2011) or even bully others at school. Therefore, it is hypothesized that family cohesion affects the school bullying of adolescents.

Similarly, based on the ecosystem theory of the interaction between individuals and the environment, microsystems and their internal elements also affect the development of individuals' self-control ability (Putrawan, 2019). The formation of early self-control ability is closely related to family factors, such as family parenting style, family environment, and inter-generational relationships (Malatras and Israel, 2013; Meldrum et al., 2016). A highly cohesive family environment helps to shape an individual's positive personality (Guo et al., 2021) and positively influences the development and adaptation of self-control (Cho et al., 2018). Thus, family plays an important role in the development of self-control. Self-control theory suggests that individuals with a higher level of self-control have greater autonomy and can regulate their impulses and meet external behavioral standards (King et al., 2011), And self-control, as a regulatory mechanism between an individual's internal natural impulses and external objective situations (Hofmann et al., 2009), is directly related to problem behaviors such as aggression and bullying (Kim et al., 2022; Sun et al., 2022). In general, people with low self-control are more likely to engage in aggressive behavior than those with high self-control (Liu et al., 2017). In a study on a sample of Nigerian adolescents, regression analysis results confirmed that low self-control might predict adolescents' experiences of bullying (Fenny, 2021). The study found that individuals with high self-control can inhibit their impulses in a timely manner; actively regulate their cognition, emotion, and behavior according to situational needs and their own intentions; and inhibit adverse and activate positive reactions, so as to avoid harmful behaviors such as aggression and bullying (Zhao et al., 2018). Thus, self-control can be an important predictor of participation in school bullying. Therefore, it is hypothesized that family cohesion influences adolescents' engagement in school bullying through self-control.

To further explore and gain a deeper understanding of the factors that influence school bullying, we need to examine its moderating mechanisms. According to the theory of social connection, parents' monitoring of teenagers is an important part of social connection (Hirsch, 1969). and parental monitoring is an important source of social control (Baz Cores and Fernández-Molina, 2022). Teenagers who are monitored by parents will have less opportunities to contact their peers with illegal or problematic behaviors, thus reducing the possibility of these bad behaviors (Tremblay Pouliot and Poulin, 2021). Parents regulate adolescents' behavior through various means of monitoring, such as attention,

guidance, and discipline of activities in which their children are involved (Hou et al., 2017). Effective parental monitoring can reduce problematic behaviors in adolescents, while low-level parental monitoring is significantly associated with problematic behaviors such as aggression, alcohol abuse, and drug abuse (Capaldi et al., 2009; Criss et al., 2015; Moon et al., 2020). The effects of parental monitoring and risk factors on adolescents' problematic behaviors are not entirely independent, but are combined in a complicated manner. Parental monitoring can act as a positive buffer between risk factors and adolescent problematic behaviors (Ding et al., 2019). Studies have found that poor peer interactions have less impact on the problematic behaviors of adolescents with a high level of parental monitoring than those with a low level of parental monitoring (Hou et al., 2017). Reasonable and moderate parental monitoring can also develop adolescents' self-control ability and prevent their engagement in criminal acts (Jin et al., 2019). For adolescents with a high level of parental monitoring, their parents have more control over their behaviors and whereabouts, thus promoting standardized behaviors, and adolescents with lower levels of parental monitoring, on the other hand, have more autonomy in their behavior and are more likely to lead to destructive behaviors. Therefore, it is hypothesized that parental monitoring plays a vital role in moderating the path of self-control affecting school bullying.

The development of individual psychological processes like self-control are closely related to the quality of adolescents's immediate environment, such as the parent–child relationship and family cohesion. In turn, the initial and ongoing contributions of parent and family factors on the development of adolescents's self-control, influence how they regulate their emotions in the school setting, and hence their potential involvement in bullying. Therefore, the construction of a hypothetical model is shown in Figure 1.

In addition to the above factors, age and gender can also affect adolescents' engagement in school bullying. Studies have pointed out that school bullying is not based on accidental or certain situations, but on discrimination against peer identity; gender is one of the important elements of an individual's social identity (Shi, 2017). Boys are significantly more likely to engage in physical violence than girls, so bullying is influenced by gender attributes (Xiao et al., 2020). Young adolescents with incomplete psychological development face a stronger degree of conflict with regard to self-unity and role confusion (Huang, 2007), and are more prone to school bullying. Previous studies have also shown that school bullying of junior high school students is detected at a significantly higher rate than that of senior high school students (Liu et al., 2008), indicating that age is also associated with school bullying. In the relationship between gender and family cohesion, according to Chinese family culture, female socialization is more reflected in her family role and emotional connection. Females keep close ties with their families, and the family cohesion is usually higher than that of males (Liu et al., 2014). Regarding age, previous studies have found that older children reduce their dependence on the family in order to pursue autonomy and adapt to the external environment, so children's subjective experience of family cohesion decreases during adolescence (Zhai et al., 2021). In terms of self-control, whether there is a gender difference in the development of self-control needs to be further explored. Some studies have shown that there is no gender difference in impulse suppression among young children (Zhang et al., 2020), while Zhang et al. (2012) found that girls have higher self-control ability than boys in adolescents aged 11 to 10. So, the reason for the inconsistent results may be that the sex difference itself is less stable in the early stages of self-control development. Early self-control increases with age. Vazsonyi and Huang (2010) also found that individual self-control increased with age between 4.5 and 10.5 years old. In the period of rapid physiological development in youth, boys are prone to behave impulsively because of hormone levels. Therefore, in terms of parental monitoring, parents have more supervision over the behavior of boys than girls (Deng et al., 2018). With the increase of age, adolescents' sense of independence will become stronger and they will strive for more autonomous control (Dane et al., 2018). Therefore, parents' behavior monitoring of adolescents in lower grades is significantly higher than that of adolescents in higher grades. Since age and gender may have significant effects on the results, we attempted to control for the effects of both variables.

In summary, adolescence is a high-frequency period for engagement in school bullying, and it is necessary for us to conduct in-depth research on it. with the support of theoretical research, this study puts forward the following hypotheses: (1)

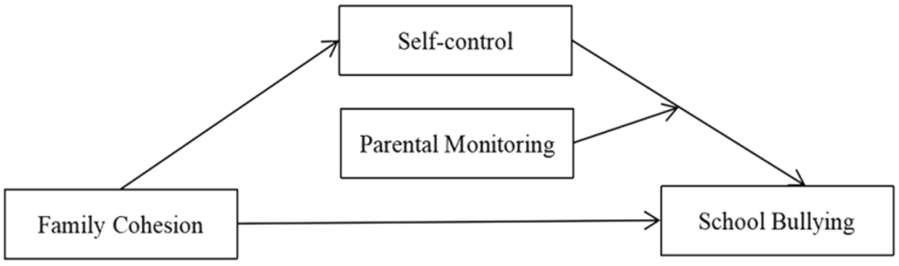

FIGURE 1
The moderated mediating model.

Family cohesion can significantly affect adolescents' engagement in school bullying; (2) Family cohesion can indirectly influence school bullying through self-control, which plays a mediating effect; (3) Parental monitoring can play a moderating role in the path of self-control affecting school bullying.

Materials and methods

Participants and data collection

Stratified random sampling was adopted to cover the cities, suburbs and rural areas of Chongqing and Sichuan. According to the distance from the central city, Chongqing Medical Technology Secondary Vocational School in Nan'an District of Chongqing was selected for urban areas, Chongqing Tongnan Middle School and Sichuan Tongjiang No.3 Middle School were selected for suburban areas, and Chongqing Zhongxian Sanhui Middle School was selected for rural areas. Simple random sampling was conducted in schools in April 2021 to construct research samples and collect questionnaire data from 23 classes. Among them, 6 classes are from urban areas, 10 classes are from suburban areas, and 7 classes are from rural areas. Each class has a maximum of 54 students and a minimum of 31 students. Due to the large number of schools in the district and the large internal differences, stratified random sampling was adopted to reduce the sampling error and improve the representativeness of the sample. In each school, the headteacher assisted in gathering the students for the data collection meeting in the classes, which took the form of an examination, and introduced the researcher and two assistants to students. When the formal questionnaire survey was administered, the headteacher withdrew from the class. The researcher served as the main examiner with two assistants. The main examiner read out the instructions for the test, and the two assistants circulated the classroom to offer guidance about anything unclear in the questionnaire and to prevent discussion among the students. The questionnaires were filled out anonymously. During the survey process, if any respondent rejected answering the questions, the researcher agreed that the respondent would be excluded from the questionnaire survey. This study involving human participants was reviewed and approved by the Local Research Ethics Committee of Chongqing Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next-of-kin.

A total of 1,026 out of 1,100 respondents from the four schools filled in the questionnaire, giving a valid response rate of 93.30%. Among the adolescents, 251 were junior high school students (grades 7–9), 444 were senior high school students (grades 10–12), and 331 were secondary vocational students (grades 10–12); 331 were from cities, 476 were from suburbs and 219 were from rural areas; 424 (41.30%) were males and 602 (58.70%) were females; the age of the respondents ranged from 11 to 20 years old [mean (M) ± standard deviation (SD) = 15.46 ± 1.96].

Questionnaires

Cohesion sub-scale of the family environment scale-Chinese version

We used the cohesion sub-scale (Wang et al., 1999) of the Family Environment Scale-Chinese Version (FES-CV) revised by Fei et al. (1991), The scale consists of nine statements (including "Our family members always give each other the most help and support" and "We feel bored at home"). Respondents were scored according to whether or not they agreed with the statements, with 1 point for "Yes" and 2 points for "No." The total score was calculated according to a specified computational formula. The higher the total score, the higher the level of family cohesion. The consistency coefficient in this study was 0.75.

Self-control scale

We used the revised Self-control Scale by Tan and Guo (2008) consisting of five dimensions: resisting temptation, healthy habits, abstaining from entertainment, impulse control, and focusing on work. The scale consists of 19 statements (including "I can resist temptation well" and "It is difficult for me to change bad habits"). A 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) was used to assess the individual students' self-control ability. The total score of the scale was calculated by adding up the scores of all questions (Questions 1, 5, 11, and 14 were positively scored, and the rest were negatively scored). The higher the total score, the worse the level of self-control. The consistency coefficient in this study was 0.81.

Parental monitoring questionnaire

Referring to (Lin's 2001) study, we examined the extent to which parents of adolescents know about their daily lives. The scale consists of eight statements (including "My parents know what I do in my spare time" and "My parents know who my friends are in their spare time"). A 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) was used to assess the extent to which parents monitor their children. The scores of all questions were added up to calculate the total score. The higher the total score, the stricter the parental monitoring of adolescents. The consistency coefficient in this study was 0.85.

Chinese version of bully/victim questionnaire for middle students

We used the Olweus Bully/Victim Questionnaire established by Olweus (1993) and modified by Zhang and Wu (1999), and selected the Bully sub-scale to obtain data on the frequency of bullying by adolescents toward their classmates. The scale consists of six

questions (including "Have you hit, kicked, pushed, bumped or threatened another student this semester?" and "Did you force certain students to give you money, or take or damage something from them this semester?"), In the questionnaire, it was found that a topic of threatening bullying was difficult to be divided into three international methods of implementation, namely, physical bullying, verbal bullying and relational bullying (UNESCO, 2017), so it became a unique category (Chen, 2010). Therefore, the manifestations of bullying in this study are divided into four categories: physical bullying, verbal bullying, relationship bullying, and threats. Threat refers to a bullying method that coerces others through different means to achieve the purpose of bullying. A 5-point Likert scale (1 = "not at all," 5 = "several times a week") was used. The total score was calculated by adding up the scores of all questions. The higher the total score, the higher the frequency of bullying by others. The consistency coefficient in this study was 0.91.

Data analysis

IBM SPSS Statistics 21.0 software was used for data analysis. The following steps were applied: First, we conducted a common method biases test; second, the gender differences of variables were tested and the correlation between variables was analyzed; finally, Model 14 in the PROCESS program compiled by Hayes (2013) was adopted to test the moderated mediation effect. Five thousand samples were taken and the confidence interval was set at 95%. If the confidence interval does not include 0, the effect is significant. Hypothesis testing methods such as T test, analysis of variance and regression were mainly used in this study.

Control and inspection of common method biases

In this study, data were obtained from questionnaires meaning that common method biases might affect the results. To reduce the impact of error on the research results, Harman's single-factor test was adopted to examine the results of unrotated factor analysis, the number of factors with characteristic roots greater than one and the cumulative percentage of the first common factor (Podsakoff et al., 2003). The results showed that there were eight factors with characteristic roots greater than 1, and that the variance explanation rate of the first common factor was 15.45%, less than the critical value. Therefore, the current study was not significantly affected by common method biases.

Results

Descriptive statistics and correlation analysis

We compared the results of males and females from the four questionnaires on family cohesion, total self-control score, parental monitoring, and school bullying, and adopted the independent samples T-test to determine gender differences in the four variables. The results showed that there were no significant gender differences in family cohesion, total self-control scores, and parental monitoring, while there were significant gender differences in engagement in school bullying, males (M = 7.71) was more likely than females to bully others. These results are shown in Table 1.

To facilitate the evaluation of the practical significance of each variable in the gender difference, effect sizes were calculated, which ranged from 0.004 (total self-control score) to 0.31 (school bullying). Cohen (1988) suggested that Cohen's $d = 0.2$, 0.5, and 0.8 corresponds to small, medium, and large effect sizes, respectively; in the current study, there was a significant gender difference in school bullying, but the effect size was lower than the medium level. This may be because the effect size is affected by sampling, measurement and other objective factors (Ferguson, 2009).

The Pearson correlation test was used to analyze age, family cohesion, parental monitoring, total self-control score, and adolescents' engagement in school bullying (see Table 2). The data analysis showed that age was significantly negatively related to family cohesion (the correlation coefficient was −0.1, with moderate correlation; the older the age, the lower the family cohesion), and also was significantly negatively related to parental monitoring (the correlation coefficient was −0.23, with moderate correlation; the older the age, the lower the degree of parental monitoring). However, age was significantly positively related to the total self-control score (the correlation coefficient was 0.07, with weak correlation; the older the age, the lower the self-control ability), and has no correlation with adolescents' engagement in

TABLE 1 Analysis of differences in variables on gender (N=1,026).

Variable	Male		Female		t	p	Cohen's d
	M	SD	M	SD			
Family cohesion	6.58	2.14	6.42	2.41	1.14	0.265	0.07
Total self-control score	50.41	10.78	50.37	10.30	0.07	0.944	0.004
Parental monitoring	25.15	7.25	25.47	6.97	−0.72	0.472	0.05
School bullying	7.71	3.90	6.87	2.43	3.95***	0.000	0.31

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

TABLE 2 Correlation coefficients for each variable (N=1,026).

Variable	1	2	3	4	5
Age	1				
Family cohesion	−0.10**	1			
Total self-control score	0.07*	−0.21**	1		
Parental monitoring	−0.23**	0.33**	0.00	1	
School bullying	−0.03	−0.15**	0.21**	−0.11**	1

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

TABLE 3 Decomposition of the total, direct and mediating effects.

Path	Effect size	Boot SE	Boot LLCI	Boot ULCI	Ratio
Family cohesion → Total self-control score → School bullying	−0.04	0.02	−0.07	−0.01	25.00%
Direct effect	−0.12	0.03	−0.18	−0.06	75.00%
Total effect	−0.16	0.03	−0.22	−0.10	

SE, standard error; LLCI, lower limit confidence interval; ULCI, upper limit confidence interval.

school bullying. Family cohesion was significantly negatively related to adolescents' engagement in school bullying (the correlation coefficient was −0.15, with moderate correlation; the higher the family cohesion, the lower the school bullying). Family cohesion was significantly positively related to parental monitoring (the correlation coefficient was 0.33, with moderate correlation; the higher the family cohesion, the higher the degree of parental monitoring). Family cohesion was significantly negatively correlated with the total self-control score (the correlation coefficient was −0.21, with moderate correlation; the higher the family cohesion, the lower the total self-control score). Parental monitoring was also significantly negatively correlated with school bullying (the correlation coefficient was −0.11, with moderate correlation; the stricter the parental monitoring, the lower the school bullying). The total self-control score was positively correlated with school bullying (the correlation coefficient was 0.21, with moderate correlation; the stronger the self-control of adolescents, the less the school bullying). However, parental monitoring was insignificantly correlated with self-control.

Family cohesion on school bullying: Examination of the mediating effect of self-control

We first standardized the variables and tested whether there was a mediating relationship between the variables. Based on the mediation test procedures proposed by Wen et al. (2004), the bootstrap method was used to test the relationship between the variables. After controlling gender and age variables, for the indirect path of family cohesion affecting school bullying through the total self-control score, the 95% confidence interval was [−0.07, −0.01], the upper and lower limits were negative, and the 95% confidence interval did not include 0. The effect size was-0.04, and the mediating effect was significant and accounted for 25.00% (the proportion of the effect). In validating the direct effect of family cohesion on school bullying, the 95% confidence interval was [−0.18, −0.06], and the interval also did not contain 0. The effect size was −0.12, and the direct effect was significant and accounted for 75.00% (the proportion of the effect). Without including the total self-control score in the regression equation, the total effect of family cohesion on school bullying was also significant, with an effect size of −0.16. Therefore, the results suggest that family cohesion predicts school bullying in adolescents. The total self-control score can play a significant mediating effect between the two factors, indicating a significant mediating effect of self-control. The specific results are shown in Table 3.

The impact of family cohesion on school bullying: Examination of the moderated mediating model

To explore whether the above mediating effects differ significantly at different levels of parental monitoring, we tested the moderated mediating effects. As shown in Table 4, the test results indicated that family cohesion significantly and negatively predicted the total self-control score ($\beta = -0.20$, $t = -6.62$, $p < 0.001$), suggesting that family cohesion positively predicted self-control. However, gender and age did not significantly predict the total score of self-control. The predictive effect of family cohesion on school bullying was also significant ($\beta = -0.09$, $t = -2.89$, $p < 0.01$). Both gender and age had significant predictive effects on school bullying ($\beta = -0.24$, $t = -3.95$, $p < 0.001$; $\beta = -0.04$, $t = -2.44$, $p < 0.05$). Moreover, the total self-control score positively predicted school bullying ($\beta = 0.18$, $t = 6.02$,

TABLE 4 Test of the moderated mediating model.

Regression Equation ($N = 1,026$)		Fit index			Significance	
Outcome variable	**Predictor variable**	***R***	***R²***	***F***	***β***	***t***
Total self-control score	Family cohesion	0.22	0.05	16.61***	−0.20	−6.62***
	Gender				−0.03	−0.50
	Age				0.03	1.82
School bullying	Family cohesion	0.33	0.11	20.11***	−0.09	−2.89**
	Gender				−0.24	−3.95***
	Age				−0.04	−2.44*
	Total self-control score				0.18	6.02***
	Parental monitoring				−0.09	−2.72**
	Total self-control score × Parental monitoring				0.12	4.96***

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

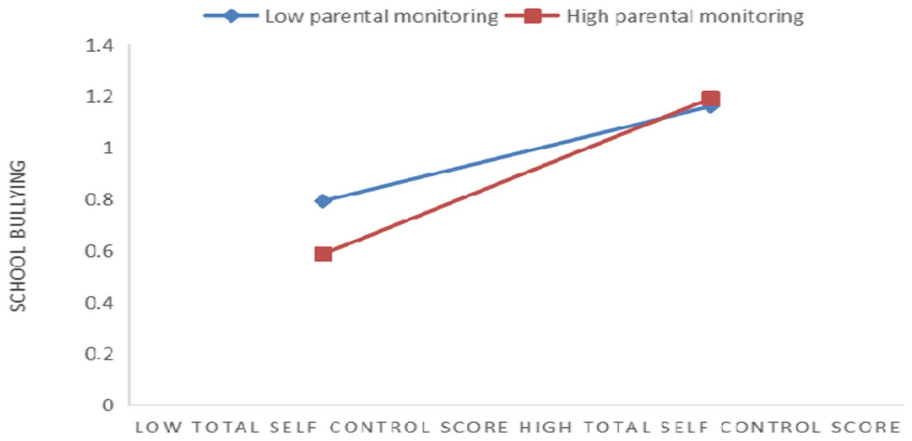

FIGURE 2
The influence of self-control on school bullying: the moderated effect of parental monitoring. The diamond represents low parental monitoring and the square represents high parental monitoring.

$p < 0.001$). The same predictive effect of the cross-term of the total self-control score and parental monitoring on school bullying also holds ($\beta = 0.12$, $t = 4.96$, $p < 0.001$). Parental monitoring moderates the second half of the path of the mediating effect.

To better explain the effectiveness of moderating effects in the pathway, a simple slope test was conducted to analyze the effect of moderating variables on the pathway (see Figure 2). The data were analyzed by setting the parental monitoring values to low and high groups. The results showed that when parental monitoring moderates the second half of the path of family cohesion–total self-control score–school bullying, the total self-control score is not a significant predictor of school bullying at low parental monitoring levels (M-SD; simple slope = 0.07, $t = 1.63$, $p > 0.05$). Under a high level of parental monitoring (M + SD), the lower the total self-control score and the higher the ability of self-control, the less the school bullying (simple slope = 0.30, $t = 8.16$, $p < 0.001$). This suggests that the higher the intensity of parental monitoring, the more pronounced the inferential effect of self-control on school bullying.

The mediating effect of self-control at different levels of parental monitoring is shown in Table 5. At a low level of parental monitoring (M-SD), the effect size of total self-control score was-0.01, with a 95% bootstrap confidence interval of [−0.05, 0.03], with a positive upper limit confidence interval (ULCI) and negative lower limit confidence interval (LLCI). The interval contained 0, indicating that it was not significant. At a high parental monitoring level (M + SD), the effect size of the total self-control score was-0.06, and the 95% bootstrap confidence interval was [−0.11, −0.03], with a positive ULCI and negative LLCI. The interval did not contain 0, indicating that it was significant. Thus, this suggests that the mediating effect of self-control is more prominent under a high level of parental monitoring.

To sum up, in the case of a high level of parental monitoring, adolescents with a higher self-control ability are less likely to engage in school bullying; on the contrary, adolescents with a low self-control ability are more likely to engage in school bullying. A

TABLE 5 The moderated mediating effect.

Intervening variable	Parental monitoring	Effect size	Boot SE	Boot LLCI	Boot ULCI
	M-SD	−0.01	0.02	−0.05	0.03
Total self-control score	M	−0.04	0.01	−0.07	−0.01
	M + SD	−0.06	0.02	−0.11	−0.03

low level of parental monitoring does not moderate the effect of self-control on school bullying. Therefore, increased parental monitoring contributes to a more significant effect of self-control on school bullying.

Discussion

The current study explored the gender difference test of family cohesion, total self-control score, parental monitoring, and school bullying, as well as the correlation between age and the above four variables. It also explored the direct impact of family cohesion on campus bullying, as well as the intermediary role of self-control and the regulatory role of parental monitoring on the path.

Test for differences in gender and correlation analysis

The results of this study showed that there were no significant differences in family cohesion, total score of self-control and parental monitoring between genders, while there were significant gender differences in school bullying.

In terms of family cohesion, previous studies have also concluded that there were no significant gender differences in family cohesion (Merkaš and Brajša-Žganec, 2011; Li, 2013). The masculinity of female education and the feminization of male education is a phenomenon that cannot be ignored in family education (Chen and Zhu, 2021), meaning that the differences in behavioral characteristics between males and females gradually fade away. a reasonable assumption is that there is no significant gender difference in family cohesion.

Jo and Bouffard (2014) argue that Gottfredson and Hirschi's (Gottfredson and Hirschi, 1990) idea of self-control stability can be studied across gender; they believe that males and females should have similar developmental pathways of self-control. Therefore, there is no significant gender difference in self-control. In terms of parental monitoring, previous studies have also confirmed that there is no significant gender difference (Son and Padilla-Walker, 2022). In China, where the number of only children is increasing, parents pay more attention to their children's family education rather than paying less attention to their children because of their gender. Therefore, we suspect that the absence of significant gender differences in parental monitoring is due to regional and cultural differences as well as the selection of samples.

This study found that males had a higher incidence of bullying than females, which is consistent with existing research findings (Deepshikha and Dalbir, 2018; Li B. L. et al., 2022). A recent study also noted that males were more likely than females to report all forms of bullying (Li X. Q. et al., 2022). Investigate the reason, the first may be related to the physiological factors of males and females, males may show higher aggressive behavior than females because of the influence of adolescent male hormones (Cheng et al., 2020). Second, males's bullying tend to obtain a dominant position in the group a higher position and target (Patchin and Hinduja, 2010). However, the correlation between adolescent females's status acquisition goals and bullying behavior is weak (Sijtsema et al., 2009) and due to differences in gender role expectation and socialization process, females than males in relationships tend to show more prosocial target and policy orientation (Almquist et al., 2014). So this leads to a higher incidence of bullying in males than in females.

In the results, there was no significant correlation between age and adolescents' engagement in school bullying, which was consistent with the previous results (Wang et al., 2022). School bullying exists in a wide age range, throughout the adolescence, and even among adult college students (Gao and Liu, 2018). The results of a survey on bullying in junior high school show that students in grade two are more likely to engage in bullying than students in grade one and grade three (Wang and Liu, 2016). From the perspective of development psychology, junior high school students in grade two are accelerating the development of junior high school self-awareness (Chen et al., 2005). The pursuit of self-control and the constraints of social pressure become the main contradiction faced by students' psychological adjustment at this time (Longe and Adeyeye, 2019). If the contradiction is not handled properly, it is easy to lead to bullying. It can be seen that it is reasonable that age is not related to participation in campus bullying. In this study, there was no correlation between the total self-control score and parental monitoring for adolescents. An assessment study of eighth-graders found that adolescents with low self-control were more deeply involved in gangs and had an increased likelihood of delinquency, as were adolescents who were not monitored by their parents (Da Na et al., 2010). Self-control is more from the subjective will, is a conscious and hard process (Hoyle, 2006), and is influenced by many aspects of genetics and environment (Mueller et al., 2022), so the correlation between parental monitoring and self-control is not stable, and this result is reasonable.

Direct effect of family cohesion on school bullying

This study found that family cohesion significantly predicted adolescents' school bullying, with a negative correlation between family cohesion and school bullying. Adolescents who grew up in intimate families were less likely to engage in school bullying. This suggests that cohesive families can better guide adolescents' behavioral norms, thus reducing school bullying incidents. Family is the first place for children's socialization and psychological development (Wang et al., 2020). Some studies have suggested that families that solve problems through indifference or even violence contribute to adolescents having a bullying personality (Su et al., 2016). Adolescents with a low level of family cohesion are more likely to commit delinquent behaviors (Cheng et al., 2016), and seeing high rates of parental conflict and poor parent–child relationships, adolescents are more likely to develop the belief that aggression can solve problems(Xia et al., 2016). Insufficient warmth from family cohesion makes adolescents more prone to aggression when they are feeling less confident, more sensitive, and impulsive (Li X. et al., 2020), which leads to their engagement in school bullying.

The mediating effect of self-control

The results suggest that family cohesion not only directly influences adolescents' school bullying, but also indirectly influences it through self-control. In previous studies, some factors in the family were found to influence the cultivation of students' early self-control ability (Niu et al., 2020; Yun et al., 2020). Moreover, a positive family atmosphere also helps adolescents to develop independent personality traits, to self-regulate and consciously improve their self-control. Therefore, family cohesion can influence individuals' self-control. Also, previous studies have shown that self-control ability can significantly influence the school bullying of students in rural boarding high schools (Zhang and Zhang, 2019), consistent with the findings of this study. People's self-control and decision-making are related to a common area of the brain, and the two factors are closely associated (Ren, 2019). Bullying is a decision-making behavior. Adolescents who have high self-control are more likely to restrain themselves from making negative decisions. Therefore, adolescents with an intimate family atmosphere feel a stronger sense of belonging and security in the family, meaning they have a stronger self-control ability. The stronger the self-control, the better they are able to control their behavior and may avoid engagement in school bullying when facing conflict. Since family cohesion affects both school bullying and the formation of self-control ability, self-control affects the emergence of school bullying. Therefore, self-control has a mediating effect between family cohesion and school bullying.

The moderating effect of parental monitoring

After exploring the mediating effect of self-control in the effect of family cohesion on school bullying, we further examined the moderating effect of parental monitoring on the mediating pathway. The data showed that parental monitoring mainly moderated the second half of the path from family cohesion to self-control and finally to school bullying. This study also clarified that the predictive effect of self-control on school bullying increased with parental monitoring, and that adolescents with a high level of parental monitoring were more likely to be influenced by self-control and engage in school bullying. Continued moderate parental monitoring can indeed enhance children's social adjustment (Zhang et al., 2011). However, parents who supervise their children severely and over-emphasize behavioral control aggravate the rebelliousness of their children (Jin and Zou, 2013). In the case of a high level of parental monitoring, adolescents with high self-control think calmly in the face of conflict at school and have a lower likelihood of being involved in school bullying. However, adolescents with low self-control may negatively influenced by a high level of parental monitoring. As adolescents with low self-control enter adolescence, sudden changes and discomfort may make them more rebellious (Zhang et al., 2021). The more rebellious adolescents are, the more likely it is that their parents will negatively monitor them (Xu, 2005). At the same time, highly supervisory parents are too restrictive of their children, who have low self-control, which hinders them from communicating with the outside world, thus limiting the development of their behavioral experiences and leading to low social competence, this is more likely to cause negative externalizing problem behavior (Tan et al., 2018). In addition, the more that parents supervise adolescents with low self-control, the more often they have a negative attitude towards adolescents, and they may even use violent education methods, this subconsciously promotes aggressive psychology among adolescents (Chen et al., 2014), who become unfamiliar with the outside world, thus accelerating the development of school bullying. Maintaining moderate parental monitoring is more effective in helping adolescents to reduce or even avoid their problematic behaviors (Deng et al., 2006). Therefore, it is reasonably suggested that the effect of self-control on school bullying is more significant when moderated by a high level of parental monitoring.

Key findings

The key findings in this study can be summarized as follows:

1. Family cohesion, self-control, and parental monitoring are significantly negatively correlated with school bullying.
2. Family cohesion can directly influence school bullying and indirectly influence school bullying through self-control, with self-control playing a mediating effect.

3. In the model of family cohesion influencing school bullying, self-control played a mediating role, and the second half of the model's path is moderated by parental monitoring.

Strengths and limitations

This cross-sectional study was conducted to obtain data on various variables through a questionnaire survey, explore the impact of family cohesion on school bullying behavior through self-control, and verify the moderating effect of parental monitoring. All hypotheses were verified by combining theories with practical data. However, this study also has some limitations. First, cross-sectional studies cannot reveal the causal relationship between family cohesion and school bullying. In future studies, an experimental or longitudinal approach may be used for further analysis. Second, all constructs and outcomes are measured by adolescents' self-reports, which may exaggerate the relationship between variables. Future studies can combine peer reports, teacher reports and other data collection methods to further enhance the reliability of data. Thirdly, the ecological theoretical model is emphasized in the theoretical discussion of this study. Because there are multiple roles in Microsystems, different roles may have different conceptual understandings of variables, leading to different research results. More related theories should be used in future research to integrate the concept of exploration variables. In addition, the adolescents surveyed in this study come from Chongqing and Sichuan, rather than nationwide. To enhance the reliability of the conclusions, the sample should be expanded for further investigation in future studies.

Conclusion

School bullying is a safety risk factor and an obstacle for students' physical and mental health, so it needs to be monitored. The family environment is an important factor that influences the school bullying behavior of adolescents and positively predicts their self-control ability. At high levels of parental monitoring, adolescents with higher self-control are less likely to engage in school bullying behaviors. In contrast, the lower the level of parental monitoring, the more likely it is that adolescents with lower self-control will engage in school bullying behaviors. Therefore, in order to help adolescents reduce school bullying behavior, we can improve their family cohesion, enhance their self-control ability, and maintain moderate parental monitoring.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by The Local Research Ethics Committee of Chongqing Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

XC was principal author of the manuscript, consulted the literature, and logged the data. ZL was advisor. JJ contributed to data analysis. YG and JD logged the data. All authors contributed to the article and approved the submitted version.

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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 teacher support, peer relationship, and university students' mental health: The mediation of reality and Internet altruistic behaviors

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Studying in universities is a crucial development stage for students, whose thoughts, feelings, and actions are affected by interactions with their teachers and peers. This study explored the relationships between perceived teacher support and mental health as well as those between peer relationship and mental health among university students, and examined the mediating effects of reality and Internet altruistic behaviors on these relationships. Perceived teacher support questionnaire, peer relationship satisfaction questionnaire, self-reported altruism questionnaire, Internet altruistic behavior questionnaire, and general health questionnaire were administered to 553 university students. Results demonstrated that perceived teacher support and peer relationship positively predicted reality and Internet altruistic behaviors and positively predicted mental health. Reality and Internet altruistic behaviors positively predicted mental health and exerted significant mediating effects on the correlations between perceived teacher support and mental health as well as those between peer relationship and mental health. The male and female students differed insignificantly in the mediating effects of reality and Internet altruistic behaviors. Therefore, no matter for males or females, teachers should provide sufficient support for the students and establish favorable relationships with them. Friendly relationships, comfort, and active communication among peer students are also essential for creating a healthy and harmonious interaction environment. Those various factors of the school have impacts on the mental health of university students through their altruistic behaviors. This study suggests that further emphasis on teacher support and peer relationship is needed to promote the positive development of altruistic behaviors among university students, and ultimately provide a viable contribution to the university students' mental health interventions.

KEYWORDS

perceived teacher support, peer relationship, reality altruistic behavior, Internet altruistic behavior, mental health, university students

Introduction

People's expectations for the services that universities should provide are increasing, and the society's requirements for the skills and abilities that university graduates need are increasing day by day, which is not only a challenge to universities, but also a challenge to university students (Chan, 2016). High-quality university environments provide students with excellent educational resources, including professional faculty and harmonious interpersonal relationships. Good interpersonal relationships established by university students can play a supportive and positive role in psychological development (Cassidy, 2004). What's more, Mallinckrodt and Leong (1992) discussed the question about establishing good teacher–student relationships in higher school can reduce the risk of depression when students feel stressed. In China, the mental health of university students has received notable attention from the government and society (Tang et al., 2021). Similarly, due to the continuous occurrence of university students' psychological campus tragedies, the international community has also paid great attention to the related problems of university students' mental health in recent years (Castillo and Schwartz, 2013). Therefore, it is time to look at the impact of campus-level factors on the mental health of university students, which will not only help to improve the educational environment, but also will have important practical implications for mental health interventions of university students.

According to the ecological systems theory, during personal development, individuals gradually become independent from their family microsystems, which are replaced by schools as one of the most crucial environments affecting their development (Bronfenbrenner and Evans, 2000). In relation to the university campus environment, Zhou et al. (2016) have developed the "field-interaction" theory, which identifies the systemic causal relationships that influence the development of university students. As individuals enter the university stage, various fields of material significance enter the student's life as they are influenced by the university field, and as other fields interact. Teachers and peers, as the most crucial and ultimate factors in the university field, are the nearest others besides the students themselves, and have a lasting influence on the students, especially on their values, cognitive styles, and ways of acting. The various domains have positive or negative resilient influences on university students, who, as educated parties, are somewhat passive in the influence. Therefore, by improving the nearest other in the university field environment, this study gives positive influence to university students, helps or guides their behaviors, and improves their mental health, so that university students can change from a passive and influenced party to a positive and active subject of behaviors, and become the provider and exporter of altruistic behaviors.

The NSSE report[1] provides us with a new perspective to pay attention to the higher education environment. As described in this report, higher education is undergoing changes, prompting our research to focus on factors such as higher education environment, teacher–student relationships, and student–student relationships. Hagenauer and Volet (2014) concluded that student-faculty relationship plays an important role in higher education because it can influence students' satisfaction with the course, students' attitudes and quality of learning, and students' dropout rates. Social support makes a person feel cared for, respected and loved, and believe that it is part of a system of mutual obligations (Cobb, 1976; Brandon et al., 2010). Social support comes from different sources, such as parental support, teacher support, and peer support, and research has found that social support helps university students adjust successfully to university life (Tao et al., 2000). It can be found that other people who have important impacts on university students, in addition to university students themselves, are teachers and peers who have positive or negative impacts on university students in school. Therefore, our research focuses on the faculty and peer factors as well as the mechanisms (i.e., altruistic behaviors) affecting the mental health of university students.

Teacher's support refers to the support, response, and help of teachers to students (Wang, 2009). That is also an essential indicator reflecting the quality of the teacher–student interaction and the formation of favorable interpersonal ecologies (Zhang et al., 2020). The main effect model in social support theory indicates that increasing social support can improve the mental health of individuals (Cohen and Wills, 1985; He et al., 2021). Scholars have asserted that students' perceptions of teacher support considerably affect their self-esteem, self-efficacy, and subjective well-being (Zhang et al., 2019; Sun et al., 2021). Ryan and Powelson (1991) have emphasized it is important to establish a close supportive relationship with adults in the school environment to encourage the internalization of behavioral norms. In the growth of students, teachers can guide them to interact properly with peers, regulate their emotions and take positive steps to deal with things. Students are also provided with a sense of security to explore their surroundings (Marcus and Sanders-Reio, 2001). Thus, students' perceived teacher support affects their mental health, and teacher support promotes the formation of a harmonious campus environment. Nowadays, universities are required to strengthen the development of scientific research. However, the further differentiation of academic roles of university teachers has prompted teachers to pay more attention to scientific research, which may aggravate the contradictions and conflicts between teachers and students originally formed by hierarchical asymmetry, which may interfere with the socialization process of university students (Zhou et al., 2016), and thus affect the training direction of higher education. The emergence of this social phenomenon reminds us that we should pay attention to the relationship between teachers and

1 https://nsse.indiana.edu/

students, specifically, the support of university teachers for university students.

In the process that university students gradually become independent of their parents and begin to seek support from their peers, the influence of peers in school becomes stronger (Roach, 2018; Li et al., 2020). The individual-environment interaction model posits that peer interactions form a social environment (Lerner, 2006), where reciprocity among individuals yields greater benefits than those gained from the parent–child relationship (Gorrese, 2016). Favorable peer relationship is conducive to the formation of a favorable peer environment. Mackin et al. (2017) discovered that peer support is a crucial protective factor against stress induced by interpersonal relationship. Active peer relationship reduces behavioral problems in individuals and improves their mental health and satisfaction with life (Huang et al., 2020). When individuals are in an unfavorable peer relationship and experience physical and relational attacks or even campus bullying, they develop a series of negative emotions (Smith et al., 2014; Ji et al., 2020). Kingery et al. (2010) observed that peer refusal and victimization are significantly correlated with anxiety. The group socialization theory based on genetics and sociology proposed that during personal development, individuals consider themselves to be part of a specific peer group (Harris, 1995). They comply with the attitude and norms of the group to ensure similarity with others and therefore easily assimilate to the characteristics of the group (Ma, 2020). University students' living environment is quite special, and peer relationship is the core of interpersonal relationships. A good interpersonal relationship can help university students maintain a good psychological state. Overall, teacher support and peer relationship exert strong effects on individuals' mental health. However, few studies have examined how university students' perceived teacher support and peer relationship are correlated with their mental health, and the underlying mechanisms governing these effects merit comprehensive exploration.

Altruistic behavior refers to the act of generating benefits for others at a cost to oneself (Fehr and Fischbacher, 2003). Many scholars have verified that such behavior improves mental health. For example, Post (2005) proposed the proactive emotion model, and asserted that the proactive emotions induced by altruistic behavior can negate passive emotions and therefore improve mental health. Feng and Guo (2017) discovered that both self-reported altruistic behaviors and peer-reported altruistic behaviors are conducive to the realization of self-value and the improvement of well-being. Post (2014) concluded that a strong correlation exists between the well-being, happiness, health, and longevity of people who are emotionally kind and compassionate in their charitable helping activities. In school environments, the teacher–student relationship is an essential social relationship of students, and is a predictor of altruistic behavior among students. According to the theory of emotional attachment, the positive attachment relationship can promote the emergence and maintenance of individuals' altruistic behavior to a great extent. Luckner and Pianta (2011) reported a strong correlation between the quality of teacher–student interaction and altruistic behavior among students. A favorable teacher–student relationship and peer relationship are conducive to active interaction among students, increase students' sense of belonging to schools, and promote an active attitude toward daily life. Moreover, the previous study found that prosocial behavior was related significantly and positively to peer acceptance and perceived support (Wentzel and Mcnamara, 1999). Sullivan (1953) suggested that there are reasons that adolescents are provided with many positive opportunities to learn prosocial skills when in contact with peers, and this conclusion can be supported by extensive literature linking prosocial behavior to peer acceptance in middle childhood (Asher and Coie, 1990). Thus, the harmonious teacher–student relationship and peer relationship can promote altruistic behavior among students (Hughes, 2011; Longobardi et al., 2016). By contrast, when teachers demonstrate unjust behavior and students feel deceived, the students are less likely to demonstrate altruistic behavior (Jiang et al., 2019). Accordingly, the following hypothesis (H1) is proposed: perceived teacher support and peer relationship indirectly predict the mental health of university students through reality altruistic behavior.

The development of the Internet has increased the attention toward Internet altruistic behavior. The large-scale spread of COVID-19 epidemic infectious diseases has affected the well-being and interests of all mankind. Education in various countries has been transformed into online teaching through the Internet. For example, online lectures, online academic life, and necessary social exchanges within the school are offered (Aristovnik et al., 2020). The Internet facilitates a novel teaching approach through online education platforms, and reduces the psychological distance between students and teachers irrespective of the physical distance between them. The teaching approach provides a new model for expanding the teacher–student relationship. Katz (2010) deeply studied the distance learning preference of university students in the early research. When individuals interact with others online, they can also acquire information and gain emotional support from others (Zheng et al., 2021). Teachers can use instant messaging applications or online courses as media to teach students remotely or provide them explanations or emotional support. When individuals receive more social support from the online environment, they experience more active emotions, which are conducive to the generation of altruistic behavior. Therefore, the Internet altruistic behavior not only has an important impact on the positive psychological quality of university students, but also helps to form a social atmosphere of "civilized netizens" (Jiang et al., 2017). Scholars have indicated that reality and Internet altruistic behaviors do not differ in essence, and Internet altruistic behavior can be reality altruistic behavior conducted in an online environment (Zheng, 2013). However, Li and Yang (2018) disagreed with this viewpoint, and Sargeant et al. (2007) also proposed that the prerequisite for conducting Internet altruistic behavior is lower than that for conducting altruistic behavior in other settings. Therefore, individuals are more likely to demonstrate Internet altruistic behavior without forethought (Bennett, 2009). With the development of the Internet, people's lives are filled with

all kinds of Internet information. In the real life, the subject can define his/her own behavior, but in the network life, the individual projects his/her real self into the virtual media world. Bai (2022) pointed out that through narcissistic expression, silent expression, and other ways, individuals present a mirror self that combines performance, openness, and narcissism. In the Internet era, the real self and the performance self constantly play games in the online and offline world. In order to avoid the mirrored self of the subjects, this study makes a detailed distinction between the Internet altruistic behavior and the reality altruistic behavior. Regarding the Internet altruistic behavior of university students, the following hypothesis (H2) is proposed: perceived teacher support and peer relationship indirectly predict the mental health of university students through Internet altruistic behavior.

The present study explored how reality and Internet altruistic behaviors mediate the relationship between perceived teacher support and mental health as well as that between peer relationship and mental health among university students. In the previous investigation, it is found that the level of social support received by boys is significantly lower than that of girls, and girls are more likely to receive material and spiritual support. Interestingly, the mental health level of female university students has not been improved (Xue et al., 2010). The issue of gender differences has always been a topic of concern in the field of education. Buchmann et al. (2008) studied the gender inequality in the field of education in reviews, specifically the gender inequality in the educational performance and achievements of young people from early childhood to adulthood, and they pointed out in the study that women have the best advantage in completing degrees. This shows that education in various countries is affected by gender differences to varying degrees. In the future, with the popularization and development of higher education, the direction of gender differences should be paid more attention to. Therefore, this study believes that it is necessary for us to analyze the gender differences.

Materials and methods

Participants and procedure

In this cross-sectional study by means of an online questionnaire survey, convenience cluster sampling was adopted to recruit 600 students from two higher education institutions in Shandong Province, China. A total of 553 samples were retrieved after invalid samples were excluded because there were much missing data on key study variables; thus, the valid response rate was 92.17%. Of the valid samples, 209 and 344 were male and female students, respectively. The participants were aged 18–25 years [mean ± standard deviation (*SD*): 21.00 ± 1.56 years].

The Coronavirus disease COVID-19 is regarded as the worst-hit pandemic of the century to date (Shanafelt et al., 2020). Due to the COVID-19 pandemic, this study distributed and collected online questionnaires through the network platform. University students were recruited by posting advertisements, forum recruitment, and social media publicity. We established group chats of participants to facilitate timely communication with them. The function of adding friends to each other was turned off to prohibit individually communication to ensure the authenticity of the self-report.

The study was carried out as follows: We communicated with the university students on the Internet, and they were completely anonymous during the formal survey. After obtaining their informed consent, we sent questionnaires online and they answered the online questionnaires, and we did not send questionnaires to those who were not willing to cooperate with the investigation. The measures were administrated to the participants by trained research assistants online. The trained research assistants clearly informed the participants before the survey that there is no right or wrong answer to the questionnaire, that there will be no privacy issue related to the participants, and that the information the participants fill in the questionnaire is completely confidential. The participants were also informed that the measures included questions on their beliefs and experiences in daily life and were encouraged to respond to all the items accurately. At the same time, if the participants feel any discomfort during the research process, they can withdraw at any time. The data collection procedures lasted approximately 30 min. The participants completed measures including the demographic questionnaire, the perceived teacher support questionnaire, the peer relationship satisfaction questionnaire, the self-reported altruism questionnaire, the Internet altruistic behavior questionnaire, and the general health questionnaire (total of 105 items). All survey materials are presented in the local language, and the language of the study was Chinese. Upon study completion, each participant received a bonus (CNY 6 = US $0.93) for compensation.

This study was conducted under the approval of the Institutional Review Board (IRB) at the Shandong University of Technology, and was conducted in accordance with the Declaration of Helsinki. Written consent was obtained prior to the research. All participants were over 18 years old, and there were no minors or children involved. This study caused no harm to participants' physical and mental health, and the results of this study were maintained confidentially.

Measures

Demographic characteristics

The participants provided demographic characteristics information including their gender and age, the number of children in the home, and the home location.

Perceived teacher support questionnaire

The perceived teacher support questionnaire designed by Ouyang (2005) for university students was employed in this study. Previous studies have shown that the questionnaire is suitable for

measuring Chinese university students' perceived teacher support (Zhang, 2012; Yu, 2019). This questionnaire contains 19 items across three dimensions. The learning support dimension contains nine items (e.g., "My teacher is very strict with me when it comes to learning."); the emotional support dimension contains six items (e.g., "My teacher shows a very gentle attitude toward me."); and the capability support dimension contains four items (e.g., "My teacher often appoints me to oversee various tasks in the classroom."). This questionnaire is scored using a 6-point scale, with scores of 1–6 indicating *completely disagree*, *disagree*, *somewhat disagree*, *somewhat agree*, *agree*, and *completely agree*, respectively. The final average scores ranged from 1 to 6. A high score indicates that respondents clearly perceive support from their teachers in learning and daily life activities. In this study, teachers include who are subjectively connected with "me" and all members who have a positive or negative impact on "me" from the perspective of students. They are teachers who have intersection with university students and have an impact or educational significance on university students. In the present study, the internal consistencies of the overall questionnaire, learning support dimension, emotional support dimension, and capability support dimension were 0.95, 0.87, 0.89, and 0.85, respectively.

Peer relationship satisfaction questionnaire

The peer relationship satisfaction questionnaire designed by Wei (1998) for university students was adopted in this study. Previous studies have shown that the scale is suitable for measuring the peer relationship of university students in the Chinese context, and the reliability is appropriate (Li et al., 2018). This questionnaire contains 20 items. Examples of the items in this questionnaire are "Classmates enjoy spending time with me," "Classmates are never angry with me," and "I feel very sad when classmates are ill." This questionnaire is scored using a 5-point scale, with scores of 1–5 indicating *completely disagree*, *somewhat disagree*, *unsure*, *somewhat agree*, and *completely agree*, respectively. The final average scores ranged from 1 to 5. A high score indicates more favorable peer relationship. In the present study, the internal consistency of this questionnaire was 0.92.

Self-reported altruism questionnaire

The self-reported altruism questionnaire can be adopted to divide altruistic behaviors into different types (Oda et al., 2013). It contains 21 items across three dimensions: altruism to family members dimension (e.g., "I provide support to my family members when they become ill."), altruism to friends dimension (e.g., "I tend to listen to the worries and complaints from my friends or acquaintances."), and altruism to strangers dimension (e.g., "When riding a train, I remind strangers that they can place their luggage on racks."). Each of these dimensions contains seven items. This questionnaire is scored using a 5-point scale, with scores of 1–5 indicating *completely disagree*, *somewhat disagree*, *unsure*, *somewhat agree*, and *completely agree*, respectively. The final average scores ranged from 1 to 5. A higher score indicates that the respondent is more likely to demonstrate altruistic behavior. The questionnaire has been verified to exhibit high reliability and validity in the context of Chinese culture (Feng and Guo, 2017). In the present study, the internal consistencies of the overall questionnaire, altruism to family members dimension, altruism to friends dimension, and altruism to strangers dimension were 0.97, 0.94, 0.93, and 0.92, respectively.

Internet altruistic behavior questionnaire

The Internet altruistic behavior questionnaire designed by Zheng (2010) for university students was adopted in this study. This questionnaire contains 26 items across four dimensions: the Internet support dimension, which contains nine items (e.g., "I actively reply to others' comments."); Internet guiding dimension, which contains six items (e.g., "I guide other Internet users to use the internet."); Internet sharing dimension, which contains six items (e.g., "I share with others internet my successful learning experience."); and Internet reminding dimension, which contains five items (e.g., I expose illegal activities Internet to remind others not to contribute to the same crimes."). This questionnaire is scored using a 4-point scale, with scores of 1–4 indicating *never*, *occasionally*, *sometimes*, and *often*, respectively. The final average scores ranged from 1 to 4. A high score indicates that the respondent frequently demonstrates Internet altruistic behavior. The questionnaire designed has been established to apply to Chinese university students (Zheng, 2013; Zheng and Wang, 2017; Zheng et al., 2021). In the present study, the internal consistencies of the overall questionnaire, Internet support dimension, Internet guiding dimension, Internet sharing dimension, and Internet reminding dimension were 0.97, 0.94, 0.92, 0.91, and 0.90, respectively.

General health questionnaire

The general health questionnaire designed by Li and Li (2015) evaluated the mental health of university students was adopted in this study. The Chinese version has been established to apply to Chinese university students (Li and Li, 2015). This questionnaire contains 12 items across two dimensions: the positive health dimension (e.g., "Can you concentrate on completing your tasks?") and negative health dimension (e.g., "Have you experienced insomnia due to worries?"). Each of these dimensions contains six items. This questionnaire is scored using a 4-point scale, in order to

conform to the habit of positive thinking, this study will score the reverse scoring questions in the forward direction, that is, the higher the score, the better the mental health of the university students. The final average scores ranged from 1 to 4. In the present study, the internal consistencies of the overall questionnaire, positive health dimension, and negative health dimension were 0.86, 0.77, and 0.79, respectively.

Statistical analysis

The collected data were processed using SPSS 19.0 and Amos 23.0. Descriptive statistics and correlational analysis in this study were conducted with the SPSS 19.0. The Amos 23.0 was used to conduct path analysis and multiple-group comparison with maximum likelihood estimation to examine the mediating effects of reality and Internet altruistic behaviors. The significance limit was set at $p < 0.05$. Evaluations of structural equation modeling (SEM) models were conventionally based on the following statistics: the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root-mean-square error of approximation (RMSEA; McDonald and Ho, 2002; Kline, 2005).

Moreover, the Bootstrap method was used to test the mediating effect by PROCESS (Hayes, 2013), wherein repeated random sampling was used to collect n bootstrap samples ($n = 5{,}000$) from the original data to generate and save n mediating effect values to form an approximate sampling distribution, and the mean path coefficient of the mediating effect was calculated. If the 95% confidence interval of these mean path coefficients did not include 0, the mediating effect was significant (Preacher and Hayes, 2008).

Results

Correlation analysis on perceived teacher support, peer relationship, reality altruistic behavior, Internet altruistic behavior, and mental health

Table 1 lists the results of the correlation analysis on perceived teacher support, peer relationship, reality altruistic behavior, Internet altruistic behavior, and mental health. Perceived teacher support was significantly and positively correlated with peer relationship, reality altruistic behavior, Internet altruistic behavior, and mental health ($p < 0.001$). Peer relationship was significantly and positively correlated with reality altruistic behavior, Internet altruistic behavior, and mental health ($p < 0.001$). Reality altruistic behavior was significantly and positively correlated with Internet altruistic behavior and mental health ($p < 0.001$). Internet altruistic behavior was significantly and positively correlated with mental health ($p < 0.001$).

TABLE 1 Correlations among the key study variables.

	1	2	3	4	5
1. Perceived teacher's support	–				
2. Peer relationship	0.64***	–			
3. Reality altruistic behavior	0.28***	0.34***	–		
4. Internet altruistic behavior	0.33***	0.36***	0.35***	–	
5. Mental health	0.33***	0.40***	0.20***	0.20***	–
M	4.33	3.78	4.07	2.62	2.55
SD	0.79	0.51	0.70	0.72	0.41

***$p < 0.001$.

Mediating effects of reality altruistic behavior on the relationships between perceived teacher support, peer relationship, and mental health among university students

Amos 23.0 was used to conduct path analysis for testing the mediation roles of altruistic behaviors between perceived teacher support, peer relationship, and mental health in a mediation model (Preacher and Hayes, 2008). Structural equation modeling was first conducted to examine the direct effects of perceived teacher support and peer relationship on mental health. The resulting model exhibited excellent fit [$\chi^2/df = 1.919$, CFI = 0.997, TLI = 0.993, and RMSEA = 0.041]. Perceived teacher support and peer relationship significantly and positively predicted mental health ($\beta = 0.14$, $p < 0.01$; $\beta = 0.36$, $p < 0.001$). Next, reality altruistic behavior was conducted as the mediating variable into the direct effect model to create the M_1 mediating effect model (Figure 1). The M_1 model exhibited excellent fit ($\chi^2/df = 2.168$, CFI = 0.993, TLI = 0.988, and RMSEA = 0.046). Perceived teacher support directly and positively predicted mental health ($\beta = 0.13$, $p < 0.05$). It also positively predicted mental health through positively predicting reality altruistic behavior ($\beta = 0.12$, $p < 0.05$; $\beta = 0.08$, $p < 0.05$). Peer relationship directly and positively predicted mental health ($\beta = 0.34$, $p < 0.001$). It also positively predicted mental health through positively predicting Internet altruistic behavior ($\beta = 0.25$, $p < 0.001$; $\beta = 0.08$, $p < 0.05$). The proportion of the mediating effect of reality altruistic behavior in total effect was 6.88 and 5.56%, respectively. The overall model explained 22.00% of the variance in university students' mental health.

A nonparametric percentile bootstrap method was adopted to verify the significance of the mediating effects of reality altruistic behavior (Hayes, 2013). The results revealed that the 95% confidence interval of the mediating effect of reality altruistic behavior on the relationship between perceived teacher support and mental health was [0.1112, 0.1962]. Moreover, the 95% confidence interval of the mediating effect of reality altruistic behavior on the relationship between peer relationship and mental health was [0.2647, 0.3884] (Table 2). The aforementioned results verified that the mediating effects of reality altruistic behavior were significant.

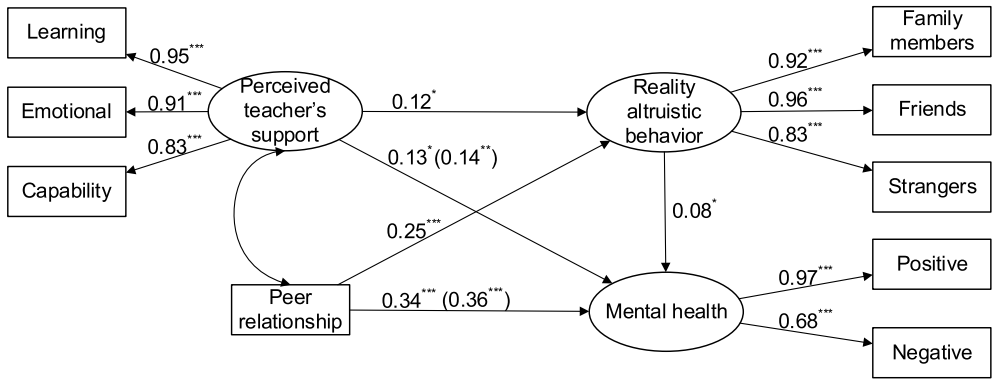

FIGURE 1
Relationships of perceived teacher's support, peer relationship, reality altruistic behavior, and mental health. *p<0.05, **p<0.01, ***p<0.001.

TABLE 2 Bootstrap analysis of the mediating effects.

Independent variable → Mediation variable → Dependent variable	Indirect effect	Boot standard error	95% bootstrap CI	
			Lower limit	Upper limit
Perceived teacher's support → Reality altruistic behavior → Mental health	0.1537	0.0216	0.1112	0.1962
Peer relationship → Reality altruistic behavior → Mental health	0.3065	0.0334	0.2647	0.3884
Perceived teacher's support → Internet altruistic behavior → Mental health	0.1527	0.1095	0.1095	0.1959
Peer relationship →Internet altruistic behavior → Mental health	0.3068	0.0336	0.2407	0.3729

Mediating effects of Internet altruistic behavior on the relationships between perceived teacher support, peer relationship, and mental health among university students

Internet altruistic behavior was conducted as the mediating variable into the direct effect model of perceived teacher support, peer relationship, and mental health to create the M_2 mediating effect model (Figure 2). The M_2 model exhibited excellent fit (χ^2/df = 2.449, CFI = 0.990, TLI = 0.986, and RMSEA = 0.051). Perceived teacher support directly and positively predicted mental health ($\beta = 0.12$, $p < 0.05$). It also positively predicted mental health through positively predicting Internet altruistic behavior ($\beta = 0.18$, $p < 0.001$; $\beta = 0.09$, $p < 0.05$). Peer relationship directly and positively predicted mental health ($\beta = 0.33$, $p < 0.001$). It also positively predicted mental health through positively predicting Internet altruistic behavior ($\beta = 0.25$, $p < 0.001$; $\beta = 0.09$, $p < 0.05$). The proportion of the mediating effect of Internet altruistic behavior in total effect was 11.89 and 6.38%, respectively. The overall model explained 21.80% of the variance in university students' mental health.

The nonparametric percentile bootstrap method was used to verify the significance of the mediating effects of Internet altruistic behavior (Hayes, 2013). The results revealed that the 95% confidence interval of the mediating effect of Internet altruistic behavior on the relationship between perceived teacher support and mental health was [0.1095, 0.1959]. Moreover, the 95% confidence interval of the mediating effect of Internet altruistic behavior on the relationship between peer relationship and mental health was [0.2407, 0.3729] (Table 2). The aforementioned results verified that the mediating effects of Internet altruistic behavior were significant.

Multi-group analysis on gender differences

To explore the moderating effect of student gender in the aforementioned two mediating effect models, multi-group analysis was performed for comparing the differences in the relevant variable relationships between the male and female student groups. Firstly, an unconstrained model was tested (i.e., path coefficients could be estimated freely for the male and female student groups). Next, a constrained model was tested (i.e., path coefficients were identical for the male and female student groups). Finally, the constrained and unconstrained models were compared. The results showed that both models were nonsignificant (Table 3). This finding verified that student gender did not play a moderating role in the M_1 and M_2 models. Moreover, it indicated that the effects of reality and Internet altruistic behaviors on the relationship between perceived teacher support and mental health as well as that

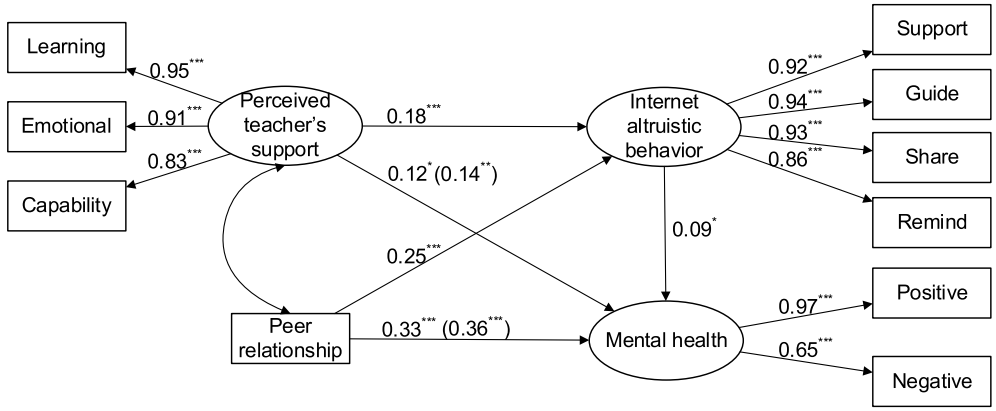

FIGURE 2
Relationships of perceived teacher's support, peer relationship, Internet altruistic behavior, and mental health. *p<0.05, **p<0.01, ***p<0.001.

TABLE 3 Goodness-of-fit indices for the multiple group comparison models.

	χ^2	df	χ^2/df	CFI	TLI	RMSEA	Δdf	$\Delta\chi^2$	p
Mediating effect model of reality altruistic behavior									
Unconstrained model	85.817	44	1.950	0.988	0.981	0.042	5	2.340	0.800
Constrained model	88.157	49	1.799	0.989	0.984	0.038			
Mediating effect model of Internet altruistic behavior									
Unconstrained model	103.100	60	1.718	0.990	0.986	0.036	5	3.267	0.659
Constrained model	106.367	65	1.636	0.991	0.987	0.034			

between peer relationship and mental health differed insignificantly between the two gender groups.

Discussion

When individuals moving from high school to university, in the new campus environment, an important thing they need to face is the relationship between teachers and students as well as between peer students. The previous studies often take primary and secondary school students as subjects, and there were few studies on university students. However, Dong and Yu (2010) found that with the growth of age, students' academic mood will change accordingly. Therefore, it is necessary to take university students as subjects to verify the relevant contents. This research is relatively novel and innovative, because few studies pay attention to the support of university teachers and most research focus on the previous stages. With the increase of age, changes in many external factors will also lead to many changes in individuals, especially when entering the university, university students are facing the situation of being far away from their families and integrating into the new collective environment. How to let university students gain positive psychological emotions in the university environment needs to be further studied. This article enriches the study of student-teacher relationships and peer relationships from the perspective of the ecological systems theory and the "field-interaction" theory, and proposes new research mechanisms to expand the pathway of improving university students' psychological well-being, providing theoretical help to focus on the university environment.

In the present study, it was found that perceived teacher support and peer relationship directly and indirectly predicted mental health through altruistic behaviors; these findings are consistent with the hypothesis 1, and the findings supported the study of Zhang (2018). This may be because, for teachers, behaviors such as putting students' feelings first and actively communicating with them to ensure their study progress are among the ways to express their support. In such cases, students would be more likely to regard their teachers as role models. Bandura (1977) believed that teachers in the school environment are crucial role models who affect the behaviors of students. Therefore, students who perceive higher levels of care and respect from their teachers pay more attention to the conduct of the teachers and view them as role models. The present study concluded that students who are led by positive role models in the school environment are more likely to be less likely to engage in delinquent behaviors and exhibit more altruistic behaviors, which is partly consistent with the findings of Lu et al. (1998). Therefore, teachers investing more support may have greater impacts on students. In the school setting, teachers can increase their own investment in students, use a variety of support tools to make students perceive their teachers' commitment effectively, extend their influence and prestige, and encourage students to actively engage in altruistic behaviors, which in turn improves their

mental health. In addition, for peer relationship, harmonious peer relationships facilitate the socialization process of the individuals. This may be because, in interacting with peers, individuals can learn more about themselves, engage in self-exploration, and gain valid information from others to help them develop. Positive peers can therefore also serve as role models for individuals as they grow. Lu et al. (1998) found that adolescent individuals would show more imitation and performance of altruistic behavior toward role models in teacher–student and peer relationship. At the same time, Cao (2019) suggested that senior pupils may also develop their communication skills and improve their social understanding, thereby improving their psychological well-being.

In addition, this study found that perceived teacher support and peer relationship directly or indirectly predict university students' mental health through Internet altruistic behavior, thus, hypothesis 2 of this study was also supported. This may be because, on the one hand, the COVID-19 has changed people's lives and has transformed the main educational environment for university students from reality to online education on the Internet, with university students increasing some of their online behaviors. The role of the teacher is important in the teaching and learning process of online education. Although online learning is personalized and open, enriching the way education is delivered and broadening its audience, prolonged online learning can also lead to deviant behaviors among students. Therefore, increasing teachers' support for students, organizing a variety of rich online interactive activities, as well as guiding and increasing students' Internet altruistic behavior in a timely manner can not only increase the practicality and fun of teaching, relieve the anxiety and tension in the context of the epidemic, but also facilitate the transformation of students' good mindset and promote their mental health. On the other hand, with the development of the Internet, online games have gradually become the main form of entertainment for students. In online games that require collaboration between game players, who know each other in the real world can develop more intimate relationships than do game players who only know each other virtually. Moreover, such online prosocial games considerably improve the peer relationship and prosocial behavior of game players. Prosocial games have their own unique advantages in improving the quality of friendship, that is, in the state of games, social companions are used to enhance mutual benefit. Although scholars have identified negative effects of the Internet (e.g., Internet addiction and cyberbullying; Akin and Iskender, 2011; Olweus, 2012), positive effects of the prosocial games should not be ignored (e.g., Zhang et al., 2016). The favorable teacher–student and peer relationships can serve as drivers of promotion and guidance of online and offline altruistic behaviors to improve the mental health of university students.

Buchmann et al. (2008) found that COVID-19 has a certain gender difference in the impact on men and women. But in this study, no gender difference was observed in the mediating effects of reality and Internet altruistic behaviors, which may be possibly because the school in China emphasized individual development oriented toward collectivism. Student development that emphasizes collectivism places students of different family backgrounds and personal traits in a fair setting, where the students interact and treat each other equally and with respect. Thus, such student development homogenizes the decision-making behaviors of male and female students. For Western individualistic culture, it emphasizes the independence of individual consciousness and logical thinking (Smith et al., 2013), and individuals' choice and development are unique. Furthermore, the 47th statistical report on China's Internet development revealed that the numbers of female Internet users and female online game players have increased with time (Jiang, 2021); thus, the difference between the proportions of male and female Internet users is reducing. In addition, Internet users can conceal their gender, which reduces the gender differences in their Internet behavior. Therefore, this study did not observe gender differences in the examined mediating effects.

To sum up, by exploring the students' teacher support and peer relationship under the COVID-19 pandemic, an effective mechanism (reality and Internet altruistic behaviors) to promote university students' mental health is proposed. This study found that a campus environment composed of adequate university teacher support and active university peer relationship is conducive to the healthy development of university students. Importantly, teachers and peers can improve university students' mental health by promoting the implementation of university students' reality and Internet altruism. The COVID-19 pandemic has changed people's lives, the relatively closed management of universities needs us to pay more attention to the mental health of university students. Therefore, this study provides strong empirical support for the prevention of mental health of university students under the COVID-19 pandemic.

Educational implications and contributions

Based on the findings of this study, this paper argues that we should pay attention to the support provided by university teachers to students and the importance of peer relationships, to guide university students to implement altruistic behavior and enhance their mental health. Overall, this paper proposes the following educational guidance: First, in learning, teachers should be responsible for transferring knowledge to students, helping them to solve problems, and acting as mentors to guide them in developing their personalities. In life, teachers should actively get to know their students, give them adequate guidance, and communicate effectively with them to encourage and praise their altruistic behavior in a timely manner to help them grow and develop psychologically. Second, students are guided to develop positive and healthy peer relationships and to exert the influence of positive peer relationships. Students exchange platforms can be established to encourage positive interaction among university students,

enable the comprehensive understanding of students' behaviors, and provide mental health services to university students. In addition to peer relationship, peers' incentive is a crucial approach for encouraging students. Bao (2020) surveyed 4,461 undergraduate students and conducted in-depth interviews with 18 of these students in China. Some of the students interviewed noted that when they were playing mobile games and they realized that other students were studying diligently, they felt considerable pressure and decided to study hard too. Therefore, we need to value and reflect on the impact of peer relationships, promote healthy competition, build a harmonious school life, and focus on the positive impact of peer relationships. Third, Overton (2013) notes that individuals live in complex and diverse environments interact with each other, and such interactions exert comprehensive and systematic effects on the individuals. Thus, teachers and students should work together to build a harmonious campus environment. The practical significance of this study has two main parts: First, from an individual micro perspective, we focus on improving the mental health of university students, hoping to promote their healthy development through a harmonious campus environment (including perceived teacher support and peer relationship); second, from a macro perspective, this study aims to raise the public's concern about the campus environment through the study of university students' mental health, as few researchers have focused on the teacher–student relationship and peer relationship of university students.

Limitations and future prospects

This study has several limitations. First, a cross-sectional research design was adopted. This type of design is subject to temporal and spatial limitations because it cannot comprehensively reflect dynamic changes in relationships between variables. Accordingly, future studies can adopt longitudinal research designs to examine how dependent variables change with time. Second, because of the COVID-19 pandemic, the data of this study were conducted through the Internet platform. Despite our efforts to create a consistent environment, we could not control all the possible factors that led to a few limitations in the present study. The self-report of participants may be overestimated or underestimated. Therefore, in the future, studies need to improve the research methods to confirm the reliability of the research results. Most of the questionnaires administered in this study were self-reported, therefore, the responses were somewhat subjective, which might affect the interpretation of causal relationships. In the future, we can increase the number of research participants to examine relevant topics from multiple perspectives. Third, this study recruited university students as participants, thus, the study results cannot be generalizable to all social groups, and the conclusions for non-school settings should be drawn cautiously. Future studies can perform social surveys to gain further insights into the characteristics of other demographic groups and thereby obtain more detailed and comprehensive results. This study had more female participants than male participants, which may have affected the results of gender difference analysis. In future studies, researchers should recruit more equal numbers of male and female participants to minimize the effect of gender on the study results.

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 study involving human participants were reviewed and approved by the Institutional Review Board (IRB) at the Shandong University of Technology. The patients/participants provided their written informed consent to participate in this study.

Author contributions

Both authors listed have contributed to data analysis, drafting and revising the article, given final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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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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Photographic intervention effect on positive and negative affects during COVID-19: Mediating role of future self-continuity

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Meaning in Life (MIL) is a protective factor that buffers the impact of COVID-19 epidemic on emotions. Our study aimed to explore whether photographic intervention based on MIL could increase Positive Affect (PA) and mitigate Negative Affect (NA), and whether Future Self-Continuity (FSC) functioned as a mediator between them. In this study, 90 college students were randomly divided into an intervention group or a control group. Participants in the intervention group were asked to take a photo and describe it every 2 days lasting 2 weeks. All the participants in the two groups were measured by the Meaning in Life Questionnaire, Positive and Negative Affect Scale, and Future Self-Continuity Scale before and after the intervention. The results showed that: (1) Before the intervention, there were no significant differences in baseline levels of MIL, PA and NA, and FSC between intervention and control groups. (2) In the intervention group, compared to pre-test, the scores of MIL, PA, and FSC of post-test increased significantly, and the score of NA of post-test decreased significantly. (3) After the intervention, the scores of MIL, PA, and FSC in the intervention group were significantly higher than those in the control group; NA score in the intervention group was significantly lower than that in the control group. (4) In terms of the difference score (post-test minus pre-test), FSC was a mediator between MIL and PA. Our study demonstrated that photographic intervention could effectively improve college students' MIL, PA, and FSC while mitigating NA. Moreover, MIL could significantly enhance PA by the mediating role of FSC.

KEYWORDS

photographic intervention, meaning in life, positive and negative affects, future self-continuity, mediating effect

1. Introduction

The COVID-19 outbreak had a significant negative impact on people's mental health (Gan et al., 2022). Meaning in life (MIL) was a protective factor that buffered the impact of the epidemic on general health (e.g., state anxiety and COVID-19 stress) and life satisfaction (De Jong et al., 2020; Trzebiński et al., 2020). MIL was defined as "the sense made of, and

significance felt regarding, the nature of one's being and existence" (Steger et al., 2006) and was one of the most fundamental variables that contributed to a pleasant and positive mood (Hone et al., 2014; King and Hicks, 2021). Frankl (1985) proposed that searching for the MIL was the original driving force of human life. Based on Seligman's (2002) theory of happiness, a meaningful life was the ultimate way to achieve genuine happiness and life satisfaction. Numerous studies have supported beneficial effects of having more MIL on individuals' positive and negative emotions (Updegraff et al., 2008; Miao et al., 2017; Hooker et al., 2018). For instance, studies showed that having more MIL was closely related to an optimistic attitude toward life (Steger and Kashdan, 2007), more positive social interactions (Steger and Shin, 2010), and increased life satisfaction (Bonebright et al., 2000). On the contrary, having less MIL could lead to one's negative psychological outcomes, such as depression (Steger et al., 2009), anxiety (Steger and Kashdan, 2007), and even suicidal tendencies (Steger et al., 2008). Therefore, enhancing MIL might be an effective means to improve positive affect (PA) and reduce negative affect (NA).

Earlier studies used self-report measures to assess MIL at a certain time point (Peterson et al., 2005; Steger and Shin, 2010). Given that the previous method was hard to deeply get one's overall sense of meaning because of a lack of dynamic evaluation of experiencing and living in life, Steger et al. (2013) developed a visual research method of photographic intervention to assess one's MIL and tested its effectiveness on positive and negative affects. The photographic intervention was constructed from the perspective of improving individuals' cognition and emotional evaluation of life's purpose and sense of value (Steger et al., 2013, 2014). In the 1-week intervention, participants were asked to take photos that made their lives meaningful, and then described the significance of all these photos at the end of the week, and the results indicated that photographic intervention promoted individuals' MIL that was significantly related to increased PA, increased life satisfaction, and reduced NA (Steger et al., 2014); however, asking participants to describe all the pictures a week later might cause memory burden and biases (Steger et al., 2014; Miao and Gan, 2019). Even more, the lack of a control group in Steger et al. (2014) made it impossible to exclude other factors' potential effects. Therefore, the present study was designed to retest the effect of photographic intervention on positive and negative affects during COVID-19 by adding a control group and asking participants to write a description of the photo in time.

Although current evidence has proven the positive effect of photographic intervention on individuals' emotions, the underlying mediation mechanism remains to be further explored. Our study speculated that future self-continuity (FSC) might play a mediating role between MIL and PA/NA. FSC meant the connection between one's present self and future self, and it was a key component of a global self-continuity or a stable identity (Van Gelder et al., 2013). FSC was closely related to behavioral outcomes, such as more financial saving behaviors, greater academic achievement, less delinquent behaviors, and healthy exercise behaviors (Ersner-Hershfield et al., 2009; Van Gelder et al., 2013; Rutchick et al., 2018). This might be because individuals with higher FSC were more likely to see the future as hopeful and attainable, and to have the willingness and ability to engage in adaptive behaviors in the present for achieving an obtainable future self (Sokol and Serper, 2019). First, Baumeister et al. (2013) stated that one of the most critical functions of MIL was temporal integration of the past, present, and future. Research indicated that seeking and discovering a meaningful life was linked with the ability to maintain and enhance the self-continuity between the present and the future (King and Hicks, 2021). Second, increased FSC contributed individuals to constructively processing negative life events, such as adopting a broader temporal perspective to reduce self-esteem declines (Wink and Schiff, 2002; Sokol and Serper, 2019). The research results indicated that individuals with more overlapping between present self and future self were more prone to positively view their future (Zhang and Aggarwal, 2015) which could directly bring positive emotions (Bryant, 2003), high levels of FSC improved PA and life satisfaction (Sokol and Serper, 2019), while low levels of FSC were strongly associated with NA and suicidal ideation (Sokol and Eisenheim, 2016; Sokol and Serper, 2017, 2019). Third, Terror Management Theory (TMT), based on existential psychodynamic tradition, indicated that one's death was always potentially imminent and inevitably in conflict with motivational systems geared toward continued life, thus triggering personal anxiety (Greenberg et al., 2008). During COVID-19 epidemic, individuals might experience psychologically the fear related to death. Frankl (1985); Becker (1973) stated that over time, the perception of self-identity and continuity of meaning psychologically protected individuals from the awareness of death threats. Studies results showed that mortality salience led high self-concept structure seekers to prefer causal consistency of recent experiences and meaningful connections between past events and the current self (Landau et al., 2009). Therefore, the continuous search for MIL can maintain self-identity in temporal self, inspiring one's positive expectations for the future life and alleviating negative emotions. Based on the above research and theory, MIL could improve emotion by the mediating role of FSC.

The present study aimed to explore the effect of photographic intervention based on MIL on college students' positive and negative affects, and FSC, and whether FSC played a mediating role between MIL and emotions. The photographic intervention, as a MIL-based approach, could draw attention to current life experiences and continuous recording of meaningful life events. Through the constant searching for meaningful information about life, people developed a continuous and uninterrupted identity about their lives, that was, they drew a close connection between their present and future lives (higher FSC), which improved their emotions. We proposed three hypotheses: (a) The MIL-based photographic intervention would enhance participants' MIL; (b) The intervention would increase the levels of PA and FSC, and mitigate the level of NA; and (c) FSC would mediate the relationship between MIL and PA/NA. In our study, a control

group was added, and the participants in the intervention group were asked to complete a 14-day photographic intervention, and they were required to upload photos and describe the content of the photos to reduce the memory burden and memory bias.

2. Materials and methods

2.1. Participants

A total of 36 participants were required by calculating the sample size using a G*power analysis (version 3.1.9, $f = 0.25$, $\alpha = 0.05$, $1\text{-}\beta = 0.95$). Ninety college students as volunteer participants were recruited during COVID-19 epidemic, and randomly assigned to an intervention group or a control group. The age of 45 participants in the intervention group ranged from 18 ~ 21 years old (36 females; $M = 19.31$; $SD = 0.70$), and the age of 45 participants in the control group ranged from 18 ~ 20 years old (33 females; $M = 19.16$; $SD = 0.74$). There were no significant differences in gender ($t = 0.74$, $p = 0.460$) and age ($t = 1.03$, $p = 0.308$) between the two groups. Informed consent was obtained from each student prior to the study. The study was conducted in accordance with the ethical standards of the institutional research committee.

2.2. Measures

2.2.1. Meaning in life questionnaire

MIL was assessed using a Chinese version of Meaning in Life Questionnaire (MLQ; Liu and Gan, 2010). This questionnaire comprised 9 items with two dimensions: The presence of meaning and the search for meaning. All items were rated on a 7-point Likert scale (1 = "absolutely untrue" or "very slightly" to 7 = "absolutely true" or "extremely"). At pre-test, the α coefficient for the questionnaire was 0.78. At post-test, the α coefficient was 0.91.

2.2.2. Future self-continuity scale

Future Self-Continuity Scale (FSCS) adapted by Ersner-Hershfield et al. (2009) was used. This visual scale contained seven pair circles labeled "current self" and "future self," ranging from complete separation (1 = least similar) to almost complete overlap (7 = most similar). Participants were asked to choose one of seven pairs of circles to represent the proximity of their present self and future self. The more the overlap between two circles, the higher the FSC level. This instrument was the most commonly used and currently the most validated FSC measure with sufficient test–retest reliability, and it could significantly predict performance on structures associated with FSC (Ersner-Hershfield et al., 2009).

2.2.3. Positive and negative affect scale

The Chinese version of the Positive and Negative Affect Scale (PANAS) consisted of two dimensions: Positive affect (such as interested and enthusiastic) and negative affect (such as guilty and irritable), including 20 items (Huang et al., 2003). All the items were rated on a 5-point Likert scale (from 1 = "very slightly" to 5 = "very much"). At pre-test, the α coefficients for positive affect and negative affect were 0.80 and 0.83, respectively. At post-test, the α coefficients were 0.78 and 0.87, respectively.

2.3. Procedures

In this study, offline questionnaire surveys using MLQ, FSCS, and PANAS were conducted for all participants before the intervention (pre-test) and after the intervention (post-test).

In the intervention group, a 2-week intervention was implemented. They were asked to take photos and answer questions online every 2 days. Specifically, the participants were instructed to take photos of "things that make you feel meaningful in your life" with their smartphones. After each photo shoot, they were asked to upload the photos and online answer the following questions based on photo contents: "(1) What does this photo represent? (2) Why does it make you feel that your life is meaningful?" through a dedicated secure website. At 8:00 AM, they were reminded to take photos, and at 9:00 PM they were reminded to upload the photos they had taken to a designated website and answer corresponding questions.

In the control group, participants did not receive the intervention for 14 days. To exclude the expectation effect of the control group, we did not inform participants of the purpose of completing the questionnaires at pre-test and post-test.

2.4. Data analyzes

All the analyzes were performed using SPSS 23.0 software. An independent sample t-test was conducted to compare the differences in baseline scores between the two groups for baseline comparison. One-way multivariate analysis of variance (MANOVA) was used to examine the pre-test to post-test change scores. Analyzes of covariance (ANCOVA) were conducted to examine the increase in PA and decrease in NA after the intervention phase. Correlation analysis was performed for all variables, and Hayes (2018) Process Macro (Model 4) was used to conduct mediation analysis. The bootstrapping method was applied to test the mediating effect. The significance level of all variables was set as $a = 0.05$.

3. Results

3.1. Baseline comparison

The results of the independent samples t-test showed that there was no significant difference in the baseline scores of MIL, FSC, and PA/NA between intervention and control groups (see Table 1), indicating that the randomization procedure was

effective and there was no significant difference at baseline level between the two groups.

3.2. The effect of photographic intervention

We examined difference scores (post-test minus pre-test) to determine whether the intervention enhanced MIL, FSC, and PA, and whether the intervention reduced NA. Means and standard deviations of pre-test and post-test scores between intervention and control groups were presented in Table 2. MANOVA for difference scores on the three questionnaires of MLQ, FSCS, and PANAS revealed significant multivariate main effect of group (control group, intervention group), Wilks' lambda = 0.41, $F_{(4,85)} = 30.94$, $p < 0.001$, $\eta_p^2 = 0.593$. An examination of the univariate tests demonstrated significant differences: MIL, $F_{(1,88)} = 45.02$, $p < 0.001$, $\eta_p^2 = 0.338$; FSC, $F_{(1,88)} = 26.74$, $p < 0.001$, $\eta_p^2 = 0.233$; PA, $F_{(1,88)} = 71.80$, $p < 0.001$, $\eta_p^2 = 0.449$; and NA, $F_{(1,88)} = 25.23$, $p < 0.001$, $\eta_p^2 = 0.223$. As predicted, compared to the control group, the intervention group showed significant increases in MIL, FSC, and PA, as well as significant decreases in NA.

The results of a one-way ANCOVA for PA, with groups (control group, intervention group) as the independent variable and PA at pre-test as the covariate, revealed significant differences between two conditions, $F_{(1,88)} = 100.33$, $p < 0.001$, $\eta_p^2 = 0.536$. Another one-way ANCOVA for NA, with groups (control group, intervention group) as the independent variable and NA at pre-test as the covariate, indicated significant differences between two groups, $F_{(1,88)} = 36.60$, $p < 0.001$, $\eta_p^2 = 0.296$. Tukey HSD *post hoc* tests indicated that the score of PA in intervention group was significantly higher than that in control group, and the score of NA in intervention group was significantly lower than that in control group.

TABLE 1 Baseline scores between intervention and control groups ($M \pm SD$).

	Intervention group	Control group	*t*	*p*	Cohen's *d*
MIL	37.42 ± 7.02	38.91 ± 6.21	−1.07	0.290	−0.22
FSC	3.56 ± 1.32	3.98 ± 1.22	−1.58	0.119	−0.33
PA	27.60 ± 4.90	29.04 ± 3.91	−1.55	0.126	−0.32
NA	28.20 ± 5.73	27.22 ± 5.27	0.84	0.401	0.18

3.3. The mediating effect of FSC

Before conducting the mediation analysis, a correlation analysis was performed to examine the relationship among the variables (see Table 3). MIL was significantly positively related to FSC and PA, respectively. FSC was significantly positively related to PA. NA was significantly negatively related to MIL and PA, respectively.

PROCESS Model 4 was used to test the mediating role of FSC. According to Liu et al. (2021), our study used difference scores (post-test minus pre-test) for mediation analysis. Before entering the model, difference scores of MIL, FSC, PA, and NA were normalized to obtain standardized parameter estimates. In addition, age and gender were entered into the model as covariates. Gender was created as a dummy variable (female = 1, male = 0). The results (see Table 4) showed that the direct effects of MIL on PA/NA and the indirect effect of MIL on PA were significant, however, the indirect effect of MIL on NA did not reach significance.

The model fit was significant when the dependent variable was PA, $R^2 = 0.26$, $F_{(3,86)} = 10.05$, $p < 0.001$. The total effect of MIL on PA was significant, $\beta = 0.51$, $SE = 0.09$, 95% CI = [0.32, 0.69], and the direct effect was also significant, $\beta = 0.34$, $SE = 0.08$, 95% CI = [0.18, 0.50]. As expected, we found a significant indirect effect of MIL on PA *via* FSC, ab = 0.17, $SE = 0.08$, 95%CI [0.05, 0.36], indicating that FSC served as a mediator in this relationship, and FSC played a partial mediating role between MIL and PA (see Figure 1).

The total effect of MIL on NA was significant, $\beta = -0.48$, $SE = 0.09$, 95% CI = [−0.66, −0.29], and the direct effect was also significant, $\beta = -0.52$, $SE = 0.10$, 95% CI = [−0.71, −0.32], however, the indirect effect of MIL on NA through FSC did not reach significance, ab = 0.04, $SE = 0.03$, 95% CI [−0.01, 0.12]. Therefore, FSC in MIL and NA did not seem to fit the mediation model, suggesting that FSC did not play a mediating role between MIL and NA (see Figure 2).

4. Discussion

In order to overcome the shortcomings of previous study (Steger et al., 2014), our study added a control group and increased the frequency of photography. Through a 2-week intervention, we verified that photographic intervention based on MIL promoted PA and reduced NA, and that FSC played a mediating role between MIL and PA. Consistent with previous findings

TABLE 2 Pre-test and post-test scores between intervention and control groups ($M \pm SD$).

Variables	Intervention group		Control group		*t*	Cohen's *d*
	Pre-test	Post-test	Pre-test	Post-test		
MIL	37.42 ± 7.02	45.96 ± 5.10	38.91 ± 6.21	36.38 ± 7.29	−6.71***	−1.42
FSC	3.56 ± 1.32	5.29 ± 1.12	3.98 ± 1.22	3.93 ± 1.30	−5.17***	−1.09
PA	27.60 ± 4.90	35.44 ± 3.41	29.04 ± 3.91	29.51 ± 3.38	−8.47***	−1.79
NA	28.20 ± 5.73	22.60 ± 5.29	27.22 ± 5.27	28.82 ± 4.73	5.02***	1.06

***$p < 0.001$.

TABLE 3 Correlations among the variables at pre-test and post-test.

Variables	1	2	3	4	5	6	7	8
1.pre_MIL	1							
2.pre_FSC	0.29**	1						
3.pre_PA	0.41**	0.23*	1					
4.pre_NA	−0.15	−0.12	−0.13	1				
5.post_MIL	0.14	−0.09	0.06	0.13	1			
6.post_FSC	0.06	0.13	−0.25*	−0.15	0.33**	1		
7.post_PA	0.11	−0.21*	0.24*	−0.07	0.56**	0.54**	1	
8.post_NA	0.10	0.02	0.12	0.09	−0.45**	−0.14	−0.22*	1

Alpha coefficients are presented in the diagonal. $^{**}p < 0.01$; $^{*}p < 0.05$.

(Steger et al., 2014; Miao and Gan, 2019), our study demonstrated that photographic intervention was an effective way to improve emotions during COVID-19.

FSC was explored as an acting mechanism between photographic intervention and PA in the present study. First, we found that photographic intervention increased individuals' FSC, demonstrating the conducive effect of MIL on FSC. This finding was in line with previous studies (Rubin et al., 2016, 2019) positing that individuals with a high sense of current life experiences tended to exhibit a psychological state that was more closely connected with the future, and that individuals with a low sense of life experience could only isolate the current meaningful life and cannot connect well with future self (Rubin et al., 2016). The photographic intervention guided participants to express the meaning of the photographs coherently and to gain a deeper understanding of their own daily lives, and the coherent expression gave meaning to life transformation and achieving self-continuity (Hong et al., 2021; King and Hicks, 2021). Thus, over time, the experience of MIL might gradually deepen one's perception of the connection of present self and future self. Second, the sense of self-continuity might play a crucial role in guiding emotional responses (Sadeh and Karniol, 2012), and increasing self-continuity could enhance subjective well-being by shifting to a broader temporal perspective (Sokol and Serper, 2019). Therefore, photographic intervention used a coherent expression of a meaningful life to achieve self-identity in time, generate psychological pleasure, and improve their overall satisfaction with life. This meant that individuals with a higher awareness of MIL could establish a closer connection with the future, thereby enhancing the positive affect on their overall life. As expected, our results confirmed the mediating role of FSC between MIL and PA.

However, we found that FSC did not play a mediating role in this relationship between MIL and NA. Taking photos could be a clear record of a meaningful life, and expressive writing helped to transform abstract MIL (generated from photos) into a narrative and emotional (usually positive) language (Steger et al., 2014; Miao and Gan, 2019). Thus, photographic intervention enhanced primarily positive emotion in our study. According to the "Undoing Hypothesis," based on the Broaden-and-Build theory (Fredrickson et al., 2000; Fredrickson, 2001), experiencing positive affects can "eliminate" or "undo" the negative effects of experiencing negative affects (Pezirkianidis et al., 2016). As a result, the mediating effect of FSC between MIL and NA did not reach significance in the present study. Future study should explore the photographic intervention aimed to reducing NA, and reexamine the mediating role of FSC.

TABLE 4 Results of mediation analysis.

Dependent variables	Predictors	β	*SE*	*t*
FSC	MIL (a)	0.31	0.10	3.08**
	Gender	0.45	0.23	1.90
	Age	−0.25	0.14	−1.76
PA	MIL (c')	0.34	0.08	4.26***
	FSC (b)	0.56	0.08	6.81***
	Gender	−0.14	0.18	−0.77
	Age	0.08	0.11	0.73
	Indirect effect (ab)	0.17	0.08	[0.05, 0.36]
NA	MIL (c')	−0.52	0.10	−5.23***
	FSC (b)	0.13	0.10	1.27
	Gender	−0.13	0.23	−0.59
	Age	−0.12	0.13	−0.86
	Indirect effect (ab)	0.04	0.03	[−0.01, 0.12]

$^{**}p < 0.01$, $^{***}p < 0.001$.

Our study had several implications. Photographic intervention focused on increasing MIL contributed to an individual's emotions and well-being. During COVID-19, MIL should be constructed in a variety of ways to increase PA and reduce NA. In addition, improving an individual's MIL through photographic intervention led to an increasing of FSC, in turn, enjoying a whole and positive life. Previous findings suggested that interventions aimed to increase self-continuity could promote an individual's self-concept and subjective well-being (Sokol and Serper, 2017, 2019). Attention should be paid to improving individuals' FSC to promote emotional regulation during COVID-19.

There were some limitations in our study. First, the participants were from a university. One should be cautious about generalizing our findings to other groups. Second, the sources of college students' MIL might be diverse. In future research, the intervention effects of different types of MIL should be investigated to develop more effective

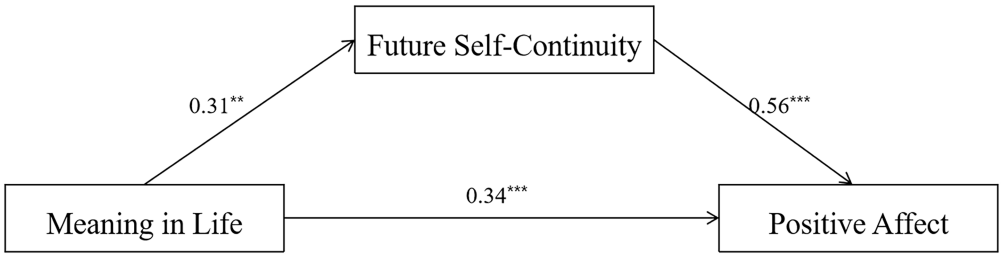

FIGURE 1
Mediational pathways of MIL on PA. **p<0.01, ***p<0.001.

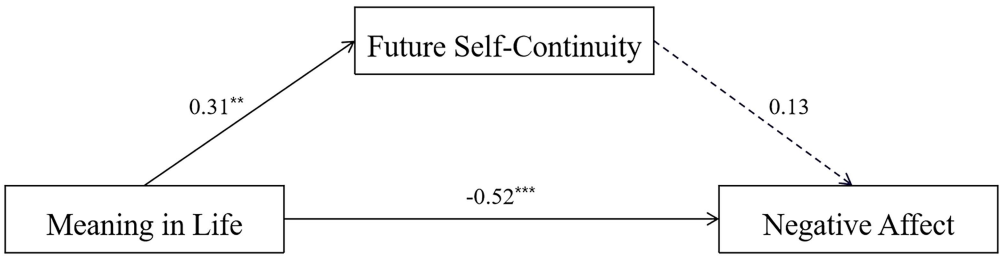

FIGURE 2
Mediational pathways of MIL on NA. **p<0.01, ***p<0.001.

intervention programs. Third, this study did not provide dynamic measurements of intervention effects. In future studies, researchers could adopt an experience sampling method to collect immediate data to examine the effectiveness of photographic intervention.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of Henan Province Key Laboratory of Psychology and Behavior. The participants provided their written informed consent to participate in this study.

Author contributions

FZ and YP contributed to conception and design of the study. YP and XL organized the database, performed the statistical analysis, and wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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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/fpsyg.2022.1085518/full#supplementary-material

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How relationship-maintenance strategies influence athlete burnout: Mediating roles of coach–athlete relationship and basic psychological needs satisfaction

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Introduction: Athlete burnout has many potential negative effects on athletes' sporting performance and careers. Maintaining and promoting the coach–athlete relationship to meet athletes' basic psychological needs is one way to reduce burnout. Existing studies of the correlation between coach-athlete relationships and athlete burnout have mainly focused on the coaches' leadership style, with little attention given to relationship-maintenance strategies and the mechanism of athlete burnout from the athletes' perspective.

Methods: Using an online survey of 256 adolescent athletes, we explore the relationship between relationship-maintenance strategies and athlete burnout, including the potential mediating effects of the coach–athlete relationship and basic psychological needs satisfaction.

Results: (1) Athletes' relationship-maintenance strategies negatively predicted athlete burnout. (2) Besides the direct effect, we found evidence to support three mediation paths: (a) the coach–athlete relationship, (b) basic psychological needs satisfaction, and (c) both as serial mediators.

Discussion: These findings enhance understanding of the mechanism of athlete burnout, demonstrating the influence of factors beyond the coach's role. The study also provides a theoretical basis for practical intervention by coaches, athletes, and sports organizations to reduce athlete burnout by focusing on athletes' perspectives.

KEYWORDS

athlete burnout, mental fatigue, relationship-maintenance strategies, coach–athlete relationship, basic psychological needs satisfaction

1. Introduction

The concept of mental fatigue originated in Freudenberger's (1974) study of workers' responses to stress in mental health care. Maslach and Jackson (1984) proposed the concept of burnout, describing the consumption of psychological resources caused by high-pressure work environments. A burnout model includes three dimensions (emotional exhaustion, depersonalization, and low scores on personal accomplishment; Maslach and Jackson, 1981). Although this model has been widely used in the study of job burnout, the concept is limited to the "people-work"; that is, the definition of general exhaustion is more applicable to the professional staff in human service with "provider—receiver" as the core characteristic. In sports, athletes focus on sports performance rather than a specific object. Therefore, Raedeke (1997) proposed the concept of athlete burnout. Athlete burnout has been described as a syndrome with three key dimensions: (a) emotional/physical exhaustion, a negative response to the intense demands of sports training and competition; (b) sport devaluation, the loss of interest and desire to participate in sports; and (c) reduced athletic accomplishment, a lower sense of achievement in one's motor skills and abilities (Raedeke, 1997). Studies have shown that athlete burnout has increased over the past two decades (Madigan et al., 2022). Athlete burnout has many potential negative effects (Goodger et al., 2007; Gustafsson et al., 2017; Eklund and DeFreese, 2020), including lack of motivation, decreased engagement, poor sports performance, deterioration of personal relationships, and increased risk of depression (Cresswell and Eklund, 2005; Jowett et al., 2016; Smith et al., 2019). Athletes who suffer from these effects may consequently avoid training and competition or even leave their sport forever (Hu and Xu, 2008; Larson et al., 2019). Therefore, the influencing factors of athlete burnout need to be investigated to understand the mechanism of athlete burnout better. By expanding the theoretical perspective on what causes athlete burnout, practical ideas can be offered for reducing athlete burnout in athletes.

Athlete burnout is affected by both endogenous and exogenous factors (Zhang et al., 2006). Studies have shown that the maladaptive profile of perfectionism (Yook and Shin, 2014; Olsson et al., 2022), low level of openness (Li et al., 2018; Garcia-Hernandez et al., 2020), low mental toughness (Wang et al., 2014; Guo et al., 2021), and other endogenous factors have significant positive correlations with athlete burnout. Exogenous factors found to significantly predict burnout include the pressure of sports competition (Yang, 2018; Lin et al., 2021), the pressure within sports organizations (Wu et al., 2021; Wu, 2022), and lack of social support (Lu et al., 2016; Martinez-Alvarado et al., 2021; Shang and Yang, 2021). In the context of China's competitive sports, athletes participate in intense training throughout the year and spend much time outside of training with teammates and coaches. Compared with individual factors, external factors such as social and organizational factors may be more important factors in predicting athlete burnout (Zhang, 2010). This view coincides with the Self-Determination Theory (SDT) proposed by Deci and Ryan (1985). According to SDT, individuals tend to grow and perfect their own personality and have three basic psychological needs for self-integration (autonomy, competence, and relatedness). The satisfaction of these three basic psychological needs is subject to external environment. When the environmental factors satisfy psychological needs, individuals will develop positively and healthily (Deci and Ryan, 2017). Athletes will make free choices of actions based on awareness of their own needs and social environment (Deci and Ryan, 2000). The proposal of SDT provides a new theoretical framework for athlete burnout. Research on athlete burnout has shifted attention from the individual to social factors (Sun and Zhang, 2012; Davis et al., 2019b). Therefore, based on SDT, we explore the social factors potentially affecting athlete burnout (Lonsdale et al., 2009).

Studies have shown that the coach–athlete relationship is an important social predictor of athlete burnout (Cresswell and Eklund, 2007; Isoard-Gautheur et al., 2016). In the social life of athletes, the relationship with their coach is an important interpersonal structure (Xie, 2018), entailing two-way interactions. However, most studies of the correlation between the coach–athlete relationship and athlete burnout have only explored from the perspective of coaches' leadership style (Gustafsson et al., 2008; Barcza-Renner et al., 2016; Cho et al., 2019).

From the perspective of athletes, maintaining and promoting the coach–athlete relationship is an important part of sports training. If athletes can interact effectively with coaches and form high-quality relationships through relationship-maintenance strategies, they will more likely feel that their psychological needs are being met, thus reducing the risk of athlete burnout (Choi and JungKooin, 2020). Therefore, focusing on athletes' perspective, this study adopts SDT as the theoretical framework to explore athletes' relationship-maintenance strategies, the coach–athlete relationship, essential psychological needs satisfaction, and athlete burnout.

2. Literature review and hypothesis development

2.1. Relationship-maintenance strategies and athlete burnout

Relationship-maintenance strategies are the behaviors adopted by peers to maintain satisfactory relationship quality, for instance, in terms of commitment or love (Stafford and Canary, 1991). For coaches and athletes, relationship-maintenance strategies refer to respective efforts to maintain emotional closeness, cognitive commitment, and behavioral complementarity (Guo, 2016). Unless both parties use effective relationship-maintenance strategies, their connection will be weak (Canary and Stafford, 1994), and the additional time and energy athletes invest in maintaining the relationship will lead to burnout. SDT believes that the positive interaction between individuals and the social environment contributes to satisfying basic psychological

needs, thus alleviating their negative feelings (Liu Y. et al., 2022). The relationship maintenance strategies athletes adopt to repair, stabilize or improve their relationship with coaches is a kind of positive interaction. The good coach–athlete relationship brought by such positive interaction is an important part of the harmonious social environment. When athletes' basic psychological needs are met in the environment, their happiness will be improved (Milyavskaya and Koestner, 2011; Ye et al., 2019), and athlete burnout will be reduced (Rhind and Jowett, 2010a).

Based on the seven types of relationship-maintenance strategies proposed by Rhind and Jowett (2010a,b) and Guo (2016) proposed six dimensions of relationship-maintenance strategies for Chinese athletes: conflict management, communication, motivation, support, assurance, and social networks. Conflict management refers to identifying, discussing, resolving, and monitoring conflicts in the relationship. Conflict management style significantly impacts athlete burnout: compromise, cooperation, and compliance have been shown to alleviate burnout, whereas the opposite effect was found for avoidance (Eun-Young, 2015). Coaches' management of conflicts through communication can also help to enhance athletes' willingness to continue participating in sports (Kim and Cho, 2022). The communication dimension refers to athletes and coaches sharing information and feedback on any problems in training and their personal life. This communication should be two-way; a democratic coach will consider athletes' views and make timely adjustments to the training program. Such democratic behavior by the coach can produce a positive emotional experience for athletes, further enhancing their engagement and reducing athlete burnout (Xie and Yao, 2010; Gao et al., 2021). Open communication is crucial in promoting the relationship between coaches and athletes. In studies of Spanish athletes (Garcia-Hernandez et al., 2020) and Chinese athletes (Li et al., 2018), a low level of openness was found to be characteristic of athletes with a high degree of burnout. Motivation refers to the intention of coaches and athletes to persist in pursuing goals. Interpersonal relationships in sports are usually intention- and results-oriented (Choi et al., 2020), and motivation has been found to predict athlete burnout negatively (Graña et al., 2021; Madigan et al., 2022). Support refers to helping others through difficulties in sports and life. Research shows that coaches' autonomy support can reduce athlete burnout by enhancing intrinsic motivation (He et al., 2021; Kang et al., 2021). Supportive coaching styles are especially effective for athletes with low self-esteem (Conroy and Coatsworth, 2006). Assurance means that the coach and athlete trust each other, believe they can perform well in sports training and personal life, and convey to the other that they will continue the relationship. Assurance indicates the athlete's emotional sustenance to their coaches and affirmation of the coach's ability, which enables athletes and coaches to reach a consensus on the team goal, and improve team cohesion (Yang et al., 2014). High-level team cohesion is one of the key factors for team success (Liang and Li, 2016), which negatively predicts athlete burnout (Chang et al., 2019; Pacewicz et al., 2020). Social network refers to the communication between coaches and athletes in training and life. A positive social network in the social environment of sports can reduce athlete burnout (Pacewicz et al., 2019). On the contrary, negative social interactions, such as rejection or neglect, will lead to athlete burnout (DeFreese and Smith, 2014).

Drawing on SDT, we first hypothesized that relationship-maintenance strategies negatively predict athlete burnout.

2.2. The mediating roles of the coach–athlete relationship and basic psychological needs satisfaction

As one of the most important interpersonal relationships for athletes, the coach–athlete relationship notably influences athletes' performance and even athlete burnout (Guo et al., 2021). Within this unique interpersonal relationship, the feelings, thoughts, and behaviors of coaches and athletes are mutually and causally interconnected (Jowett and Meek, 2000; Jowett and Ntoumanis, 2004; Adie and Jowett, 2010). This definition emphasizes the bidirectional and dynamic nature of the coach–athlete relationship, highlighting both sides' interdependence and mutual influence. These feelings, thoughts, and behaviors have been reflected in Jowett's (2007) 3Cs model, which holds that the relationship between coaches and athletes includes closeness, commitment, and complementarity. Closeness reflects the affective meanings the coach and athlete assign to their relationship (e.g., respect, trust, liking). Commitment is the intention to maintain a long-term partnership within the focal sport. Finally, complementarity refers to the complementary or cooperative interactions between coach and athlete during training. Research shows that the quality of the coach–athlete relationship is a typical organizational stressor in the context of athletes' training and competition. When this relationship is harmonious, athletes not only avoid interpersonal pressure but also benefit from coaches' help and support, thus reducing the likelihood of experiencing burnout symptoms (Tabei et al., 2012). Conversely, a lower-quality coach–athlete relationship will increase athlete burnout (Isoard-Gautheur et al., 2016; Ruser et al., 2021; JungKooin et al., 2022; Kim and Cho, 2022). Therefore, improving the quality of this relationship should reduce the risk of athletes experiencing burnout. Jowett and Poczwardowski (2007) proposed that the quality of the coach–athlete relationship is determined by the interpersonal communication between coaches and athletes, with two-way communication positively impacting the relationship (Choi et al., 2020). This communication depends somewhat on relationship-maintenance strategies, which have been found to partly explain differences in the closeness, commitment, and complementarity dimensions of the coach–athlete relationship. Openness and social networks are positively correlated with closeness; motivation and support are positively related to commitment; and assurance is positively related to complementarity (Rhind and Jowett, 2011). Beyond exercise, intimacy research has shown that effective

relationship-maintenance strategies facilitate stable, long-term, and satisfying intimate relationships (Canary and Stafford, 1994; Ogolsky and Bowers, 2013). Thus, we predict that high-quality relationship-maintenance strategies can maintain effective coach–athlete relationships, reducing athlete burnout.

> *H2*: The coach–athlete relationship mediates the relationship between athletes' relationship-maintenance strategies and athlete burnout.

Self-Determination Theory suggests that basic psychological needs satisfaction is an important concept in explaining healthy participation in sports (Ryan and Deci, 2000). Meeting the three basic needs of autonomy, competence, and relatedness is necessary for individuals to achieve their potential, flourish, and avoid unhealthy or maladaptive states (e.g., athlete burnout; Sheldon and Niemiec, 2006). For athletes, autonomy is satisfied by being able to act on their own will and values when training and competing; competence needs are met by improving performance, meeting higher challenges, and having opportunities to develop their sports skills; and relatedness needs are satisfied through social support networks and strong interpersonal connections within the sporting community (Vallerand and Rousseau, 2001). Research suggests that basic psychological needs satisfaction promotes autonomous motivation, positive emotions, well-being, and athletic performance in athletes, whereas non-satisfaction is associated with physical health disruption, lack of motivation, and decreased well-being (Tay and Diener, 2011; Ryan and Deci, 2017; Lopes and Vallerand, 2020). Quested and Duda (2010) highlighted personal qualities that may facilitate or hinder basic psychological needs satisfaction as the main predictors of maladaptive outcomes such as athlete burnout. Satisfying their basic psychological needs helps protect athletes from high levels of burnout symptoms (Lonsdale et al., 2009; Quested and Duda, 2011; Li et al., 2013; Jowett et al., 2016). Basic psychological needs satisfaction is influenced by situational factors such as social support and organizational environment (Van den Broeck et al., 2016; Coxen et al., 2021). The positive social environment created by a good coach–athlete relationship helps to satisfy athletes' basic psychological needs, thereby supporting their long-term sport participation and well-being (Chu and Zhang, 2019) and reducing athlete burnout. We propose that athletes can obtain social support and improve relationship satisfaction by using relationship-maintenance strategies in interactions with their coaches, thus satisfying their basic psychological needs and, in turn, reducing burnout (Rocchi and Pelletier, 2018; Nascimento et al., 2019).

> *H3*: Basic psychological needs satisfaction mediates the relationship between athletes' relationship-maintenance strategies and athlete burnout.

According to SDT, athlete burnout result in basic psychological needs not being satisfied, which hinders the internalization of external motivation, and leads to the lack of motivation, enthusiasm, and interest of athletes (Sun and Zhang, 2012). Therefore, satisfying basic psychological needs is a prerequisite for preventing and alleviating athlete burnout, while the social environment is an external determinant of basic psychological needs satisfaction (Wu et al., 2018). The social environment usually involves people close to the individual, such as parents, teachers, and coaches (Deci and Ryan, 2012). For athletes, bonding with their coach is an important social relationship in training and competition (Ai and Wang, 2017). In addition, the 3Cs model theorizes that the coach–athlete relationship is a medium for satisfying both parties' basic psychological needs (Jowett, 2005, 2007). An athlete's perception of the quality of the coach–athlete relationship is an important determinant of basic psychological needs for satisfaction (Riley and Smith, 2011; Choi et al., 2013; Felton and Jowett, 2013b), self-determined motivation (Riley and Smith, 2011), and well-being (Felton and Jowett, 2013b). Felton and Jowett (2013a,b, 2015) conducted a series of studies demonstrating the predictive utility of social relationships in sports (i.e., secure coach attachment, perceived quality of the coach–athlete relationship) for basic psychological needs satisfaction and subsequent well-being. As relationship quality cannot be maintained without effective relationship-maintenance strategies (Canary and Stafford, 1994; Rhind and Jowett, 2010b), we predict that the coach–athlete relationship and basic psychological needs satisfaction are serial mediators.

> *H4*: The coach–athlete relationship and basic psychological needs satisfaction serially mediate between athletes' relationship-maintenance strategies and athlete burnout. Our research model is outlined in Figure 1.

3. Materials and methods

3.1. Participants

Convenience sampling was used to select 272 athletes from various sports teams in Chongqing, China, to complete the online questionnaire survey. Sixteen participants were excluded from the data analysis due to inconclusive responses, too many missing values, and short response durations (Gröschke et al., 2022). The valid response rate was 94.1%. Of the 256 participants whose responses were analyzed, 171 (66.8%) were male, and 85 (33.2%) were female. In terms of athletic prowess, 87 (34.0%) were national first-class athletes or above, 76 (29.7%) were national second-class athletes, and 93 (36.3%) were below that level. The average age was 19.95 ± 3.22 years, while the average number of training years was 3.17 ± 2.91 years. Participants' focal sports included race walking, taekwondo, boxing, and tennis.

Harman's single-factor test was used to assess possible common method bias. The results showed that 14 factors had characteristic roots greater than 1, and the unrotated first factor explained only 33.9% of the total variation. As this value is below the threshold of 40%, there appears to be no significant common method bias in this study (Podsakoff et al., 2003).

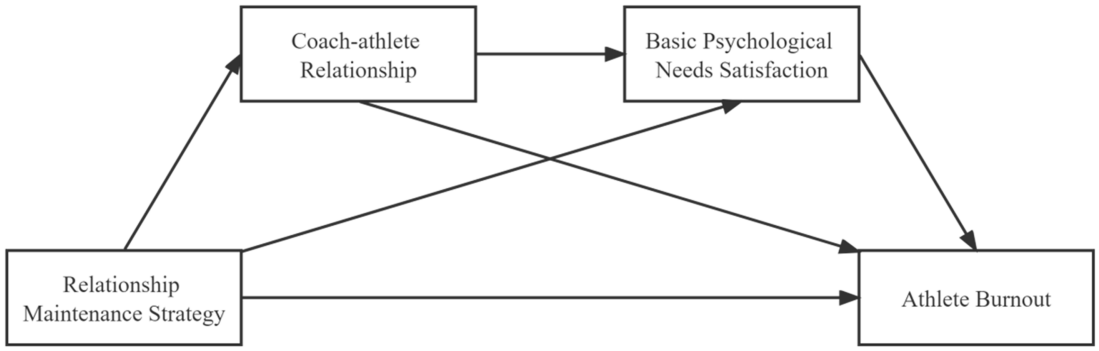

FIGURE 1
Proposed sequential mediation model.

3.2. Methods

3.2.1. The coach–athlete relationship maintenance questionnaire (CARM-Q)

Developed by Guo (2016), the CARM-Q comprises 29 items across six subfactors: communication (e.g., "I am willing to share my emotions with my coach"), motivation (e.g., "I work out challenging tasks"), support (e.g., "I help the coach when he/she is in trouble"), conflict management (e.g., "I try to keep myself in check when I disagree"), social networks (e.g., "we have a lot of mutual friends"), and assurance ("I let the coach know he/she can count on me"). Participants respond to each item on a seven-point Likert scale, ranging from 1 ("completely inconsistent") to 7 ("completely consistent"). Higher scores indicate that the athlete engages more extensively in relationship-maintenance strategies with respect to their coach. Cronbach's α was 0.96 for the total questionnaire and 0.79, 0.88, 0.85, 0.79, 0.82, and 0.69 for each respective subfactor.

3.2.2. The coach–athlete relationship questionnaire (CART-Q)

Developed by Jowett and Ntoumanis (2004), the CART-Q includes 11 items across three subfactors: closeness (e.g., "I like my coach"), commitment (e.g., "I feel loyal to my coach and am willing to maintain a long-term cooperative relationship with him/her"), and complementarity (e.g., "When I am coached by my coach, I adopt a friendly stance"). Again, participants responded to each item on a seven-point Likert scale, ranging from 1 ("completely inconsistent") to 7 ("completely consistent"). Higher scores indicate a higher quality coach–athlete relationship. Cronbach's α was 0.94 for the total questionnaire and 0.84, 0.86, and 0.88 for each respective subfactors.

3.2.3. The basic needs satisfaction In sport scale (BNSSS)

The BNSSS was developed by Ng et al. (2011) and includes 20 items across three subscales: autonomy needs (e.g., "I feel I am doing what I really want to do"), competence needs (e.g., "I have proficient skills in my sport"), and relatedness needs (e.g., "I care about others"). Once again, responses to each item were given on a seven-point Likert scale, ranging from 1 ("completely inconsistent") to 7 ("completely consistent"). Higher scores indicate greater satisfaction of basic psychological needs in the given dimension (with item 14 reverse-scored). Cronbach's α was 0.93 for the total questionnaire and 0.91, 0.89, and 0.91 for each subscale.

3.2.4. Athlete burnout questionnaire (ABQ)

Developed by Raedeke and Smith (2001), the ABQ comprises 15 items across three subfactors: emotional/physical exhaustion (e.g., "I feel overly tired from my sport participation"), reduced athletic accomplishment (e.g., "It seems that no matter what I do, I cannot do my best"), and sport devaluation (e.g., "The energy I expend on training for a game might be better used doing something else"). Participants responded to each item on a five-point Likert scale, ranging from 1 ("never") to 5 ("always"). Higher scores indicate a higher degree of athlete burnout (with items 1 and 14 reverse-scored). Cronbach's α was 0.83 for the total questionnaire and 0.85, 0.52, and 0.74 for each subfactor.

3.3. Statistical analysis

Descriptive statistics analysis and correlation analysis of the data were performed in SPSS 25.0. Hierarchical regression analysis was carried out to investigate predictive relationships between variables. We used Hayes (2013) SPSS macro PROCESS (Model 6) to calculate the confidence intervals and effect values of the direct effects between relationship maintenance strategies and athlete burnout, as well as the indirect effects of relationship maintenance strategies on athlete burnout through the coach–athlete relationship and basic psychological needs satisfaction. The bootstrapping method with robust standard errors was employed to test the significance of the effects (Hayes, 2013). The bootstrapping method produced 95% bias-corrected confidence intervals (CIs) of these effects from 5,000 resamples of the data. If CIs did not include zero, the effects in Model 6 were significant at $\alpha = 0.05$. All statistical tests were two-tailed.

4. Results

4.1. Descriptive statistics and correlation analysis of variables

We analyzed the correlations between athletes' relationship-maintenance strategies, coach–athlete relationship, basic psychological needs satisfaction, and athlete burnout.

As reported in Table 1, the results show that relationship-maintenance strategies were significantly negatively correlated with athlete burnout ($r = -0.52$, $p < 0.01$) but significantly positively correlated with the coach–athlete relationship ($r = 0.71$, $p < 0.01$) and basic psychological needs satisfaction ($r = 0.70$, $p < 0.01$). The coach–athlete relationship and basic psychological needs satisfaction were both significantly negatively correlated with athlete burnout ($r = -0.47$, $p < 0.01$; $r = -0.57$, $p < 0.01$). The data meet the statistical requirements for further analysis of the mediating effects of the coach–athlete relationship and basic psychological needs satisfaction (Wen and Ye, 2014).

4.2. Regression analysis

We next analyzed the predictive relationships between relationship-maintenance strategies, coach–athlete relationship, basic psychological needs satisfaction, and athlete burnout.

As presented in Table 2, the regression results show that relationship-maintenance strategies negatively predicted athlete burnout ($\beta = -0.47$, $p < 0.001$), supporting Hypothesis 1. Relationship-maintenance strategies positively predicted the coach–athlete relationship ($\beta = 0.71$, $p < 0.001$) and basic psychological needs satisfaction ($\beta = 0.61$, $p < 0.001$), while the coach–athlete relationship positively predicted basic psychological needs satisfaction ($\beta = 0.13$, $p < 0.05$) and negatively predicted athlete burnout ($\beta = -0.15$, $p < 0.05$). Finally, basic psychological needs satisfaction negatively predicted athlete burnout ($\beta = -0.38$, $p < 0.001$).

4.3. Mediating effect test

The Bootstrap method was adopted in this study to analyze the mediating effect, with relationship maintenance strategy as the independent variable, coach–athlete relationship and basic psychological needs satisfaction as the mediating variable, and athlete burnout as the dependent variable.

TABLE 1 Descriptive statistics and correlation analysis.

Variables	M±SD	1	2	3	4
1. CARM	5.22 ± 0.96	1			
2. CAR	6.14 ± 0.92	0.71**	1		
3. BNS	2.38 ± 0.54	0.70**	0.56**	1	
4. AB	5.28 ± 0.93	−0.52**	−0.47**	−0.57**	1

CARM, coach–athlete relationship maintenance; CAR, coach–athlete relationship; BNS, basic psychological needs satisfaction; AB, athlete burnout. M ± SD, mean ± standard deviation. **$p < 0.01$.

Table 3 reports the results of the mediating effect test. The coach–athlete relationship partially mediated between relationship-maintenance strategies and athlete burnout (95% CI = [−0.21, −0.02]); the effect value is −0.11, accounting for 21% of the total effect. Hypothesis H2 is thus supported. Basic psychological needs satisfaction is also partially mediated between relationship-maintenance strategies and athlete burnout (95% CI = [−0.43, −0.09]); the effect value is −0.23, accounting for 44% of the total effect. Therefore, Hypothesis 3 is also supported.

The coach–athlete relationship and basic psychological needs satisfaction play a serial mediating role between relationship-maintenance strategies and athlete burnout (95% CI = [−0.08, −0.00]); the effect value is −0.04, accounting for 7% of the total effect. The results supported Hypothesis 4.

The research model, including effect values, is shown in Figure 2.

5. Discussion

Drawing on SDT, this study explores the mechanism of the association between relationship-maintenance strategies and athlete burnout. The results show the negative predictive effect of relationship-maintenance strategies on athlete burnout, as well as the individual and serial mediating effects of the coach–athlete relationship and basic psychological needs satisfaction. The study thus reveals three mediation paths, indicating that athletes who use more relationship-maintenance strategies will perceive a higher quality coach–athlete relationship and meet more of their basic psychological needs, thereby reducing the risk of athlete burnout.

5.1. The negative predictive effect of relationship-maintenance strategies on athlete burnout

The results show that athletes' relationship-maintenance strategies negatively predict athlete burnout. The relationship maintenance behavior of athletes can create a positive social interaction environment in which athletes are less likely to experience burnout during sports because their basic psychological needs are met. Regarding the specific dimensions of these strategies, conflict management and motivation strategies reflect athletes' efforts to clarify their own and the coaches' expectations and express their intention to continue cooperating with coaches (Rhind and Jowett, 2010b). These strategies can reduce the incidence and severity of conflicts between athletes and coaches and help athletes maintain full enthusiasm for their sport to avoid excessive emotional exhaustion and negative evaluation of sports. The assurance strategy reflects athletes taking a positive approach to problems in training and life, ensuring coaches can

TABLE 2 Regression analysis of variables in the model.

Regression		Model index			Coefficients	
Outcome variable	Independent variable	R	R^2	F	β	t
AB	CARM	0.47	0.22	72.58***	−0.47	−8.52***
CAR	CARM	0.71	0.50	252.42***	0.71	15.89***
BNS	CARM	0.71	0.50	128.56***	0.61	9.76***
	CAR				0.13	2.12*
AB	CARM	0.61	0.36	48.63***	−0.14	−1.72
	CAR				−0.15	−2.16*
	BNS				−0.38	−5.39***

CARM, coach–athlete relationship maintenance; CAR, coach–athlete relationship; BNS, basic psychological needs satisfaction; AB, athlete burnout. *$p < 0.05$; ***$p < 0.001$; $N = 256$; β = standardized coefficients.

trust them to deal with them well (Guo, 2016). This strategy dimension also focuses on preserving athletes' high evaluation of their own abilities, which helps them avoid losing a sense of accomplishment. Communication, support, and social network strategies all reflect the importance to athletes of establishing supportive relationships and maintaining effective communication with their coaches regarding sports and non-sports matters (Rhind and Jowett, 2010b). These strategies also help athletes relieve their negative emotions regarding sports. Therefore, whereas previous studies emphasized the coach's responsibility for creating a good atmosphere and thereby minimizing athlete burnout, we demonstrate the importance of athletes' own relationship-maintenance strategies. In particular, it is essential for athletes to actively and openly communicate with their coaches about personal troubles in training and life and to obtain coaches' help and advice.

5.2. The mediating roles of coach–athlete relationship and basic psychological needs satisfaction

The study's results show that athletes' relationship-maintenance strategies indirectly affect athlete burnout through coach–athlete relationship and basic psychological needs satisfaction, as individual and serial mediators. These findings indicate that the athlete's relationship with their coach and satisfaction of basic psychological needs are important ways for relationship-maintenance strategies to reduce the athlete' s risk of burnout. These insights are consistent with the results of previous studies (Isoard-Gautheur et al., 2016; Kent et al., 2018; Ariani, 2019; Davis et al., 2019a).

Athletes who use appropriate relationship-maintenance strategies will show respectful and friendly attitudes during interactions with their coaches, thereby contributing to the development and maintenance of good interpersonal relationships (LaVoi, 2007) and enhancing the quality of the coach–athlete relationship (Davis et al., 2019a; Choi et al., 2020). When athletes feel close to coaches and appreciate one another (closeness), believe they can work with their coaches (complementarity), and intend to maintain a long-term partnership (commitment), they will be less likely to experience feelings of reduced athletic accomplishment, emotional exhaustion, and sport devaluation (Cresswell and Eklund, 2007; Gustafsson et al., 2008; Isoard-Gautheur et al., 2016). Thus, athletes' relationship-maintenance strategies can predict athlete burnout through the mediating role of the coach–athlete relationship.

Athletes who use relationship-maintenance strategies are more proactive in their interactions with coaches, facilitating the satisfaction of three basic psychological needs: autonomy, competence, and relatedness (Mo and Pi, 2020). When their basic psychological needs are satisfied, athletes are less inclined to devalue their sport and have a greater sense of belonging to the sporting environment (Ariani, 2019). They also strongly believe they can achieve good results and rationally allocate training time to avoid excessive physical consumption (Kent et al., 2018). The basic psychological needs satisfaction causes athletes to experience less sports devaluation, reduced athletic accomplishment, and emotional/physical exhaustion, and the level of burnout decreases accordingly (Kent et al., 2018; Liu M. et al., 2022; Shannon et al., 2022). Thus, athletes' relationship-maintenance strategies can predict athlete burnout by mediating basic psychological needs satisfaction.

Based on the finding that the coach–athlete relationship and basic psychological needs satisfaction function as serial mediators, the study provides new evidence that athletes' psychological needs are satisfied through the coach–athlete relationship, consistent with Jowett and Timson-Katchis (2005; see also Jowett and Shanmugam, 2016). Athletes establish and sustain good relationships with coaches through relationship-maintenance strategies. When the coach–athlete relationship is harmonious, athletes may gain more respect from coaches, satisfying their relatedness needs. With more support and help from coaches, athletes will also perceive a greater sense of control, satisfying their

TABLE 3 Mediating effect test.

Effect type	Path	Effect	Proportion of total effect	Bootstrap 95% CI	
				LLCI	ULCI
Indirect	CARM→CAR→AB	−0.11	21%	−0.203	−0.015
	CARM→BNS→AB	−0.23	44%	−0.430	−0.093
	CARM→CAR→BNS→AB	−0.04	7%	−0.080	−0.005
Direct effect	CARM→AB	−0.14	27%	−0.306	0.021
Total effect		−0.52		−0.627	−0.417

CARM, coach–athlete relationship maintenance; CAR, coach–athlete relationship; BNS, basic psychological needs satisfaction; AB, athlete burnout. Bootstrap sample size = 5,000. CI, confidence interval; LLCI, lower limits of confidence interval; ULCI, upper limits of confidence interval.

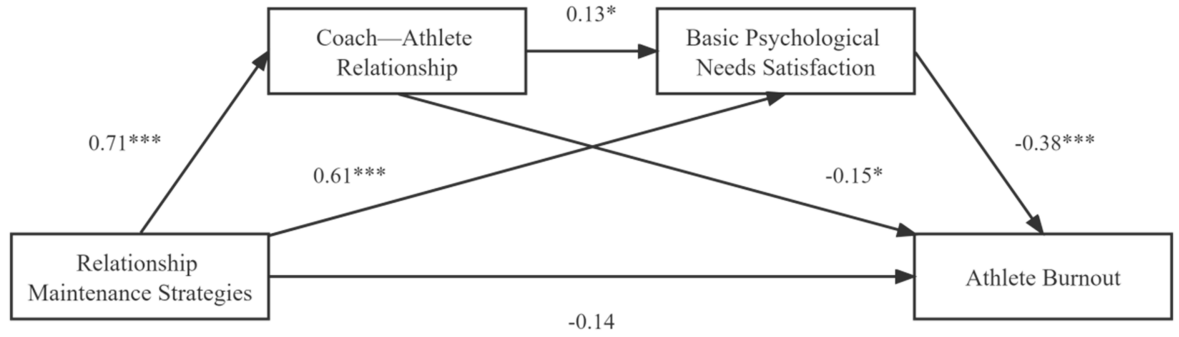

FIGURE 2
Associations between relationship-maintenance strategies and athlete burnout for the whole sample (N=256). *p<0.05, ***p<0.001.

autonomy needs. Through their efforts to promote mutual trust with coaches, athletes will participate more actively in training and competition, facilitating continuous improvement in their abilities and, thus, satisfying their competence needs (Riley and Smith, 2011; Choi et al., 2013). In addition, SDT considers motivation as a continuum of self-determination and holds that basic psychological needs satisfaction contributes to the internalization of external motivation, and the degree of internalization is determined by the degree of satisfaction of psychological needs (Ryan and Deci, 2000). Therefore, basic psychological needs satisfaction will increase the level of athletes' self-determination motivation to participate in training or competition and avoid externalization and loss of athletic motivation (Adie and Jowett, 2010). As athletes maintain a positive psychological state (Ye et al., 2016), burnout is prevented or alleviated.

Three new ideas emerged from this study. First, we provide a new perspective on athlete burnout by revealing the positive associations among athletes' relationship-maintenance strategies, the coach–athlete relationship, and the satisfaction of basic psychological needs. Second, this study found that the antecedent role of the coach–athlete relationship in basic psychological needs satisfaction, that is, the positive influences of coach–athlete relationship on basic psychological needs satisfaction, suggesting that the direction of this relationship should be taken into account. Third, whereas most previous studies have examined how coaches' behaviors influence athlete burnout, this study highlights the importance of athletes' own relationship-maintenance behaviors in preventing burnout. Compared to previous findings before the COVID-19 epidemic (Isoard-Gautheur et al., 2016; McGee and Defreese, 2019; Davis et al., 2019a), our study demonstrated that athletes' relationship maintenance strategies still predicted coach–athlete relationship quality, and athletes who perceived strong coach–athlete relationship experienced less burnout, suggesting the importance of athletes' relationship maintenance strategies in preventing athlete burnout in different social contexts.

Our findings have important practical implications for promoting athlete burnout interventions from athletes, coaches, and sports organizational management. First, athletes' training in sports skills should be combined with psychological training focused on improving interpersonal relationships. Through learning how to use appropriate relationship-maintenance strategies, athletes will become better equipped to cultivate high-quality interpersonal relationships, helping satisfy their basic psychological needs and creating a more comfortable

environment for their sporting activities. Second, coaches should observe and improve interaction patterns with athletes and seek to maintain a good coach–athlete relationship. For athletes with unmet autonomy needs, coaches should give them a certain degree of freedom to decide on training activities in preparation for competitions. For athletes with unmet competence needs, coaches should help them create successful experiences and enhance their self-efficacy. For athletes with unmet relatedness, coaches should ensure they receive more education on interpersonal skills. Third, sports organizational management should intervene in difficult relationships between athletes and coaches to find solutions and prevent athlete burnout. Furthermore, in order to eliminate the negative effects of athlete burnout, policy support and guidelines should be adequately provided so that athletes and coaches, as well as management, are aware of the importance of maintaining good coach–athlete relationship and actively engage in relevant training.

5.3. Limitations and future research avenues

This study has several limitations. First, the sample size hinders the research, as the small number of Chinese athletes recruited in Chongqing could hardly represent all athletes in China. Future studies should contain more convincing samples, especially athletes in different sports, to better support the present findings and possibly provide further insight into the study on athlete burnout. Second, this study is a cross-sectional investigation, which made it impossible for us to deduce the causal relationships between research variables. Therefore, a longitudinal study in the future needs to elucidate the causal relationship between relationship-maintenance strategies and athlete burnout. Third, because all the questionnaire responses were self-reported by athletes, the results may be affected by endogeneity bias. It would benefit future studies to include other measures, such as in-depth observations and coach-reported data. Fourth, this study does not consider the cultural universality of interpersonal relationships. In Chinese culture, coach–athlete relationship is characterized by a typical paternalistic leadership, a tendency of absolute worship and obedience of juniors to seniors and subordinates to superiors based on blood ties and ranks. This differs from the characteristic of coach–athlete relationships in Western culture, which emphasizes contractual elements. Cross-cultural research should be conducted to verify the role of coach–athlete relationship in athlete burnout.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee at the Faculty of Psychology Southwest University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

FF: conceptualization, methodology, investigation, and funding acquisition. JC: writing — original draft and investigation. YC: data curation, writing — review and editing. BL and LG: resources and validation. YS: resources and project administration. FY: validation. QY: data curation. LY: investigation. CD: conceptualization, supervision, and writing – review and editing. HS: project administration, methodology, writing – review and editing, and funding acquisition. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

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Childhood psychological abuse and relational aggression among adolescents: A moderated chain mediation model

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Introduction: Adolescents are in a period when a marked upward trend of adolescents relational aggression. Even though previous studies have found that childhood psychological abuse experience is an important factor influencing adolescent relational aggression, it is unclear when and under what circumstances childhood psychological abuse impacts adolescent relational aggression. This study constructed a moderated chain mediation model to investigate the influence of childhood psychological abuse on relational aggression among Chinese adolescents and its internal mechanism.

Methods: Data from 1868 (923 male and 945 female, M = 14.31, SD = 1.60) Chinese adolescents in two full-time middle schools in Guangzhou were collected via a cross-sectional survey in 2020. Adolescents reported on childhood psychological abuse, relational aggression, rejection sensitivity relational victimization and cognitive reappraisal.

Results: The results demonstrated that: (1) childhood psychological abuse was significantly positively related to relational aggression; (2) childhood psychological abuse was significantly linked with adolescents' relational aggression through the separate mediating effects of rejection sensitivity and relational victimization, as well as through the chain mediating effects of rejection sensitivity and relational victimization; (3) the chain mediated effect of childhood psychological abuse on relational aggression through rejection sensitivity and relational victimization was moderated by cognitive reappraisal.

Conclusion: These findings indicate that childhood psychological abuse, as a kind of poor parenting style, has influence on adolescents' internal personality (rejection sensitivity) and external behavior development (relational victimization and relational aggression). This study is helpful to demonstrate the protective effect of cognitive reappraisal and reveal the internal mechanism of childhood psychological abuse on relational aggression.

KEYWORDS

childhood psychological abuse, relational aggression, rejection sensitivity, relational victimization, cognitive reappraisal

Highlights

- Childhood psychological abuse was significant positively related to adolescents' relational aggression.
- Childhood psychological abuse was significantly linked with adolescents' relational aggression through the separate mediating effects of rejection sensitivity and relational victimization, as well as through the chain mediating effects of rejection sensitivity and relational victimization.
- The chain mediated effect of childhood psychological abuse on relational aggression through rejection sensitivity and relational victimization was moderated by cognitive reappraisal.

Introduction

Adolescents are in a critical period of rapid physical and mental development, there is a marked upward trend in the importance of maintaining fine peer relationships and social status (Liu et al., 2011). Relational aggression refers to a series of behaviors that the attacker deliberately destroys the peer relationship of the attacked by means of exclusion, rumor, and social manipulation (Crick and Grotpeter, 1995). In comparison to direct aggression, relational aggression is a form of campus violence that is intangible and characterized by concealment. Individuals who suffer from relational aggression will not only further deteriorate their own interpersonal relationships, but also may have direct aggression and other behaviors, and their physical and mental health development will suffer severe and long-lasting detrimental effects (Lei et al., 2019; Wang and Yu, 2019). In light of this, there is an urgent need to comprehend the factors that influence relational aggression among adolescents.

Childhood psychological abuse and relational aggression

General aggression model is the most extensive model to explain the mechanism of relational aggression. According to the model, the generation of individual aggression behavior can be explained by environmental factors (such as family) and individual factors (such as personality) (Kowalski et al., 2014). Among environmental factors, childhood psychological abuse, as the family environment experienced by adolescents at the earliest stage, has a direct and long-term impact on their subsequent cognitive and behavioral development. Adverse childhood experiences, including many different kinds of child maltreatment (such as physical or psychological neglect and abuse), and adverse parenting styles are risk predictors of both internalized (Barber et al., 2014; Balistreri and Alvira-Hammond, 2016) and externalized problems (Perez et al., 2018; Mumford et al., 2019) in adolescents.

Previous studies have found that childhood psychological abuse experience is an important factor influencing adolescent relational aggression (Crawford and Wright, 2007). 36% of the world's children are affected by childhood psychological abuse, which is defined as the long-term use of intimidation, denigration, meddling, connivance, and neglect by the primary caregivers of children in inappropriate ways to raise children (Stoltenborgh et al., 2012). This parenting style can have a substantial impact on adolescents' behavioral disorders (Afifi et al., 2011) and aggressive behavior (Harford et al., 2014). Individual emotion or behavior can be transferred from one environment to another, according to the spillover hypothesis (Almeida et al., 1999), as evidenced by the acquisition of certain aggressive behavior, authoritarian behavior, or psychological control by children from their parents, and apply these behaviors to situations outside the home, where they become aggressors themselves. Studies have demonstrated that negative parenting styles (such as authoritarian, permissive) can significantly predict relational aggression in children (Casas et al., 2006). Experience of psychological abuse is a strong predictor of individuals' problem behaviors (Liu et al., 2019) and aggressive behaviors (Jin and Wang, 2017; Sun et al., 2017a, b). Therefore, this study proposed the hypothesis:

> *Hypothesis 1* (*H1*): Childhood psychological abuse is significantly positive related to relational aggression.

It is unclear, however, when and under what circumstances childhood psychological abuse impacts adolescent relational aggression. Therefore, we need to further explore the internal mechanism of action between childhood psychological abuse and relationship aggression. Considering that rejection sensitivity and relational victimization were correlated with childhood psychological abuse (Erozkan, 2015) and relational aggression (Zimmer-Gembeck and Duffy, 2014), and cognitive reappraisal can significantly alleviate the frustration emotional response caused by rejection sensitivity (Zuo et al., 2016). This study intends to take rejection sensitivity and relational victimization as mediating variables and cognitive reappraisal as moderating variables to further discuss the influence of childhood psychological abuse and relational aggression.

The chain mediating effect of rejection sensitivity and relational victimization

Rejection sensitivity is a negative personality tendency, which refers to the anxious anticipation, the perception of accommodation and the intense emotional behavior reaction of individuals to possible rejection in interpersonal communication (Downey and Feldman, 1996). Studies have found that childhood psychological abuse may be one of the most significant variables influencing rejection sensitivity (Erozkan, 2015). On the one hand, attachment theory asserts that if children are often rejected and neglected by their main caregivers in their early life, their psychological needs

cannot be met and they are prone to develop an insecure attachment pattern, which will make them more sensitive to rejection cues in interpersonal communication. Empirical studies support the theory that parental violence significantly and positively predicts rejection sensitivity in children (Brendgen et al., 2002). Erozkan (2009) also found that poor parental style leads to individuals being in a situation of long-term stress and rejection, thus developing high rejection sensitivity. On the other hand, according to the theory of frustration - attack, attack behavior is caused by the setbacks in the individual, the individual perceived from others' refusal (Berkowitz, 1989) is a common human setbacks, refused to high sensitivity of teenagers are easily in interpersonal communication signal for hostile to explain, so feel more personal setbacks, triggering more attacks (Bondü and Krahé, 2015). From the defensive motivational system, in the case of possible rejection, individuals with high rejection sensitivity are more likely to activate the self-protection mechanism and exhibit aggression (Downey et al., 2004; Romero-Canyas et al., 2010). Research supports the aforementioned theoretical perspectives. In a longitudinal study, Zimmer-Gembeck et al. (2016) found that adolescents with high rejection sensitivity are more likely to have angry emotions and participate in retaliatory conduct when facing rejection information, that is, to carry out more explicit and relational aggression behaviors. Therefore, this study hypothesized that:

> *Hypothesizes 2a* (*H2a*): Rejection sensitivity mediates the relationship between childhood psychological abuse and relational aggression.

Meanwhile, relational victimization, as a subtype of peer victimization, can significantly predict adolescents' relational aggression (Ji et al., 2012). Relational victimization is when individuals endure relational attacks from peers in interpersonal communication, resulting in specific damage to their social standing and friendships (Crick et al., 2002). On the one hand, according to attachment theory (Bowlby, 1969), abusive experiences inhibit the development of the secure attachment model in individuals, and individuals apply the negative emotional reactions and hostility engendered by abusive experiences to peer situations, resulting in increased peer victimization of individuals (Zhu et al., 2019). Past studies have shown that individuals who have been abused in the past lack social skills and may therefore have difficulty dealing with peer conflict and experience more ostracism and aggression (Ohene et al., 2006). Shields and Cicchetti (2001) also found that childhood psychological abuse was a risk factor for peer victimization. Interpersonal risk model (Kochel et al., 2012) denotes that for adolescents, a lack of solid interpersonal relationships or being attacked by others are significant stress events that cannot be disregarded, leading to a succession of adverse consequences such as problem behaviors (Light et al., 2013). A meta-analysis showed a strong association between relational victimization and relational aggression (Casper et al., 2020). On this basis, this study hypothesized that:

> *Hypothesizes 2b* (*H2b*): Relational victimization mediates the relationship between childhood psychological abuse and relational aggression.

On the other hand, based on the developmental systems theory, both individual internal factors and peer factors may play a role in the relationship between family factors and individual behavior. That is to say, adolescents who experience childhood psychological abuse in adverse family environments will first affect their own cognition, making individuals more sensitive to rejection cues in interpersonal communication, and thus more likely to suffer peer victimization in interpersonal communication (Jacobs and Harper, 2013). Multiple studies have demonstrated that relational victimization is a significant predictor of future violations and aggressive behavior (Sullivan et al., 2006). Based on the foregoing theoretical and empirical research, this study hypothesized that:

> *Hypothesizes 2c* (*H2c*): Rejection sensitivity and relational victimization play a chain mediating role between childhood psychological abuse and relational aggression.

The moderating effect of cognitive reappraisal

In addition, studies have found that cognitive reappraisal, as a positive emotion regulation strategy, can mitigate the impact of negative life events on individuals (Zuo et al., 2016; Wang et al., 2020). Previous empirical studies also have shown that cognitive reappraisal can effectively reduce individuals' aggressive behaviors by replacing automated hostile explanations (rejection sensitivity) with reasonable and non-hostile explanations (Denson, 2015; Hou et al., 2017). Cognitive reappraisal refers to that when individuals are faced with negative events that may trigger emotions, they alter their cognition of the event and diminish its negative meaning to the individual in order to avoid the generation of negative emotions (Gross and John, 2003). According to the emotional regulation process model, individuals who are good at using cognitive reappraisal can face negative emotional events with a more positive attitude, so as to weaken the adverse influence of emotional events on their inner psychological quality. An empirical study demonstrated that cognitive reappraisal moderated the mediating effect of shame between social exclusion and adolescent self-injury, and that the detrimental impact of social exclusion on individual shame was mitigated when the individual's cognitive reappraisal level was high (Wang et al., 2020). Considering that cognitive reappraisal, as an antecedent focus strategy, generally occurs at the early stage of emotion generation (Buhle et al., 2014), and has a significant easing effect on frustration emotional responses generated by rejection sensitivity (Zuo et al., 2016). This study hypothesizes that (H3):

Hypothesizes 3 (*H3*): Cognitive reappraisal can moderate the first half of the chain mediation path (childhood psychological abuse → rejection sensitivity), Specifically, adolescents with a higher level of cognitive reappraisal can mitigate the negative effects of childhood psychological abuse to rejection sensitivity.

Current study

Based on the aforementioned theories and research, the purpose of this study is to investigate the chain mediating effect of rejection sensitivity and relational victimization on the association between childhood psychological abuse and adolescent relational aggression, as well as the moderating effect of cognitive reappraisal. The hypothetical theoretical model is exhibited in Figure 1.

Method

Participants

This study investigated 1,966 middle school students from two full-time middle schools in Guangzhou employing cluster sampling. With the approval of the students and their parents, the test was administered to the class as a unit, and 1,868 valid questionnaires with a recovery rate of around 95% were gathered. In the effective sample, there were 923 boys and 945 girls, aged from 12 to 17 years old ($M = 14.31$, $SD = 1.60$).

Measures

Childhood psychological abuse

In the form of a recall scale, the Child Psychological Maltreatment Scale (Pan et al., 2010) was used to measure the level of childhood psychological abuse among middle school students. There are 23 items in this scale, and participants were asked to respond based on their childhood experiences (such as "my parents scolded me for no reason"). The participants were asked to respond to items on a 5-point Likert-type scale, ranging from 0 = never to 4 = all the time. The Cronbach's α coefficient of the scale in this study is 0.92.

Relational aggression

The Chinese revision of the Self-rated Relational Aggression Questionnaire (Liang, 2005) established by Werner and Crick (1999) and adapted by Loudin et al. (2003) was used to measure relational aggression among middle school students. The questionnaire contained nine items, and participants were asked to respond based on their experiences over the 6 months (such as "when someone annoys me, ignore him/her for a short time"). The participants were asked to respond using a 5-point Likert-type scale, ranging from 0 = never to 4 = all the time. After all items were scored in reverse, the relational attack level increased proportionally to the subject's score on all items. The Cronbach's α coefficient of the questionnaire in this study is 0.88.

Rejection sensitivity

The Children's Rejection Sensitivity Questionnaire (Downey et al., 1998) was utilized to measure the levels of rejection anxiety, rejection anger and rejection expectation of middle school students. Each of the 12 peers and teacher scenarios contained three questions. The questionnaire was scored by 6 points, and the score calculation method was as follows: rejection anxiety dimension = rejection anxiety × rejection expectation; Anger rejection dimension = anger rejection × expectation rejection. Combining the rejection anxiety dimension and the anger rejection dimension yields the overall rejection sensitivity score,

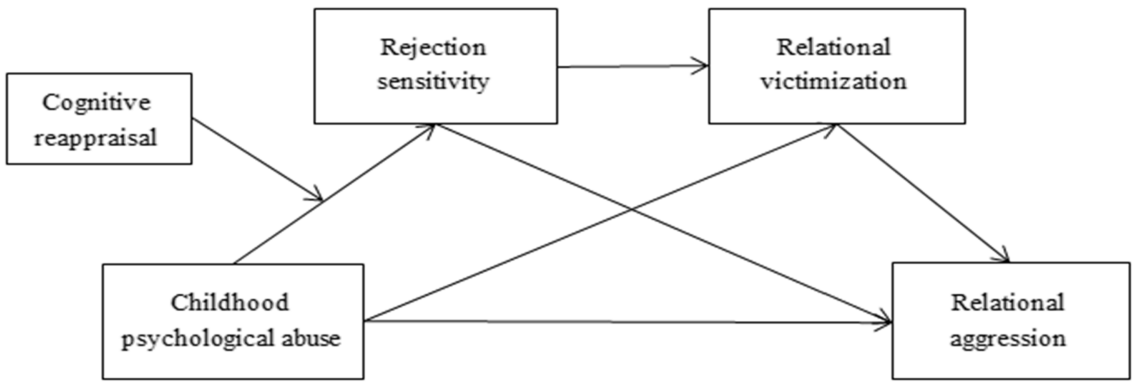

FIGURE 1
The hypothetical theoretical model.

and the higher the score, the greater the rejection sensitivity. The Cronbach's α coefficient of the questionnaire in this study is 0.86.

Relational victimization

Children's exposure to peer victimization was measured using the Relational Victimization Subscale (Zhang et al., 2009) in the Multidimensional Peer Victimization Scale (MPVS) developed by Mynard and Joseph (2000). There were 8 items in the scale, and participants were asked to respond based on their experiences over the past 6 months (such as "nearly half a year, other students deliberately do something to let the teacher do not like me"). The scale was scored by 4 points, and the higher the score, the greater the degree of relationship infringement. The Cronbach's α coefficient of the scale in this study is 0.90.

Cognitive reappraisal

The Cognitive Reappraisal Strategy Subscale (Wang et al., 2007) of the Emotional Regulation Strategy scale compiled by Gross and John (2003) was used to assess the level of cognitive reappraisal strategies employed by middle school students. The scale contained seven items, and participants were asked to respond based on their experiences over the 6 months (such as "I change the way I interpret situations to control my emotions"). The participants were asked to respond using a 5-point Likert-type scale, ranging from 1 = never to 5 = all the time. The frequency with which respondents employed the cognitive reappraisal strategy was proportional to their score. The Cronbach's α coefficient of the scale in this study was 0.89.

Procedure

Before conducting the survey, the consent of teachers, participants, and their guardians was secured. One or two graduate students majoring in psychology were responsible for the distribution and collection of questionnaires. All respondents were informed that their participation was entirely voluntary and that the results would be utilized exclusively for scientific research. In addition, our testing material and survey procedures were approved by the Ethics in Human Research Committee of School of Education, Guangzhou University.

In this study, SPSS 22.0 (IBM, Armonk, NY, USA) was used to input and process the data, and the macro program PROCESS v4.0 ([1] accessed on 25 May 2022) plug-in compiled by Hayes (Hayes, 2017) and Mplus 7.4 was utilized to examine a moderated chain mediation model. The analyses were performed in the following four aspects. First, the independent sample *T*-test, descriptive statistics and correlation analysis were conducted for each variable. Second, using 2,000 bootstrap samples and the PROCESS macro (Model 6), we tested the chain-mediating effect of rejection sensitivity and relational victimization in the link between childhood psychological abuse and relational aggression. The parameter was statistically significant if the confidence interval excluded 0. Third, according to the suggestions of Wen and Ye (2014), we used Mplus7.4 to examine the moderating effect of cognitive reappraisal on the chain mediation models with 2,000 bootstrap samples. All variables were standardized prior to the formal data processing. Finally, we used Mplus7.4 to analyses alternate model for greater confidence in the proposed direction of associations between the childhood psychological abuse and relational aggression. For all model, good model fit was determined by the following criteria: comparative fit index (CFI) > 0.90; Tucker-Lewis index (TLI) > 0.90; standardized root mean residual (SRMR) < 0.08; and root mean square error of approximation (RMSEA) <0.05.

Results

Common method bias

The data acquired for this study came from self-reports. Although for some items reverse scoring was utilized to control the bias generated by the effect of the common method, additional bias testing of the common method was still required. Therefore, exploratory factor analysis was undertaken on the variables using the Harman single factor method test (Zhou and Long, 2004). The results revealed 11 common factors with characteristic root values greater than 1, and the highest variation explained by common factors was 19.26 percent, which was less than the critical value of 40 percent. Therefore, there was no significant common method bias in this study.

Descriptive statistics

The independent sample T-test results of the gender and age of the subjects among the model variables were shown in Table 1. Of all the variables, the level of childhood psychological abuse [$t_{(1866)} = 4.238$, $p < 0.001$], relational victimization [$t_{(1866)} = 6.013$, $p < 0.001$] and cognitive reappraisal [$t_{(1866)} = -5.323$, $p < 0.001$] proved to be significantly different among age; the level of childhood psychological abuse [$t_{(1866)} = -3.324$, $p < 0.01$] and rejection sensitivity [$t_{(1866)} = -7.732$, $p < 0.001$] proved to be significantly different among gender.

Table 2 showed the correlation analysis results among childhood psychological abuse, rejection sensitivity, relational victimization, relational aggression, and cognitive reappraisal. Childhood psychological abuse was positively correlated with rejection sensitivity ($r = 0.34$, $p < 0.01$), relational victimization ($r = 0.42$, $p < 0.01$), and relational aggression ($r = 0.22$, $p < 0.01$).

1 http://www.afhayes.com

TABLE 1 The independent sample *T*-test of the gender and age among the model variables.

Variables	*N*	CPA		RS		RV		RA		CR	
		M±*SD*	*t*/*F*	*M*±*SD*	*t*/*F*	*M*±*SD*	*t*/*F*	*M*±*SD*	*t*/*F*	*M*±*SD*	*t*/*F*
Age			0.17***		0.03		0.15***		−0.08		−0.14***
12–14 years	901	0.80 ± 0.68		7.22 ± 4.08		1.36 ± 0.52		0.75 ± 0.82		3.39 ± 0.97	
15–17 years	967	0.68 ± 0.56		7.19 ± 3.77		1.23 ± 0.42		0.80 ± 0.65		3.61 ± 0.77	
Gender			−0.31**		−0.28***		−0.31		−0.06		−0.10
Male	923	0.69 ± 0.59		6.51 ± 3.49		1.28 ± 0.47		0.77 ± 0.78		3.48 ± 0.93	
Female	945	0.78 ± 0.66		7.89 ± 4.19		1.30 ± 0.48		0.78 ± 0.69		3.52 ± 0.83	

**$p < 0.01$, ***$p < 0.001$. CPA, Childhood psychological abuse; RS, Rejection sensitivity; RV, Relational victimization; RA, Relational aggression; CR, Cognitive reappraisal.

TABLE 2 Descriptive statistics of model variables and correlations among model variables.

Variables	*M*±*SD*	CPA	RS	RV	RA	CR
CPA	0.74 ± 0.62	–				
RS	7.21 ± 3.92	0.34**	–			
RV	1.29 ± 0.47	0.42**	0.33**	–		
RA	0.78 ± 0.74	0.22**	0.27**	0.22**	–	
CR	3.50 ± 0.88	−0.12**	−0.16**	−0.13**	−0.19**	–
Gender	0.51 ± 0.50	0.08**	0.18**	0.02	0.01	0.02
Age	14.31 ± 1.60	−0.05*	0.00	−0.12**	0.07**	0.13**

*$p < 0.05$, **$p < 0.01$. Gender: 0 = male, 1 = female. CPA, Childhood psychological abuse; RS, Rejection sensitivity; RV, Relational victimization; RA, Relational aggression; CR, Cognitive reappraisal.

Rejection sensitivity was positively correlated with relational victimization ($r = 0.33$, $p < 0.01$) and relational aggression ($r = 0.27$, $p < 0.01$). Relational victimization was positively correlated with relational aggression ($r = 0.22$, $p < 0.01$). Negative correlations were observed between cognitive reappraisal and childhood psychological abuse ($r = -0.12$, $p < 0.01$), rejection sensitivity ($r = -0.16$, $p < 0.01$), relational victimization ($r = -0.13$, $p < 0.01$), and relational aggression ($r = -0.19$, $p < 0.01$), respectively. Both childhood psychological abuse ($r = 0.08$, $p < 0.01$) and rejection sensitivity ($r = 0.18$, $p < 0.01$) were positively associated with gender. Age was adversely correlated with childhood psychological abuse ($r = -0.05$, $p < 0.05$) and relational victimization ($r = -0.12$, $p < 0.01$). Both relational aggression ($r = 0.07$, $p < 0.01$) and cognitive reappraisal ($r = 0.13$, $p < 0.01$) were positively correlated with age.

Testing the mediating effects of rejection sensitivity and victimization on childhood psychological abuse and relational aggression

The Process plug-in (Model 6) in SPSS compiled by Hayes (2017) was used to test the chain mediating effect of rejection sensitivity and relational victimization on childhood psychological abuse and relational aggression with gender and age serving as control variables. As shown in Table 3, the direct effect of childhood psychological abuse on relational aggression was significant ($\beta = 0.23$, $p < 0.001$), and remained significant ($\beta = 0.11$, $p < 0.001$) after the inclusion of two mediating variables, rejection sensitivity and relational victimization. Childhood psychological abuse was significant positively related to rejection sensitivity ($\beta = 0.33$, $p < 0.001$); rejection sensitivity was significantly positive related to relational victimization ($\beta = 0.22$, $p < 0.001$), which in turn was positively related to relational aggression ($\beta = 0.12$, $p < 0.001$). The findings suggest that childhood psychological abuse was significantly linked with relational aggression *via* the chain mediated effect of rejection sensitivity and relational victimization. Meanwhile, childhood psychological abuse was significantly positive related to relational victimization ($\beta = 0.34$, $p < 0.001$). Rejection sensitivity ($\beta = 0.20$, $p < 0.001$) and relational victimization ($\beta = 0.12$, $p < 0.001$) were significantly related to relational aggression. The findings suggest that childhood psychological abuse was significantly linked with relational aggression *via* the separate mediated effect of rejection sensitivity and relational victimization.

The results of the additional mediating effect test (shown in Table 4; Figure 2) stated that childhood psychological abuse could influence relational aggression *via* the separate mediating effects of rejection sensitivity and relational victimization, as well as *via* the chain mediating effects of rejection sensitivity and relational victimization. In particular, the mediating effect is generated through three pathways: indirect pathway 1, childhood psychological abuse → rejection sensitivity →relational aggression; indirect pathway 2, childhood psychological abuse →relational victimization → relational aggression; indirect pathway 3,

TABLE 3 Regression analysis of variables in the model.

Regression equation		Overall fitting index			SORC			
Outcome	Predictor	*R*	R^2	*F*	*β*	95% CI LI	95% CI UI	*t*
RA	CPA	0.24	0.06	37.21***	0.23	0.18	0.27	10.10***
	Gender				−0.01	−0.06	0.03	−0.51
	Age				0.08	0.04	0.13	3.59***
RS	CPA	0.37	0.14	99.28***	0.33	0.29	0.37	15.19***
	Gender				0.15	0.11	0.19	6.98***
	Age				0.02	−0.03	0.06	0.68
RV	RS	0.47	0.22	133.39***	0.22	0.18	0.26	9.91***
	CPA				0.34	0.30	0.38	15.61***
	Gender				−0.04	−0.08	−0.01	−2.02*
	Age				−0.10	−0.14	−0.06	−4.85***
RA	RS	0.33	0.11	46.61***	0.20	0.16	0.25	8.36***
	RV				0.12	0.07	0.16	4.65***
	CPA				0.11	0.07	0.16	4.64***
	Gender				−0.04	−0.08	0.02	−1.84
	Age				0.09	0.05	0.13	4.04***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Before substituting into the equation, all variables in the model were standardized. 95% CI LI, 95% CI lower limits; 95% CI UI, 95% CI upper limits; SORC, significance of regression coefficient; CPA, Childhood psychological abuse; RS, Rejection sensitivity; RV, Relational victimization; RA, Relational aggression; CR, Cognitive reappraisal.

TABLE 4 The chain mediating effect of rejection sensitivity and relational victimization.

Effect	Pathway	Effect value	95% CI LI	95% CI UI	RME
Direct effect	CPA → RA	0.115	0.184	0.273	50%
Mediation effect	CPA → RS → RA	0.066	0.049	0.088	29%
	CPA → RV → RA	0.039	0.020	0.060	17%
	CPA → RS → RV → RA	0.008	0.004	0.014	4%
Total effect		0.228	–	–	100%

95% CI LI, 95% CI lower limits; 95% CI UI, 95% CI upper limits; RME, Relative mediating effect; CPA, Childhood psychological abuse; RS, Rejection sensitivity; RV, Relational victimization; RA, Relational aggression; CR, Cognitive reappraisal.

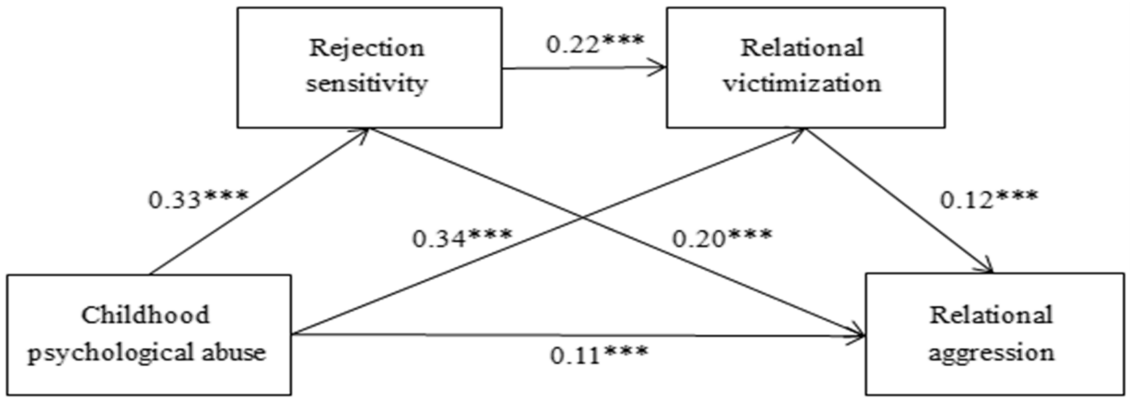

FIGURE 2
The chain mediating effect of rejection sensitivity and relational victimization, ***p <0.001.

childhood psychological abuse →rejection sensitivity →relational victimization →relational aggression. The indirect effect of the three indirect paths does not contain 0 in the 95% confidence interval of Bootstrap, reflecting that the indirect effect of the three indirect paths has achieved a significant level, and the mediation effect accounts for 29, 17 and 4% of the aggregate effect, respectively.

Test of moderating effect of cognitive reappraisal

According to the suggestions of Wen and Ye (2014), the moderated chain mediation model was constructed using Mplus7.4 with childhood psychological abuse as the independent variable, relational aggression as the dependent variable, rejection sensitivity and relational victimization as the mediating variables, cognitive reappraisal as the moderating variable, and gender and age as the control variables. The results showed that the model fitted well: $\chi^2 = 60.272$, $df = 11$, CFI = 0.961, TLI = 0.909, RMSEA = 0.049, SRMR = 0.022, indicating that the model was acceptable. Controlling for gender and age, the interaction effect between cognitive reappraisal and childhood psychological abuse on rejection sensitivity was significant ($\beta = -0.06$, $p < 0.05$, 95% CI = [−0.068, −0.047]), highlighting that cognitive reappraisal may moderate the effect of childhood psychological abuse on rejection sensitivity (shown in Figure 3). Considering that the correlation between cognitive reappraisal and other variables may lead to deviation of the results of the study, the multicollinearity test was conducted. The results showed that the VIF values of childhood psychological abuse, rejection sensitivity, relational victimization, cognitive reappraisal and the interaction terms of childhood psychological abuse and cognitive reappraisal were 1.258, 1.202, 1.276, 1.037 and 1.012, respectively, all of which were less than the critical value 5 (Wen et al., 2018), and there was no multicollinearity problem.

To further reveal the moderating effect of cognitive reappraisal in the chain mediation path, this study divided cognitive reappraisal into high group ($M + 1SD$) and low group ($M - 1SD$), and calculated the effect value of childhood psychological abuse on rejection sensitivity under different levels of cognitive reappraisal, so as to draw a simple slope analysis figure (Figure 4). Simple slope tests showed that childhood psychological abuse was significantly linked with adolescents' rejection sensitivity in high and low-level cognitive reappraisal, but the relationship between childhood psychological abuse and rejection sensitivity in adolescents with low cognitive reappraisal level ($b_{simple} = 0.01$, $p < 0.001$, 95% CI = [0.006, 0.015]) was significantly stronger than that in adolescents with high cognitive reappraisal level ($b_{simple} = 0.006$, $p < 0.001$, 95% CI = [0.003, 0.01]). The results indicate that the relationship between childhood psychological abuse and rejection sensitivity was moderated by cognitive reappraisal.

Alternate model analyses

Based on the general aggression model and developmental systems theory, this study hypothesizes that childhood psychological abuse was significantly linked with relational aggression through the chain mediating effects of rejection sensitivity and relational victimization (CPA → RS → RV → RA). For greater confidence in the proposed direction of associations between the childhood psychological abuse and relational aggression, three alternative models were tested to control the

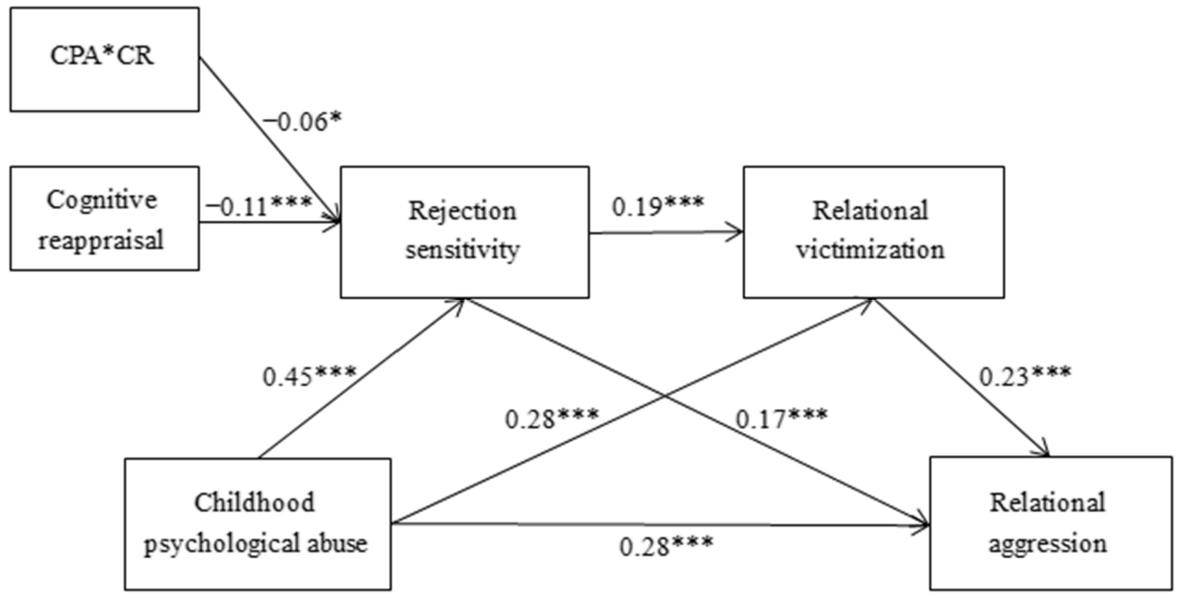

FIGURE 3
The moderated mediation model, gender and age are not represented in the model for concise purposes, *$p < 0.05$, ***$p < 0.001$.

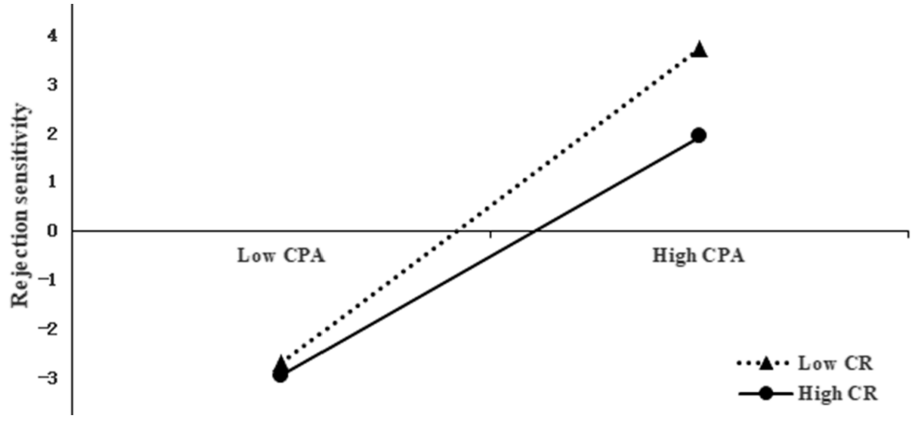

FIGURE 4
The moderating effect of cognitive reappraisal on childhood psychological abuse and rejection sensitivity.

TABLE 5 The model fit comparisons between hypothetical theoretical model and alternative model.

Model	χ^2	*df*	CFI	TLI	RMSEA	SRMR
CPA → RS → RV → RA(Hypothesizes Model)	7.664	2	0.994	0.972	0.039	0.016
CPA → RS → RA → RV(Alternate Model 1)	52.222	2	0.945	0.754	0.116	0.04
CPA → RA → RV → RS(Alternate Model 2)	56.02	2	0.941	0.735	0.12	0.039
CPA → RV → RS → RA(Alternate Model 3)	55.816	2	0.941	0.736	0.12	0.04

CPA, Childhood psychological abuse; RS, Rejection sensitivity; RV, Relational victimization; RA, Relational aggression; CR, Cognitive reappraisal.

timeframe that was being asked in each questionnaire. The results (shown in Table 5) indicate that hypothesizes model ($\chi^2_{(2)} = 7.664$, CFI = 0.994, TLI = 0.972, RMSEA = 0.039 [0.013, 0.07], SRMR = 0.016) display good model fit and provide stronger evidence for the chain mediating pathways proposed.

Some empirical studies have found that relational aggression is a predictor of and relational victimization (Schmidt and Jankowski, 2014), and there was an interactive relationship between relational victimization and rejection sensitivity (Nicole et al., 2018). Therefore, we propose three alternative models: childhood psychological abuse (CPA) → rejection sensitivity (RS) → relational aggression (RA) → relational victimization (RV); childhood psychological abuse (CPA) → relational aggression (RA) → relational victimization (RV) → rejection sensitivity (RS); and childhood psychological abuse (CPA) → relational victimization (RV) → rejection sensitivity (RS) → relational aggression (RA). The results (shown in Table 5) indicate that alternative model 1 ($\chi^2_{(2)} = 52.222$, CFI = 0.945, TLI = 0.754, RMSEA = 0.116 [0.09, 0.144], SRMR = 0.04), alternative model 2 ($\chi^2_{(2)} = 56.02$, CFI = 0.941, TLI = 0.735, RMSEA = 0.12 [0.094, 0.148], SRMR = 0.039), and alternative model 3 ($\chi^2_{(2)} = 55.816$, CFI = 0.941, TLI = 0.972, RMSEA = 0.12 [0.094, 0.148], SRMR = 0.04) display not well model fit. The above results is well-supported the hypothetical model, but potential reciprocal relationships among childhood psychological abuse, rejection sensitivity, relational victimization and relational aggression cannot be ruled out.

Discussion

The study found that childhood psychological abuse was significantly positive linked with relational aggression among adolescents, which means that adolescents who have suffered more childhood psychological abuse will have a higher level of relational aggression. The results accord with the general aggression model and spillover hypothesis, adolescents tend to apply the psychological abuse they learn from their parents in childhood to interpersonal situations, thus causing aggression. At the same time, in order to understand the internal mechanism of childhood psychological abuse and relational aggression among adolescents. This study proposed a moderated chain mediation model based on general aggression model, attachment theory, frustration-aggression theory, interpersonal risk model, developmental systems theory, and emotion regulation process model to investigate the internal mechanism.

The chain mediating effect of rejection sensitivity and relational victimization

The findings indicate that childhood psychological abuse was significantly positive linked with adolescents' relational aggression through the separate mediating effects of rejection sensitivity and relational victimization, as well as through the chain mediating effects of rejection sensitivity and relational

victimization. This illustrates that rejection sensitivity and relational victimization are the key factors for the development of negative coping styles of adolescents who have experienced childhood psychological abuse. Preceding empirical research has demonstrated that rejection sensitivity mediates the relationship between childhood abuse and aggression (Liu et al., 2018). Individuals residing in unhealthy familial contexts are more susceptible to peer victimization in peer communication (Shields and Cicchetti, 2001; Hong and Espelage, 2012), hence increasing the frequency of aggressive behavior (Sullivan et al., 2006; Light et al., 2013). This further indicates that there are important influencing variables between childhood psychological abuse and relational aggression. Specifically, the intrinsic traits (rejection sensitivity) and peer relationship factors (relational victimization) of individuals who endured childhood psychological abuse are the significant determining variables that contribute to relational aggression in adolescents.

According to attachment theory and frustration-aggression theory, childhood psychological abuse can impair adolescents' rejection sensitivity, which in turn influences their relational aggression behavior. On the one hand, adolescents who have withstood long-term psychological abuse (such as intimidation and rejection) find it difficult to establish a sense of security in the interpersonal environment and become especially sensitive to rejection cues in the interpersonal environment (Natarajan et al., 2011). On the other hand, individuals who are sensitive to rejection cues experience interpersonal frustration for an extended period of time, thereby triggering aggression (Bondü and Krahé, 2015). This is also consistent with preceding empirical research that adolescent rejection sensitivity is influenced by early traumatic experience, attachment pattern, and parenting style (Zheng et al., 2020), and that rejection sensitivity can lead to a variety of problematic behaviors (Romero-Canyas et al., 2010). Therefore, childhood psychological abuse can escalate relational aggression in adolescence by heightening their rejection sensitivity. According to attachment theory and the interpersonal risk model, however, adolescents who experienced childhood psychological abuse have difficulty in establishing a secure attachment mode and are more likely to express negative emotions and hostile reactions in interpersonal communication, thereby suffering from peer relationship victimization (Zhu et al., 2019). Individuals who experience relational victimization are inclined to respond with relationship aggression in order to defend themselves from the harm in the interpersonal environment. Additionally, prior empirical research has demonstrated that relational victimization can predict relational aggression (Ji et al., 2012). Hence, as a subtype of peer victimization, relational victimization is another crucial factor driving adolescent relational aggression following childhood psychological abuse.

The study also discovered that rejection sensitivity and relational victimization mediated the association between childhood psychological abuse and relational aggression, and it investigated the internal mechanism between childhood psychological abuse and relational aggression. Individual's internal personality inclination and companion factors are two significant elements that influence the development of adolescents. According to developmental systems theory, individuals who endure a poor family environment characterized by childhood psychological abuse are more sensitive to cues of rejection and hostility in the interpersonal context because they frequently receive negative responses from their parents (Brendgen et al., 2002). This overreaction to interpersonal cues renders individuals more susceptible to victimization by peers (Rudolph et al., 2008). Individuals who are victimized by their peers in turn become the subject of relational aggression (Sullivan et al., 2006).

The moderating effect of cognitive reappraisal

The moderating role of cognitive reappraisal in the chain-mediated pathway of rejection sensitivity and relational victimization was also investigated. The results indicate that cognitive reappraisal can impact the association between childhood psychological abuse and rejection sensitivity. Cognitive reappraisal mitigated the negative effects of childhood psychological abuse on rejection sensitivity and further attenuates the indirect effects of childhood psychological abuse and relational aggression. This result again supports the emotional regulation process model and gives strong evidence for demonstrating that cognitive reappraisal acts as a buffer in the influence of negative life events on individuals. When presented with a similar home setting of psychological abuse, individuals who are adept at employing cognitive reappraisal strategies are able to see the event positively and lessen the negative emotional experience and negative cognition brought on by the harsh environment (Gross and John, 2003). Secondly, individuals with high frequency of cognitive reappraisal can continuously strengthen their positive cognition and emotion to environmental cues, and reduce their sensitivity to interpersonal environment rejection cues, thereby lessening the negative impact of childhood psychological abuse on adolescents' rejection sensitivity.

Conclusion

Childhood psychological abuse was significant positively related to adolescents' relational aggression. The severity of their childhood psychological abuse was proportional to their level of relational aggression. Childhood psychological abuse was significantly linked with adolescents' relational aggression through the separate mediating effects of rejection sensitivity and relational victimization, as well as through the chain mediating effects of rejection sensitivity and relational victimization. Cognitive reappraisal moderated the chain mediating effect of childhood psychological abuse on adolescent relational aggression *via* rejection sensitivity and relational victimization.

Implications for theory and practice

This study investigated the internal mechanism of childhood psychological abuse on adolescent relational aggression by constructing a moderated chain mediation model, revealing the separate mediating roles of rejection sensitivity and relational victimization, as well as the chain mediating roles of both. In light of this, we investigate further the moderating effect of cognitive reappraisal on the link between childhood psychological abuse and rejection sensitivity, which provides useful insight for mitigating the harmful effects of childhood psychological abuse on adolescent development.

First and foremost, we should be mindful of our parenting style and strive to avoid shaping children's behavior patterns through intimidation, denigration, and neglect. Secondly, parents and educators should timely pay attention to the personality tendency of adolescents' rejection sensitivity and intervene with rational emotive therapy. The findings suggest that cognitive reappraisal can mitigate the negative effects of childhood psychological abuse on rejection sensitivity. Therefore, educators can train students to use positive emotion regulation strategies in the form of psychology classes, class meetings and group tutorials, enhance students' positive cognition, learn to identify and adjust their unreasonable cognition, so as to correct students' attribution bias, help students understand rejection and how to properly deal with the negative emotions caused by rejection. Finally, it is necessary to find out the relational victimization phenomenon in time and reduce the frequency of this phenomenon. It is difficult to identify relational victims because of the invisible nature of relational victimization. Parents can build connections and strengthen communication with adolescents so that the children can gain support and strength in the family to avoid the situation of isolation after the relational victimization. Psychology teachers can develop some experiential courses or group counseling programs related to interpersonal relationship and campus violence, identify victims from observation, and provide timely help and support to students who have been victimized by relationships, so as to reduce the possibility of their transformation into relational aggressors.

Limitations and future study

First of all, the variables in this study were measured by subjective assessment of adolescents, which may hold some deviation. Peer nomination, parent/teacher report, and teenage self-evaluation can be merged in the future to provide multifaceted evidence for the data. Second, teenage relational aggression is highly variable, making it challenging to determine the causal relationship between variables using a cross-sectional design alone. In the future, longitudinal studies should be considered to further investigate the dynamic development of relational aggression and its causal link with other variables. Thirdly, rejection sensitivity is not only influenced by external factors such as childhood psychological abuse, but also by individual internal factors such as self-esteem. Future studies should comprehensively consider the influence of internal and external factors on rejection sensitivity. Finally, this study only addressed the moderating effect of cognitive reappraisal; for a more comprehensive discussion, additional forms of emotion regulation strategies can be included in future research.

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 human participants were reviewed and approved by the Ethics in Human Research Committee of School of Education, Guangzhou University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

TL, YH, and YM were involved in the conceptualization of the research project and supervised the data collection. TL and YH were responsible for data analysis and report writing. MJ, SM, and YM provided feedback on the manuscript. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

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Personality assessment usage and mental health among Chinese adolescents: A sequential mediation model of the Barnum effect and ego identity

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Introduction: Adolescence is a crucial period for establishing ego identity and becoming a social individual. However, numerous adolescents suffer from mental health problems, especially after the conditions surrounding the COVID-19 outbreak. Personality assessments are often used when adolescents look for psychological self-help services. However, the meaning and mechanism of these personality assessments remain unknown. Taking the increasingly popular MBTI personality assessment as an entry point, the current study examined the potential sequential mediation relationship of Barnum effect – ego identity on the link between personality assessment usage and mental health.

Methods: The current study surveyed 308 Chinese high school students, including 109 males and 199 females. MBTI use, Barnum effect, ego-identity, and mental health (subjective well-being, depression, and anxiety) were measured by seven questionnaires, respectively. Sequential mediation models were constructed to analyze the relationship.

Results: The results indicate that the Barnum effect and ego identity together function as a sequential mediation path between personality assessment use and teenagers' mental health, including subjective well-being, depression, and anxiety. Specifically, a higher level of MBTI use triggers a stronger Barnum effect. The Barnum effect then promotes adolescents' ego identity, ultimately increasing subjective well-being levels and reducing anxiety and depression.

Discussion: Our findings suggest that by properly using personality assessment and stimulating the Barnum effect, we can enhance adolescents' mental health. The theoretical and practical implications of our findings are discussed.

KEYWORDS

personality assessment, Barnum effect, ego identity, anxiety, subjective well-being, depression, MBTI, adolescent mental health

1. Introduction

Adolescence is a crucial period for establishing ego identity and becoming a social being. However, under the conflicts of society, culture, and self, adolescents at this stage typically fall into "identity crises" (Erikson, 1994). Data show that the mental health situation of adolescents worldwide is not optimistic. Approximately 20% were diagnosed with mental health problems, while the detection rate of depression and anxiety was close to 30% (Centers for Disease Control and Prevention, 2019; Chen et al., 2020). The outbreak of COVID-19 has made the situation worse. During the pandemic, the severity and incidence of psychological problems among adolescents have

increased (Zhang et al., 2020; Ford et al., 2021; Jones et al., 2021; Panchal et al., 2021). It is urgent to design effective and feasible psychological interventions to enhance adolescent mental health.

When encountering psychological problems, adolescents prefer seeking self-help information support (Rickwood et al., 2007). Among them, personality assessments are favored, including some low-scientific ones (Archer et al., 1991; Das et al., 2022). However, whether and how personality assessments affect adolescent mental health remains unknown. Recently, one of the personality assessments, the Myers-Briggs Type Indicator (MBTI), has received a dramatic increase in attention on Chinese Social Networking Sites (SNSs), especially among adolescents (Baidu Index, 2022). On Weibo, the number of readings related to "MBTI" and "MBTI memes" exceeded 6 billion, with more than 2 million discussions. The MBTI is a personality assessment based initially on Jungian psychological types. However, its reliability and validity do not meet scientific standards (Pittenger, 2005). Therefore, the MBTI can serve as an entry point in our exploration.

The Barnum effect, the tendency of people to accept general personality descriptions as their own characteristics (Snyder et al., 1977), provides a possible explanation for how these low-validity personality assessments contribute to adolescent mental health. A few prior studies have suggested that the Barnum effect may play a role in the relationship between personality assessment and ego identity, which is strongly associated with mental health. However, such a relationship has yet to be empirically examined.

This study seeks to explore whether the Barnum effect triggered by the MBTI can help to enhance adolescents' ego identity and whether the relationship between MBTI use and mental health (subjective well-being, depression, and anxiety) among Chinese adolescents can be sequentially mediated by the Barnum effect and ego identity.

2. Literature review

2.1. Personality assessment and mental health

Personality describes a unique pattern of a person's thoughts and behaviors that distinguishes one person from another (Mischel et al., 2007; Eysenck, 2014). Personality assessments are methods to quantify personality (Hannay et al., 2010). As it matured in the 20th century, personality assessments gradually became essential instruments in the professional world for understanding human characteristics.

One of the ancient personality assessments is astrology. Certain astrological beliefs classify people into 12 astrological types based on an individual's date of birth, believing that each type has a different personality. To this today, Astrology is popular and influential worldwide (Eurobarometer, 2005; Besley and Hill, 2020). However, astrology is regarded as unscientific by the academic community (Lu et al., 2020).

Another prevalent personality assessment among the general public today is the Myers–Briggs Type Indicator (MBTI; Myers et al., 1985). The MBTI model divides personality differences into four dimensions: (1) the perceptual orientation of an individual, Extraversion–Introversion; (2) their preferred way of obtaining information, Sensing–Intuition; (3) their preferred method of making decisions, Thinking–Feeling; and (4) their way of dealing with the external world, Judgment–Perception (Pittenger, 2005). Through the combination of four dimensions, the MBTI classifies people into 16 personality types (e.g., INFJ, ESTP, etc.; Pittenger, 2005). Since its inception as a formal instrument in 1942 (as initially used for selection and training by the United States military), the MBTI has extended and maintained worldwide influence (Furnham, 1996). The reliability and validity of the MBTI have also been questioned. Theoretically, it classifies people into two opposite types in each dimension (McCrae and Costa, 1989), which obey the continuous quasi-normal distribution of personality (Hicks, 1984). Empirically, the retest reliability of the MBTI did not exceed 0.6 (Levy et al., 1972; Johnson, 1992; Tsuzuki and Matsui, 1997). Its construct and external validity were also lower than the standard (Pittenger, 2005).

With the fact that the MBTI and astrology are low-scientific but prevalent, more is needed to know about the ensuing social significance of these personality assessments provided to individuals. Rarely have studies investigated the relationship between personality assessments and mental health. Nevertheless, some evidence supports this potential link. Firstly, data showed that adolescents sought support from some personality assessments when encountering psychological problems (Archer et al., 1991; Rickwood et al., 2007; Das et al., 2022). This indicates positive implications of personality assessments. Secondly, researchers suggested that personality assessments in consultations are beneficial and therapeutic (Halperin and Snyder, 1979; Lee and Park, 2014). The results of psychological tests can predict a person's ego strength and indicate primary ways to handle their life (Mosak and Gushurst, 2018). Thirdly, when looking into popular culture, astrology information on SNSs was found to possibly help alleviate stress from uncertainty (Lopez et al., 2021).

In sum, personality assessment use may be positively associated with individuals' subjective well-being and negatively associated with depression and anxiety.

> *H1*: MBTI use is positively related to (a) subjective well-being and negatively related to (b) depression and (c) anxiety.

2.2. Ego identity as a mediator

The term "ego identity" ("self-identity" has been used in some studies for the same concept) originated from Erikson's (1994) formulation of identity development. It refers to the essential stage in which teenagers transform their childhood identifications into coherent and personally meaningful identities (Soenens and Vansteenkiste, 2011). Marcia et al. (2012) operationally define ego identity into two dimensions: exploration and commitment. The former refers to the period of exploring various possibilities of personal identity and ideological beliefs. The latter describes making a firm decision in such areas and investing in ideal activities. By combining these two dimensions, ego identity can be classified into four statuses: (1) achievement (strong commitment with full exploration), (2) foreclosure (strong commitment without exploration), (3) moratorium (active exploration without commitment), and (4) diffusion (the absence of both commitment and exploration; Marcia et al., 2012).

Although the determinants of adolescents' ego identity were well-studied, limited studies have investigated the influence of external personality-related information on ego identity. However, personality assessment usage is likely to shape adolescent ego identity. Firstly, information from the social world is one of the most important sources for people to obtain self-perception (Brown, 2014). In daily life, people cannot observe or reflect on themselves as outsiders in every moment.

They need to rely on external information to construct a basic self-cognition. According to Erikson (1994), ego identity is an increasingly coherent self-cognition under psychodynamics, personal life history, self-belief, and other factors. Therefore, self-relevant information from the outside world, such as personality assessment feedback, may influence ego identity through the cognitive process. Secondly, the topological model of the MBTI conforms to the workings of the human brain (Tversky and Kahneman, 1974). Everyone can be classified into one of 16 types, which enables individuals to make some easy-to-understand interpretation of their inner selves, even though the types are overly generalized.

Empirically, Lee and Park's (2014) experiment demonstrated that adolescents who participated in astrology counseling developed higher self-awareness than non-astrology counseling adolescents. Another experiment using astrology, German, and psychology courses as materials also found a causal relationship between astrology and self-concept (Lillqvist and Lindeman, 1998). According to Guo and Che's (2004) and Makros and McCabe's (2001) research, there is an overlap between self-identity and other concepts related to the self. Therefore, the findings discussed above can be extended to the study of ego identity. We hypothesize that the usage of personality assessments such as MBTI influences adolescents' ego identity.

> *H2*: MBTI use is positively related to ego identity.

Researchers have found a strong connection between ego identity and mental health. According to Erikson (1994) and Marcia et al. (2012)'s theory, the establishment of ego identity contributes to adolescents' physical and mental health, promotes their better adaptation to society, and has far-reaching implications for their self-actualization and future development. In an empirical study, Waterman (2007) explored the relationships among the four identity statuses and the three types of well-being states. He found that undergraduates with an achievement status (high commitment and high exploration) had higher levels of well-being. Other statuses, due to deficits in exploration or commitment, showed lower levels of well-being. Many studies have also demonstrated that self-identity helps to enhance individual well-being (Hofer et al., 2007; Cakir, 2014). In addition, a survey by Schwartz et al. (2011) explored the negative dimensions of well-being. They found that individuals with a diffuse identity showed the highest levels of depression and anxiety, while individuals with an achievement identity showed the lowest.

In summary, personality assessments can provide insight into ego identity in adolescents, and there are connections between ego identity and adolescent mental health.

> *H3*: Ego identity mediates the relationship between MBTI use and mental health [(a) subjective well-being, (b) depression, and (c) anxiety].

2.3. The Barnum effect and ego identity as sequential mediators

The "Barnum effect" refers to a psychological phenomenon in which people easily accept general and ambiguous personality interpretations and believe they accurately express their unique characteristics. This cognitive trend was initially detected in astrology (Forer, 1949) and later found in various low-scientific personality assessments, such as graphology and MBTI (Tyson, 1982a,b).

Personality assessment use has a strong association with the Barnum effect. Firstly, apart from individual traits such as neuroticism (Fichten and Sunerton, 1983) that would increase the Barnum effect, information characteristics also play a role. The focal information characteristics include the positivity of the content (Mosher, 1965; Halperin et al., 1976), the scientific nature of the source, and the professionalism of the procedure (Dickson and Kelly, 1985). Additionally, the Barnum effect works due to the subjective validation effect and the flattery effect. The former refers to the phenomenon in which a person feels a description is appropriate because it is personally meaningful or crucial to them (Forer, 1949). The latter describes the tendency that most people are willing to believe things that make them appear more positive (Wiseman, 2007). These information characteristics and underlying processes can be found in self-related personality assessments such as astrology and MBTI. Thus, despite these personality assessments' low validity, people continue to accept these "Barnum personality feedbacks" as an accurate description of their traits (Furnham and Schofield, 1987).

Some evidence indicates that the Barnum effect can contribute to individuals' ego identity. Self-verification theory suggests that people would like to obtain objective, accurate and diagnostic information to reduce uncertainty about themselves. Once such certainty perceptions are formed, people will strive to justify them (Swann and Read, 1981). The Barnum effect describes the recognition and belief of feedback about people's personalities. According to the self-verification theory, this recognition and belief can further enhance people's prediction and control over reality, which in turn, contributes to the formation of a stable self-concept (Swann and Read, 1981). In addition, the Barnum statements are mostly positive, stimulating individuals' recognition for creating a "positive illusion" about the self. This positive illusion acts as a cognitive filter that selects and organizes self-relevant information. Such a process helps to achieve self-service and self-enhancement (Taylor and Brown, 1999).

Several studies also provided empirical support for the potential mediating role of the Barnum effect in the association between personality assessment and ego identity. Halperin and Snyder (1979) demonstrated that the Barnum effect could be utilized to enhance clients' personal expectations in the potential of self-change. The expectations would then actually facilitate therapeutic improvement. Lillqvist and Lindeman's (1998) found students taking astrology courses had higher certainty about their self-concept than students taking German and psychology courses. The Barnum effect was considered a possible explanatory factor. They also raised the possibility that astrological information affects individuals' well-being through this path. Recently, Lopez et al. (2021) found significant associations among exposure to astrology information, the Barnum effect, and individual stress levels.

Collectively, these studies outline the potential role of the Barnum effect in helping to enhance an individual's ego identity. Together, we hypothesized that there would be a significant sequential mediation path from MBTI use, to the acceptability of the Barnum effect, to ego identity, and then to adolescents' subjective well-being, depression, and anxiety.

> *H4*: The Barnum effect and ego identity mediate the relationship between MBTI use and mental health ([a] subjective well-being, [b] depression, and [c] anxiety) sequentially.

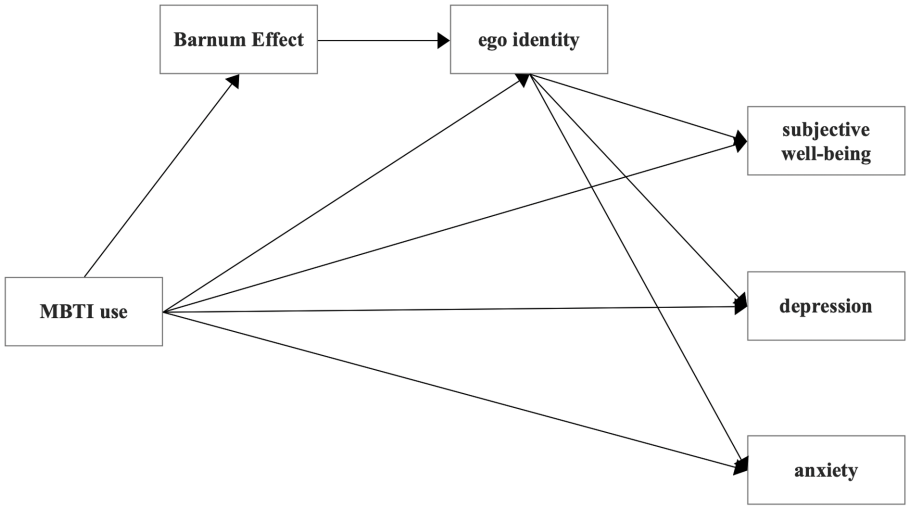

FIGURE 1
Diagrams of the proposed hypotheses.

The conceptual model of this study is illustrated in Figure 1.

3. Methods

3.1. Participants

Before the survey, we conducted Monte Carlo Power Analysis for Indirect Effects application (Schoemann et al., 2017) to estimate the sample size. The minimum sample size was 273 to reach power.90, assuming correlations of $r = 0.30$ (SD = 0.10) among the independent variable, the mediators, and the dependent variables. The current study collected a sample of 403 high school students, which is adequate to produce reliable results. Participant recruitment and survey conduction are both done *via* Wenjuanxing,[1] a widely known and applied Chinese online questionnaire platform. After completing the online questionnaire, which took about 5–10 min, each participant received 27 Chinese yuan as compensation.

Excluding 95 participants who failed our attention check question or selected "have not heard of MBTI before," a total of 308 participants qualified for the study. The final sample consisted of 109 males (35.4%) and 199 females (64.6%). Their ages were: 15 (4.9%), 16 (17.2%), 17 (37%), and 18 (40.9%); the average age was 17.19 (SD = 0.871). The subjective social class of the sample roughly approximated a normal distribution. The descriptive statistics of the demographic variables are displayed in Table 1.

3.2. Measures

3.2.1. Myers-Briggs Type Indicator use

We adapted the Social Contagion-Conscious Behavioral Response (CBR) scale to measure MBTI use. The CBR was originally developed by Lopez et al. (2021) to measure astrology information use during the COVID-19 outbreak. The scale draws on 10 items to measure the three phases of MBTI use. These are the intake, output, and internalization phases (newly added), which describe the reading of information, analyzing one's personality, and discussing the MBTI in SNSs, respectively. All items were measured on a five-point scale (1 = never, 5 = always). The average of the item scores demonstrated a respondent's MBTI use level.

The CBR scale measured reported behavior regarding reading and the basic application of MBTI information. A deeper understanding of MBTI information was not covered. Therefore, we proposed three extra items to better comprehend a respondent's MBTI use. An example is "the degree to which you are familiar with different MBTI dimensions and types." We used the same five-point scale.

A factor analysis showed that these 13 items could be classified as one factor, reaching a high Cronbach's alpha of 0.908.

3.2.2. Level of susceptibility to the Barnum effect

We measured Barnum effect susceptibility by adapting and translating the scale by Lopez et al. (2021). Based on this scale, the Barnum effect susceptibility level to the MBTI was examined in three dimensions: personal accuracy rating ("the personality traits about my MBTI are accurate"), interpretation favorability rating ("the MBTI affirms my inner self"), and interpretation exclusivity rating ("the MBTI interpretations suit my characteristics more than they do other people"). The items were rated on a range of 1 to 5 (1 = strongly disagree, 5 = strongly agree). By computing the mean score, we acquired the participants' susceptibility to the Barnum effect. The Cronbach's alpha value was 0.875 in the sample.

3.2.3. Ego identity

By referring to the mature and representative scale compiled by Balistreri et al. (1995), Zhou (2006) translated and revised an ego identity process scale for a Chinese context, which achieved good reliability and validity. We adopted it for the current research. The scale consists of 37 items, including 16 exploration and 21 commitment items. The scale is scored on a six-point Likert scale (1 = very non-conforming,

1 www.wjx.com

TABLE 1 Demographic characteristics.

Variable	Values	Frequency	Percentage
Gender	Boy	109	35.39%
	Girl	199	64.61%
Age	15	15	4.87%
	16	53	17.21%
	17	114	37.01%
	18	126	40.91%
Subjective social class	1	1	0.32%
	2	4	1.30%
	3	30	9.74%
	4	53	17.21%
	5	79	25.65%
	6	70	22.73%
	7	53	17.21%
	8	15	4.87%
	9	1	0.32%
	10	2	0.65%

6 = very conforming), with four items being reverse scored. According to a factor analysis, we dropped three items that could not be associated with a specific factor (e.g., "I am confused about whether certain behaviors in love should occur"). The total Cronbach's alpha value, including the exploration and commitment dimensions, was 0.997, exhibiting high reliability.

3.2.4. Subjective well-being

The measurement of subjective well-being consisted of two widely applied scales: the Satisfaction with Life Scale (SWLS) and the Positive and Negative Affect Scale (PANAS). Both have existed in Chinese translations for a long time. The SWLS was first compiled by Diener et al. (1985) and consists of five items scored on a five-point Likert scale.

We used the Chinese edition of PANAS revised by Qiu et al. (2008). The scale contains a total of 14 emotion words (seven positive and seven negative), which are interspersed in the questionnaire. The items are ranked on a five-point scale and calculated separately by the positive or negative group. The Cronbach's alpha values of the scale were 0.872 (complete SWLS), 0.879 (positive only), and 0.834 (negative only). We calculated subjective well-being by summing the standardized positive affect scores, negative affect scores, and life satisfaction scores (reverse coding was taken into account).

3.2.5. Depression and anxiety

To measure the mental health of adolescents from both positive and negative aspects, we also investigated adolescent depression and anxiety levels. Based on the Symptom Checklist 90 (SCL-90; Derogatis and Unger, 2010), Derogatis and Melisaratos (1983) developed the Short Symptom Inventory (BSI). The scale consists of 53 items to identify nine factors: somatization, obsessive–compulsive symptoms, depression, anxiety, interpersonal sensitivity, hostility, phobic anxiety, paranoid ideation, and psychoticism. According to the purpose of this study, the depression and anxiety subscales, each consisting of six items, were used. A 5-point Likert scale was used for the items. The Cronbach's alpha values of the two subscales were 0.829 (depression) and 0.840 (anxiety).

3.2.6. Demographic information

At the end of the questionnaire, we included demographic variables such as gender, age, and subjective social class.

3.3. Data analysis

The data analyzes in the study were run using SPSS 26.0 and R4.2.2. Primarily, we took Harman's single-factor test to exclude the problem of common method variance (CMV) for the variables that were measured by the self-report questionnaire. Twenty-six factors were extracted with characteristics greater than one. The largest accounted for 13.98% of the total variance (smaller than 40%). Therefore, there was no evidence of serious common method deviation in the current study. Then, we performed a correlation analysis between variables using SPSS 26.0. After that, R with Lavaan was applied to test the sequential mediation effect of the main analysis. In each mediation model, we selected a bias-corrected and accelerated bootstrap with 5,000 replicates and a 95% confidence interval.

4. Results

4.1. Descriptive statistics and correlation analysis

The means, standard deviations, and correlations among the variables are shown in Table 2. The results revealed that when controlling for demographic characteristics, MBTI use was positively correlated with Barnum effect susceptibility ($r = 0.05$, $p < 0.001$) and ego identity ($r = 0.27$, $p < 0.001$), and the latter two were also positively correlated with each other ($r = 0.40$, $p < 0.001$). MBTI use ($r = 0.18$, $p < 0.01$), Barnum effect susceptibility ($r = 0.26$, $p < 0.001$), and ego identity ($r = 0.43$, $p < 0.001$) all had significant positive relationships with subjective well-being. Ego identity was negatively correlated with depression ($r = -0.26$, $p < 0.001$) and anxiety ($r = -0.15$, $p < 0.01$). However, the relationship between MBTI use and depression ($r = -0.02$, $p > 0.05$) and anxiety ($r = 0.11$, $p > 0.05$) was not significant.

4.2. Simple mediation analysis of ego identity

We constructed a mediation model to examine H1 and H2. The results indicated that the total effect of MBTI use on subjective well-being was significant [$\beta = 0.45$, 95% CI = (0.15, 0.76)], whereas the total effects on depression [$\beta = 0.02$, 95% CI = (−0.11, 0.14)] and anxiety [$\beta = 0.11$, 95% CI = (−0.01, 0.23)] was not. H1a was supported, while H1b and H1c were rejected.

The heterogeneity was also found in the direct effects of the three paths. The direct path from MBTI use to anxiety was significant [$\beta = 0.17$, 95% CI = (0.05, 0.28)]. However, the other two paths were insignificant [subjective well-being: $\beta = 0.17$, 95% CI = (−0.10, 0.46); depression: $\beta = 0.10$, 95% CI = (−0.03, 0.22)].

Then we looked into the simple mediation model from MBTI use on mental health *via* the mediator variable, ego identity. When the dependent variable was subjective well-being, the indirect effect was significant [β = 0.28, 95%CI = (0.16, 0.44)]. When we took depression and anxiety as the dependent variable respectively, the indirect effects

TABLE 2 Descriptive and bivariate correlations.

Variables	$M \pm SD$	1	2	3	4	5	6
1. MBTI use	2.76 ± 0.81	–					
2. The Barnum effect	3.63 ± 0.51	0.53***	–				
3. Ego-identity	4.31 ± 0.46	0.27***	0.40***	–			
4. Subjective well-being	0 ± 2.25	0.18**	0.26***	0.43***	–		
5. Depression	2.26 ± 0.85	0.02	−0.13*	−0.26***	0.35***	–	
6. Anxiety	2.23 ± 0.84	0.11	−0.12*	−0.15*	−0.23***	0.71***	–

Control variables: gender; age; subjective social class *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TABLE 3 Significant results of simple mediation models.

	Effect	Boot SE	p	Boot LLCI	Boot ULCI
MBTI use→ego identity→subjective well-being	0.28	0.07	$p < 0.001$	0.16	0.44
MBTI use→ego identity→depression	−0.08	0.02	$p < 0.01$	−0.13	−0.04
MBTI use→ego identity→anxiety	−0.05	0.02	$p < 0.01$	−0.10	−0.02

Bootstrap sample size = 5,000; SE, standard error; LL, low limit; UL, upper limit; CI, confidence interval.

were also significant [depression: $\beta = -0.08$, 95% CI = (−0.13, −0.04); anxiety: $\beta = -0.05$, 95% CI = (−0.10, −0.02)]. That is to say, using MBTI tools would add to the level of ego identity (supported H2) and, in turn, increase subjective well-being and decrease depression and anxiety (see Table 3). The results of the indirect effects supported our H3 (a-c). All of the above analysis controlled for gender, age, and subjective social class.

4.3. Sequential mediation analysis of the Barnum effect and ego identity

We then verify the sequential mediation model in H4. Controlling for gender, age, and subjective social class, we took MBTI use as the independent variable; Barnum effect susceptibility and ego identity were the mediators, and mental health was the dependent variable in the model. As predicted, the indirect path from MBTI use to subjective well-being through the Barnum effect and ego identity was significant [$\beta = 0.20$, 95% CI = (0.12, 0.31)]. The indirect effects of the sequential mediation model on depression and anxiety were also significant [depression: $\beta = -0.06$, 95% CI = (−0.10, −0.03); anxiety: $\beta = -0.04$, 95%CI = (−0.07, −0.01)]. When we added the Barnum effect, the relationship between MBTI use and ego identity was no longer significant, meaning that the Barnum effect completely mediated the effect of MBTI use on ego identity. Thus, the path consisting of the Barnum effect and ego identity together represents the potential mechanism between MBTI use and mental health. In conclusion, the data support H4 (a-c), suggesting that an elevated Barnum effect triggered by more MBTI use causes teenagers to have a higher ego identity and, as a result, contributes to an increase of subjective well-being and decrease of depression and anxiety (Table 4). The final model is displayed in Figure 2.

5. Discussion

While the mechanisms of personality assessment and the Barnum effect have been well studied, little is known about the subsequent psychological effects of this path. The present study was conducted to determine the influence of the Barnum effect triggered by MBTI on adolescent ego identity and mental health (subjective well-being, depression, and anxiety). The results support that, for Chinese adolescents, MBTI use has a positive impact on adolescent mental health. However, the results showed heterogeneity due to the dependent variables. Furthermore, the Barnum effect and ego identity together act as an essential mediating path between MBTI use and mental health. Specifically, the personality feedback provided by the MBTI is somewhat vague and general, which motivates the Barnum effect among users. The Barnum effect then sequentially enhances the adolescent ego identity, elevates their sense of subjective well-being, and reduces the levels of depression and anxiety.

5.1. Heterogeneity in subjective well-being, depression and anxiety

Although we hypothesized a consistent effect of MBTI use on three aspects of mental health, our findings showed heterogeneity. Specifically, MBTI use affected subjective well-being (H1a was supported) but did not affect depression and anxiety (H1b and H1c were not supported). A longitudinal study by Janicke-Bowles et al. (2022) reports that posting and engaging with hedonic or inspiring Facebook content increased love and comparison to others (eudaimonic well-being) but had no influence on depression and anxiety. Considering that MBTI use is also related to entertainment and widespread "Internet meme" on SNSs, it is possible that well-being is more likely to be affected by MBTI use.

When looking into the direct effects in the sequential mediation model, MBTI use exerts a positive influence on anxiety, although its total effect is nonsignificant. This means when considering and controlling the Barnum effect and ego identity, MBTI use increases anxiety. The positive relationship was also reported by Clements (2020). He pointed out that habitual engagement in astrology requires individuals to make choices from the various identities and possibilities offered, leaving them cognitively disorientated and therefore threatening to anxiety. Such influence is suppressed, considering that the psychological process through the Barnum effect and ego identity can relieve anxiety.

In sum, MBTI use can positively influence well-being in the general context. Its role in negative aspects of mental health, such as depression

TABLE 4 Significant results of sequential mediation models.

	Effect	Boot SE	*p*	Boot LLCI	Boot ULCI
MBTI use→ego identity→subjective well-being	0.08	0.07	ns	−0.04	0.22
MBTI use→Barnum effect→ego identity→subjective well-being	0.20	0.05	$p < 0.001$	0.12	0.31
MBTI use→ego identity→depression	−0.02	0.02	ns	−0.07	0.01
MBTI use→Barnum effect→ego identity→depression	−0.06	0.02	$p < 0.01$	−0.10	−0.03
MBTI use→ego identity→anxiety	−0.02	0.01	ns	−0.05	0.01
MBTI use→Barnum effect→ego identity→anxiety	−0.04	0.02	$p < 0.05$	−0.07	−0.01

Bootstrap sample size = 5,000; SE, standard error; LL, low limit; UL, upper limit; CI, confidence interval.

of self-concept (Lillqvist and Lindeman, 1998; Lopez et al., 2021). As mentioned above, ego identity can be understood as a maturity of self-concept (Guo and Che, 2004). This result extended the sources of self-perception theoretically. Among the information from the external world, apart from social comparison and reflexive evaluation (Brown, 2014), the usage of personality assessment can also influence ego identity through cognitive processes. There are several detailed possible explanations for this result. First of all, although the MBTI test is judged invalid and unreliable, some dimensions of MBTI are related to the Big Five dimensions, which indicates that the MBTI can interpret individuals' personalities to some degree (Furnham, 1996). This result could also be due to the wealth of feedback from the MBTI results. Like astrology, the personality information of MBTI types ranges from strengths and weaknesses, romantic relationships, and friendships to career paths. Similarly, ego identity is defined and measured from these aspects, including exploration and commitment to hobbies, romantic relationships, careers, etc. These factors may explain the correlation between MBTI use and ego identity. As mentioned in the literature review, ego identity is crucial for mental health, and the data we collected reflected those ideas (Hofer et al., 2007; Waterman, 2007; Cakir, 2014). Specifically, the current study found that high ego identity inspired by MBTI also benefits adolescent mental health, such as increasing subjective well-being and decreasing

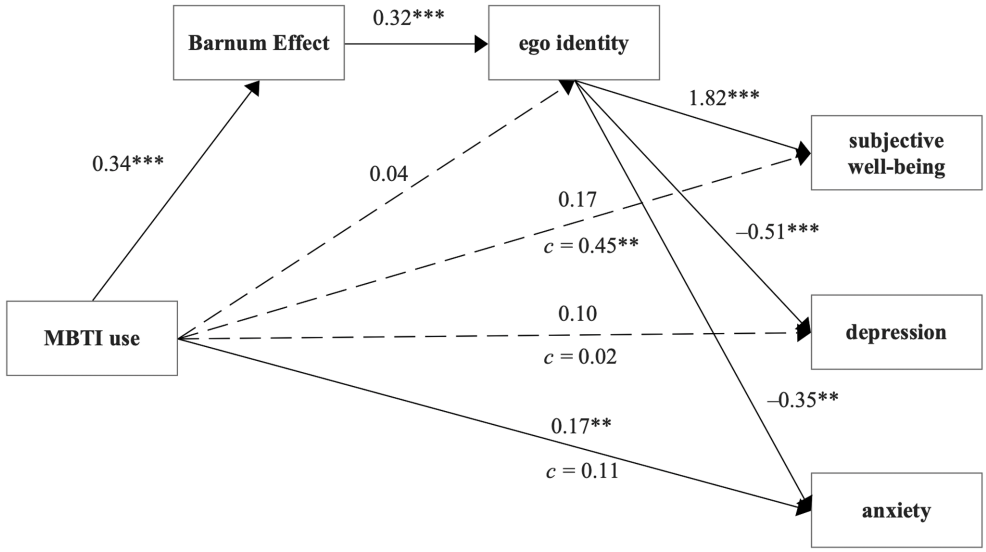

FIGURE 2
Sequential mediation models of Barnum effect and ego identity on the relationship between MBTI use and mental health (subjective well-being, depression, anxiety). *N*=308, *p<0.05, **p<0.01, ***p<0.001 (two-tailed test).

and anxiety, is more complicated. It affects depression and anxiety through the Barnum effect and ego identity (see the discussion below).

5.2. The mediating role of ego identity

The simple mediation analysis supported our H2 and H3. Unscientific personality assessments are beneficial to adolescents in the identity-cognition stage, increasing their ego identity. These results are in line with previous empirical studies in astrology, which showed that the contract of astrology information is related to the promotion depression and anxiety. To conclude, taking the MBTI assessment as an example, this study demonstrates that low-valid personality assessment can help enhance ego identity and, consequently, maintain adolescent mental health.

5.3. The sequential mediating role of the Barnum effect and ego identity

The few studies on the relationship between personality assessment and ego identity lack an in-depth analysis of the

underlying mechanism. Through a review of the literature, we assumed a possible mediating role of the Barnum effect. The present results suggest that the more frequently adolescents use the MBTI, the more they perceive these explanations to be accurate and distinct. It supports previous studies on the correlation between the Barnum effect and low-effective personality assessments, such as the MBTI, the Rorschach test, and astrology (Dickson and Kelly, 1985; Furnham and Schofield, 1987). In addition, the current work strives to test the possibility proposed in previous studies. Both Lillqvist and Lindeman (1998) and Lopez et al. (2021) have mentioned the potential of the Barnum effect in explaining the association between the use of personality assessment and self-concept. The data presented here demonstrate its existence. This may be related to the following reasons. Firstly, according to the self-validation theory (Swann and Read, 1981) and positive illusion theory (Taylor and Brown, 1999), people tend to organize self-related information in order to strengthen their self-concept automatically. Secondly, the manipulation definition of ego identity consists of exploration and commitment processes. That is, the more susceptible adolescents are to the Barnum effect, the more receptive they are to a wealth of personality explanations, and the higher their level of self-exploration. Similarly, susceptibility to the Barnum effect also affects their recognition of Barnum feedback, further altering their level of self-commitment. Taken together, this means that the Barnum effect may influence adolescent ego identity.

Turning to the sequential mediation model, the data in this study support our H4. That is, frequent MBTI use by adolescents will stimulate the Barnum effect, which then enhances their ego identity and, ultimately, increases their subjective well-being levels and also reduces their anxiety and depression levels. These findings suggest that low-validity personality assessments may help maintain adolescent mental health. Apart from obtaining social connectivity and entertainment from personality assessments (Allum, 2011; Lu et al., 2020), individuals can also acquire positive psychological benefits through the "Barnum effect ⟶ ego identity" mechanism. Hopefully, it may be easily triggered by reading and assessing ample personality feedback involving identity traits, life attitudes, or relationship advice.

5.4. Implications

5.4.1. Theoretical implications

The present research discusses the positive psychological implications of personality assessments, as exemplified by the MBTI, and examines the underlying mechanisms. First, we conducted empirical research based on previous findings regarding personality assessment use and the self. The Barnum effect was introduced as a mediating variable to explain the pathway between personality assessment use and adolescent ego identity. Second, because ego identity is crucial to adolescent mental health, we further explored whether personality assessment would increase adolescents' subjective well-being and decrease their depression and anxiety after enhancing their ego identity. The results support our hypotheses.

This research provided an alternative perspective from which to study the Barnum effect. We examed whether the MBTI can trigger the Barnum effect in individuals as with other assessment tools and then investigated its subsequent psychological effects on individuals. The empirical findings in the current study preliminarily demonstrate the psychological significance of the Barnum effect and enrich the theory. It also lays the groundwork for future research on the psychological consequences and social implications of the Barnum effect.

The current study also contributes to the existing research literature on adolescent mental health. By taking a low-validity personality assessment as a predictor of adolescent well-being, we found a new potential path for maintaining adolescent mental health. The sequential mediation model demonstrated a link between MBTI use, the Barnum effect, ego identity, and mental health. These findings open up more possibilities for future research on adolescent mental health.

Moreover, most existing studies were conducted in Western countries, which lack external validity in other contexts. These findings validate the consequential impact of personality assessment and the Barnum effect in a Chinese context, making them a useful contribution to the literature.

5.4.2. Empirical implications

The findings of this study also have significant implications for future practice.

Given that low-validity personality assessments are widely recognized and believed to be effective among laypeople, the current study attempts to investigate their social impact. These positive results remind us to hold a deeper insight into the application of MBTI and other personality assessments. In addition to test the reliability and validity, we should also value the contribution of personality assessments in constructing ego identity, alleviating anxiety and depression, and enhancing well-being.

In addition, this study provides a theoretical pathway for a new approach to adolescent mental health interventions. As noted above, the adolescent population rarely seeks professional help when confronted with psychological problems, but will actively explore some self-help services. The present findings suggest an original but simple idea. By manipulating the personality information they receive, we can effectively stimulate the Barnum effect, expand the dimensions of their self-perceptions, and further increase the adolescents' ego identity and subjective well-being. This is a cost-effective intervention compared to the relatively higher investment involved with professional counseling on one end and the low effectiveness of arbitrary information searches on the other.

5.5. Limitations and future works

Notwithstanding the contributions of the current study, there are some limitations. First, the cross-sectional data used here impact the causality among the covered variables. Future longitudinal designs are encouraged to retest the mediation model in the current study.

This study lacked the heterogeneity analysis of the pathway mechanism. For example, the present research measured the variable described as "MBTI use" at a rather high level. We integrated various MBTI usage behaviors into a general variable and found a primary relationship between it and other variables. Referring to extant research on the use of SNSs, more detailed measurements have been applied, such as positive and negative use. The results have indicated that diverse use behaviors have significantly different effects on users' psychology (Meier and Reinecke, 2021). In the present study, we also found that MBTI has different effects on depression, anxiety, and well-being. Although we proposed possible explanations, further investigation is necessary. In addition, individual factors such as gender and personality were found to be associated with the Barnum effect (Fichten and

Sunerton, 1983; Piper-Terry and Downey, 1998). Future work can explore the heterogeneity of the pathway by looking into individual differences.

Furthermore, the generalizability of these results is subject to certain limitations. Future research could move beyond the context of the MBTI and use other personality assessments or more general descriptive personality texts to explore the feasibility of a "textual features ⟶ Barnum effect ⟶ ego identity ⟶ well-being" pathway. As mentioned above, an exploration in this field would greatly help to test the causality of the current results and simplify the text and processing of mental health intervention for high school students, which may have higher practical value in the future.

Data availability statement

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

Ethics statement

This study involving human participants were reviewed and approved by Nanjing University. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

JH and Y-XZ contributed to the conception and design of the study. JH performed the statistical analysis and wrote the first draft of the manuscript. Y-XZ developed the general framework of the manuscript and reviewed the manuscript. All authors contributed to the manuscript revision, read, and approved the submitted version.

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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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The longitudinal association between potential stressful life events and the risk of psychosocial problems in 3-year-old children

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Background: Experiencing certain potentially stressful life events can impact psychosocial well-being among school-aged children and adolescents. This study aims to evaluate the association between life events occurring before age 2 and risk of psychosocial problems at 3 years of age.

Methods: All parents invited for the regular well-child visit when their child was 2 years of age by the preventive Youth Health Care in the Rotterdam-Rijnmond area, the Netherlands, were invited to participate in this study. In total 2,305 parents completed the baseline questionnaire at child age 2-years; 1,540 parents completed the questionnaire at child age 3-years. The baseline questionnaire included a life events assessment (12 items), and tension caused by the event (range 0–3). At child age 3-years the questionnaire included the Strengths and Difficulties Questionnaire (SDQ) to assess risk of psychosocial problems. Logistic regression models were applied.

Results: In the current study 48.5% of families experienced ≥1 life event before child age 2 years. Divorce and problems in the relationship between the parents received the highest perceived severity score [respectively 2.1 ($SD = 0.8$) and 2.0 ($SD = 0.7$)]. Children experiencing ≥1 event before the age of 2 years were at higher risk of psychosocial problems at 3 years of age, compared to children that had experienced no life event (1–2 events OR = 1.50, 95%CI: 1.09; 2.06, and >2 events $OR = 2.55$, 95%CI 1.64; 4.00, respectively). When life events caused high perceived levels of tension, there was also an association with an increased risk of psychosocial problems at age 3-years ($OR = 2.03$, 95%CI 1.43; 2.88).

Conclusions: Approximately half of children in our study experienced a potential stressful life event before the age of 2 years. Results suggest an association between experiencing a life event and risk of psychosocial problems at child age 3-years. These findings emphasize the need for child health care professionals to pay attention to life events taking place in the life of young children in order to provide appropriate support.

KEYWORDS

stressful life events, psychosocial problems, SDQ, preschool child, emotional and social development

Introduction

Psychosocial problems, problems in psychosocial functioning, can be divided into three groups: internalizing/emotional problems (e.g., depressive feelings; anxiety), externalizing/behavioral problems (e.g., hyperactivity; aggressive behavior), and social problems (e.g., difficulties in making or keeping contact with peers) (1). The prevalence of psychosocial problems differs per country and per age group also depending on assessment methodology (2–5).

Psychosocial problems are associated with severe adverse outcomes, such as impaired social skills, lower academic results, substance abuse, delinquency and elevated suicide risk (5) and can be persistent over time (6). Already in 1998, Lavigne et al. (7) showed that children with a risk score on the Child Behavior CheckList (CBCL) at 2–3 years of age, had a higher risk for being diagnosed with a psychiatric disorder up to 8 years later. Moreover, the authors concluded that the family context is associated with the onset and maintenance of psychosocial problems in young children (7).

Stressful life events are events that a person appraises as threatening, which in turn triggers a behavioral and physiological response that might cause implications related to disease (8). The experience of stressful life events in childhood have been linked to increased risk of chronic illness later in life as well as increased mortality risk (9–11). Examples of life events are divorce, moving, death of a loved one, unemployment of parents, and family conflicts (10). Stressful life events might have a direct impact on child health through a behavioral or physiological response, while they might also have an indirect impact on the child *via* the family context. How well a family is able to deal with a stressful life event is depending on multiple factors such as coping skills, resources for support, other stressors in the family (11)). Besides that, each stressful life event can be experienced differently be each individual and family, e.g., relocation might cause stress and tension in one family but not in another. This subjective experienced tension of a stressful event might also be indicative of its impact on the family. Previous research, mainly among school-aged children and adolescents, has demonstrated an association between stressful life events and child anxiety (12), depression (13–16), alcohol abuse (17), and internalizing symptoms (18–20). The impact of life events in preschool children (i.e., between age 1–3 years) is not known, while it may provide insight for timely and adequate support to potentially minimize or reduce the consequences on child well-being in both short and long term.

This study aimed to evaluate the association between life events occurring before child age 2 years and risk of psychosocial problems at 3-years of age. We hypothesized that both the number of life events, as well as parent-rated high tension caused by the life event, were associated with the risk of psychosocial problems at child age 3-years. We explored whether the association between experiencing a life event and the risk of psychosocial problems was different by family social economic characteristics (10, 21, 22).

Materials and methods

Ethics statement

Parents received written information about the study and were free to refuse to participation or stop participation at any time. The Medical Ethical Committee of the Erasmus Medical Center Rotterdam declared that the Medical Research Involving Human Subject Act (Dutch abbreviation WMO) did not apply to the present study and, subsequently, permission was given to carry out the study and to publish the results in scientific journals (number MEC-2014-152). This study was conducted by following the guidelines proposed in the World Medical Association Declaration of Helsinki.

Design and data collection

A longitudinal study design was applied, a baseline measure was performed at child age 2-years and a follow-up measure at child age 3-years. Data was collected by parent-reported questionnaires.

In the Netherlands, there is well-organized community-based preventive pediatric and family care, collectively known as the preventive Youth Health Care (YHC). Until the age of 18 years, each child in the Netherlands is invited by the YHC to come in for a periodic well-child visit, free of charge (23). Although participation is voluntary, the compliance rate in the first 18 months after childbirth goes up to 95% in some regions (23).

For the current study, all parents who were invited by the YHC professionals (i.e., youth health care physician or nurse) in the city of Rotterdam, the Netherlands, for a well-child visit when their child was 2 years of age (November 2014 and July 2015), were invited to participate in this study. The invitation for the study accompanied the invitation for the 2-year well-child visit at the YHC-center. An information leaflet, consent form and baseline questionnaire, was sent to the parents. The baseline questionnaire contained questions about socio-demographic characteristics, life events and psychosocial health of the child. If parents wanted to participate, they would leave the baseline questionnaire with the signed consent form at the YHC-center during the well-child visit and the YHC returned the forms to the researchers. In total, the researchers received 2,316 written informed consent forms from parents. The baseline questionnaire was completed by 2,305 parents. See Supplementary Figure 1 for the study flow chart.

Participating parents were sent a follow-up questionnaire by post or e-mail, containing questions about general and psychosocial health of the child when their child was 3 years old. At the 3-year time point, the questionnaire was returned by 1,540 (66.5%) parents. For the current study participants with data from twins ($n = 17$), other caregivers than parents ($n = 32$) and missing data on the SDQ at age 3-years were excluded, leaving a study population of 1,470 participants for analyses.

Measurements

Life events

At child age 2-years, parents were asked if 12 life events had occurred in the past 2 years. These life events were based upon the Adverse Life Events Scale for children and adapted for parental-report (24): relocation of the family; relocation of someone close to the child; tensions at work of one of the parents that are felt at home; unemployment of one of the parents; financial problems; quarrels with neighbors/friends/acquaintances/family; problems within relationship of parents; divorce; victim of burglary or fire; physical health problems of someone close to the family; mental health problems of someone close to the family; death of someone close to the family. The correlation between the life events was considered low (Spearman's rho 0.39). If a particular life event had occurred, a score of 1 was assigned to the item. If a life event did not occur, a score of 0 was assigned. A total score was calculated by summing up the scores of the 12 life events, with a range from 0 to 12. Subsequently, following the total score distribution, three groups were created based on the total score of the life events: no life events, 1–2 life events or >2 life events.

Tension experienced from life events

If respondents indicated a life event had occurred, they were asked to specify to what extent this caused stress or tension, using a 3-point scale (1 = a little, 2 = somewhat, 3 = a lot). Supplementary Table 1 presents the frequency and average tension scores per individual life event.

We hypothesized that experiencing one or more high tension events may have an association with psychosocial health of the child. To be able to indicate the impact of experienced tension of a life event on psychosocial health a new variable was calculated. This variable 'overall tension experienced from life events' groups data based on tension level reported. A group "no events" (participants who reported not to have experienced any life event, considered the reference group), a group "low" tension (participants of whom all experienced life events had a tension score of 1) and a group 'high' tension (participants whom reported at least one experienced life event with a tension score of 2 or 3). See Supplementary Table 2 for a cross tabulation.

Risk of psychosocial problems at age 3-years

Risk of psychosocial problems at child age 3 years was assessed by the Strengths and Difficulties Questionnaire (SDQ) (25). The SDQ consists of 25 items with three response options (0 = not true/1 = somewhat true/2 = certainly true) and can be divided into 5 subscales: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship, and prosocial behavior. For the purpose of this study only the scales related to psychosocial problems were used. A summation score of the first four subscales was calculated to generate the Total Difficulties Score (range 0–40). If a child has a Total Difficulties Score of ≥9, the child is considered at-risk of psychosocial problems (26, 27). If a child has a summation score of ≥3 on the emotional symptoms subscale or ≥4 on the conduct problems subscale, the child is seen as at-risk of emotional and/or conduct problems (26, 27). Cut-off scores for at risk of psychosocial problems are equal for boys and girls. Cronbach's Alfa for the scales were: Total Difficulties Scale 0.75, Emotional Problems subscale 0.58, Conduct Problems subscale 0.58.

Other measurements

Various child, parental and family characteristics were assessed. For the child socio-demographic characteristics gender, age (in months), and ethnic background were assessed. Ethnic background was classified as Dutch (both parents are born in the Netherlands) or non-Dutch (at least one parent is born outside the Netherlands) following the definition of Statistical Netherlands (28). Risk of psychosocial problems at child age 2 years was assessed by the Brief Infant-Toddler Social and Emotional Assessment (BITSEA). The BITSEA is a parent-report questionnaire, consisting of 42 items, with three response options (0 = not true/rarely; 1 = somewhat true/sometimes; 2 = very true/often). The BITSEA is comprised of two scales, a Problem scale (31 items, focusing on social-emotional/behavioral problems such as aggression, and anxiety) and a Competence scale (11 items, focusing on social-emotional abilities such as empathy, and prosocial behavior). Responses can be summed for each scale. Cut-off scores for at risk of psychosocial problems are equal for boys and girls ≥14 for the Problem scale and ≤15 on the Competence scale (29, 30). A child was considered at risk of psychosocial problems at age 2-years if the child scored at-risk on either the BITSEA Problem scale, the Competence scale, or both.

For both mother and father, age (in years), ethnic background, and educational level were assessed. Educational level was categorized as low (primary education, lower secondary education), middle (higher secondary education, vocational education) or high (higher vocational education, university) (28). Ethnic background of the parent was classified as Dutch (the parents' parents, i.e., grandparents of the child, were born in the Netherlands) or non-Dutch (at least one of the parents' parents was born outside the Netherlands) following the definition of Statistical Netherlands (28).

At family level family structure was assessed; whether the child lived with both parents or with a single parent.

Statistical analyzes

The characteristics of the sample are presented using descriptive statistics. Chi-square tests were used to indicate statistically significant differences between the children with and without risk of psychosocial problems at age 3 years ($p < 0.05$).

Two multivariable logistic regression models were applied to evaluate the association between a) life events before age 2 years (no life event, 1–2 life events, >2 life events) and b) tension experienced by the life events (no events, low, high) and at risk of psychosocial problems at age 3 years. Risk of psychosocial problems at age 3-years (yes/no) was assessed with the SDQ total score, the subscale emotional problems, and the subscale conduct problems. All models were corrected for risk of psychosocial problems at child age 2 years (yes/no). The following covariates were evaluated:

child gender, ethnic background, maternal education level and family structure. Maternal education level was associated with the outcome, while family structure was associated with number and overall tension of life events; both were added as covariates in the final models ($p < 0.05$). Odds ratios (OR) and 95% confidence intervals (95% CI) are reported and were considered statistically significant if the p-value reached a level of <0.05. Cross sectional analyses of life events at age 2-years and risk of psychosocial problems at 2-years are presented in the Supplementary Table 3. The results using the number of life events continuously (i.e., total score by summing up whether each life event happened yes/no, range 1–12) are presented in Supplementary Tables 4, 5. The results of the regression analyses between individual life events and child psychosocial health at age 3 were added as Supplementary Table 6.

Interaction between life events (i.e., number of life events and overall tension experienced) and relevant covariates (i.e., child gender, ethnic background, family structure, maternal/paternal education level) was tested in the association with risk of psychosocial problems at age 3-years (i.e., SDQ total score). Interaction terms were added to the logistic regression models. After correction for multiple testing (0.10/14) interaction terms were considered statistically significant at p<0.007. No significant interaction terms were observed (see Supplementary Table 7). In addition a non-significant interaction term was observed between number of life events and tension experienced (Supplementary Table 8).

Non-response analyses using Chi-square tests and t-tests were performed to compare socio-demographic characteristics of parents and children participating in the follow-up assessment (n = 1,540) and participants who were lost-to-follow-up between the baseline and follow-up assessment (n = 765). Results are presented in Supplementary Table 9.

Analyses were conducted using SPSS version 25 (31).

Results

Non-response analysis

Respondents who were lost to follow-up (n = 765), were more often of non-Dutch ethnic background (child 41.4 vs. 19.8%; mother 49.4 vs. 24.5%; father 45.1 vs. 22.0%; all $p < 0.001$), the children were more often at-risk of psychosocial problems at 2-years of age (28.5 vs. 17.2%, $p < 0.001$), mother and father more often had a low educational level (13.8 vs. 6.4% and 19.1 vs. 11.3%, respectively for mother and father, both $p < 0.001$), and were more often single parent families (14.7 vs. 6.4%, $p < 0.001$) compared to the participants in the current study (see Supplementary Table 9).

Sample characteristics

The sample consisted of 1,470 children of which 48.9% was a boy. The children were on average 24.5 (SD = 1.8) months old, and 80.2% of the children were of Dutch ethnic background. Of the mothers, 6.2% had a low educational level and 75.7% was of Dutch ethnic background. Of the fathers, 11.4% had a low educational level and 78.2% was of Dutch ethnic background. Of 6.0% of the children the family structure was single parent (Table 1).

Life events

Table 1 shows that 37.9% of the families experienced 1–2 life events, and 10.6% experienced >2 life events at child aged 2-years. Of all families experiencing a life event (n = 689), 50.7% (n = 349) experienced low and 49.3% (n = 340) experienced high tension levels. A total of n = 1,305 life events was reported.

The life events most often experienced were the relocation of the family (16.8%), tensions at work of parent, felt at home (16.5%) and physical health problems of someone close to the family (14.8%). Children more often scored at risk of psychosocial problems ($p < 0.05$) compared to not at risk when the following life events were reported: tensions at work of one of the parents, financial problems, physical or mental health problems of someone close to the family, problems within relationship between parents, divorce (see Table 2).

Life events, overall experienced tension, and risk of psychosocial problems

Compared to children having not experienced any life event before the age of 2-years, having experienced 1–2 life events was associated with a significant higher Odds Ratio (OR) for an at risk score for psychosocial problems (OR = 1.50, 95%Confidence Interval (CI) = 1.09; 2.06), and emotional problems (OR = 2.08, 95%CI = 1.27; 3.42) at child age 3 years. Also, having experienced >2 life events was associated with a significant higher OR for an at risk score for psychosocial problems (OR = 2.55, 95%CI = 1.64; 4.00), emotional problems (OR = 3.16, 95%CI = 1.65; 6.02), and conduct problems (OR = 2.21, 95%CI = 1.20; 4.09).

An overall high level of tension experienced from life events was associated with a significant higher OR for an at risk score for psychosocial problems (OR = 2.03, 95%CI = 1.43; 2.88), emotional problems (OR = 3.57, 95%CI=2.16; 5.92) and conduct problems (OR = 1.81, 95%CI = 1.09; 2.99; Table 3).

Discussion

This study presents the longitudinal associations between potential stressful life events and risk of psychosocial problems in 3-year-old children. In addition, the tension or stress perceived by the life event was related to risk of psychosocial problems of the child. Approximately half of the families reported one or more life events before the child was 2-years old and at least one life event that caused high levels of stress. Notably, having experienced one or more life events before child age 2 was associated with higher odds for the child to be at risk of psychosocial problems at 3 years of age. Moreover, having experienced one or more life events that were reported to result in high tension levels, higher odds for the child to be at risk for psychosocial problems were observed.

Our study adds to the literature by confirming the impact of life events happening in a family when the child is still very young.

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TABLE 1 Characteristics of the study population.

	Total sample (n = 1,470)	SDQ total difficulties score		
		Not at risk (n = 1,214)	At risk (n = 256)	P-value
Child characteristics				
Age child in months, mean ± SD	24.5 ± 1.8	24.5 ± 1.9	24.4 ± 1.6	0.347
Gender, boy [n(%)]	714 (48.9)	579 (48.0)	135 (52.9)	0.156
Ethnic background, Dutch [n(%)]	1133 (80.2)	946 (80.7)	187 (77.9)	0.321
Psychosocial problems age 2-years, at risk [n(%)][1]	246 (16.9)	155 (12.9)	91 (36.3)	**<0.001**
Parent characteristics				
Maternal ethnic background, Dutch [n(%)]	1,068 (75.7)	894 (76.3)	174 (72.5)	0.206
Maternal educational level [n(%)]				**0.001**
High	862 (59.8)	741 (62.1)	121 (48.8)	
Middle	489 (33.9)	382 (32.0)	107 (43.1)	
Low	90 (6.2)	70 (5.9)	20 (8.1)	
Paternal ethnic background, Dutch [n(%)]	1,103 (78.2)	914 (78.4)	189 (77.1)	0.668
Paternal educational level [n(%)]				
High	732 (52.2)	641 (55.1)	91 (37.9)	**<0.001**
Middle	511 (36.4)	396 (34.0)	115 (47.9)	
Low	160 (11.4)	126 (10.8)	34 (14.2)	
Family characteristics				
Family structure, single parent [n(%)]	86 (6.0)	66 (5.5)	20 (8.1)	0.121
Number of life events [n(%)]				**<0.001**
No life event	741 (51.6)	642 (53.9)	99 (40.1)	
1–2 life events	544 (37.9)	442 (37.1)	102 (41.3)	
>2 life events	152 (10.6)	106 (8.9)	46 (18.6)	
Overall experienced tension from life events [n(%)][2]				**<0.001**
No event	738 (51.7)	640 (54.1)	98 (40.3)	
Low	349 (24.5)	286 (24.2)	63 (25.9)	
High	340 (23.8)	258 (21.8)	82(33.7)	

Number of missing: child gender = 10, child ethnic background=58, child psychosocial problem at age 2 years =13, maternal ethnic background = 59, maternal educational level = 29, paternal ethnic background=59, paternal educational level = 67, family structure = 29, number of life events = 33, tension caused by life event if life event happened = 40.

At-risk of psychosocial problems was measured by the Brief Infan t –Toddler Social and Emotional Assessment. Having an at risk score on BITSEA Problem or Competence scale, or both scales, was considered "at-risk."

"No events" (participants who reported not to have experienced any life event, considered the reference group), a group "low" tension (participants of whom all experienced life events had a tension score of 1) and a group "high" tension (participants whom reported at least one experienced life event with a tension score of 2 or 3).

Significant p-values are printed bold.

Namely, life events between child age 1 and 2-years old, can have an impact on the 3-year old child's psychosocial well-being. Thus far, these studies were performed among school-aged children and adolescents (12, 13, 18, 32). Also, the current findings suggest a trend (data not shown) that the risk of psychosocial problems, at the age of 3, increases as more life events are experienced or when life events have a higher impact on the family. This increase in risk has been reported in previous research in 6-year-olds (33), and 11–13 year-olds (22).

More research is needed to explore the pathways and mechanisms that cause these longer term effects on child psychosocial health. A behavioral and physiological pathway has been suggested to explain impact on health and well-being (8). In young children the impact on psychosocial health may also be impacted *via* the family environment. Such as the potential of the family (environment) to cope with the life event, including the ability to seek and receive help when needed (11). In general, it has been shown that having stress as a parent affects psychosocial well-being of the children (34). Coping skills, social support networks and many more related factors are related to how a parent can deal with the stress that can accompany life events (8). Therefore, life events may impact the child directly, as well as through the way parents are able to deal with the situation at hand (34, 35). Moreover, children develop over time, including their coping skills, which can help them deal with the situation better and/or ask for help earlier (36). In order to better understand

TABLE 2 Life events and risk of psychosocial problems at age 3-years.

	SDQ total difficulties score			
	Total yes[a] n (%)	Not at risk n (%)	At risk n (%)	P-value
Relocation of the family [37]	241 (16.8)	200 (16.8)	41 (16.7)	0.944
Relocation of someone close to the child [36]	11 (0.8)	10 (0.8)	1 (0.4)	0.701
Tensions at work of one of the parents, felt at home [53]	233 (16.5)	170 (14.5)	63 (25.7)	**<0.001**
Financial problems [44]	56 (3.9)	33 (2.8)	23 (9.5)	**<0.001**
Unemployment of one of the parents [41]	139 (9.7)	106 (9.0)	33 (13.5)	**0.030**
Quarrels with neighbors/friends/acquaintances/family [42]	44 (3.1)	32 (2.7)	12 (4.9)	0.068
Problems within relationship of the parents [39]	73 (5.1)	45 (3.8)	28 (11.5)	**<0.001**
Divorce [39]	31 (2.2)	21 (1.8)	10 (4.1)	**0.024**
Victim of fire or burglary [35]	20 (1.4)	16 (1.3)	4 (1.6)	0.764
Physical health problems of someone close to the family [61]	209 (14.8)	161(13.8)	48 (19.8)	**0.016**
Mental health problems of someone close to the family [46]	107 (7.5)	78 (6.6)	29 (11.9)	**0.004**
Death of someone close to the family [43]	141 (9.9)	110 (9.3)	31 (12.7)	0.104

[Missing N] indicates the missing data on SDQ Total Difficulties Score for this life event. *P*-values based on Chi-square test or Fisher's Exact test (when one cell has an expected count $0<T<5$), significant *p*-values are printed bold.

[a]The number of parents that reported this specific life event to have taken place. The total number of unique life events reported by $n = 696$ parents.

TABLE 3 Associations between experiencing life events before age 2 years and the risk of psychosocial problems at child age 3 years.

	SDQ total difficulties score	SDQ emotional problems	SDQ conduct problems
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Number of life events			
No life event	Ref	Ref	Ref
1–2 life events	1.50 (1.09–2.06)*	2.08 (1.27–3.42)*	1.46 (0.92–2.33)
>2 life events	2.55 (1.64–4.00)**	3.16 (1.65–6.02)**	2.21 (1.20–4.09)*
Overall experienced tension from life events			
No events	Ref	Ref	Ref
Low	1.37 (0.95–1.98)	1.18 (0.63–2.22)	1.43 (0.85–2.41)
High	2.03 (1.43–2.88)**	3.57 (2.16–5.92)**	1.81 (1.09–2.99)*

SDQ, Strengths and Difficulties Questionnaire; OR, Odds Ratio; CI, Confidence Interval.
Logistic regression model: number of life events as independent variable and adjusted for baseline risk of psychosocial problems, maternal educational levels and family structure. Total $n = 1,383$ because of missing data on predictor and covariates.
Logistic regression model: overall tension caused by life events as independent variable and adjusted for baseline risk of psychosocial problems, maternal educational levels and family structure. Total $n = 1,376$ because of missing data on predictor and covariates. $^{*}p < 0.05$ and $^{**}p < 0.01$.

the impact of life events among young children, research should use mixed methods combining both qualitative and quantitative data collection methods. This can help gain in-depth insight in how children and families experience, cope and seek help for life events.

Some life events appeared to be more 'common' than others when the frequency of reporting was considered (Supplementary Table 1). Relocation of the family was a 'common' life event among the study sample. Relocation of the family had an on average low tension rating. Furniss et al. (33) reported a negative association between the relocation (consisting of family relocated, and going to a new nursery school) and mental health assessed by the Child Behavior Check List. Since the study of Furniss et al. (12) was performed among older children, it could be argued that young children (2–3 years of age) are not impacted from moving from one place to another, while for a 6-year-old, it can have a severe impact, as they are just entering school and start making friends. Divorce on the other hand was a less 'common' event, but with an average high tension rating. A meta-analysis of Amato (37) has suggested that divorce has no negative impact in very young children, but only in older, school-aged children. In our study the numbers in the analyses were too low to draw reliable conclusions on impact of individual events. In a study by Pruett et al. (38), divorce was associated with a negative impact on child (0–6 years) mental health, only when the divorce brought along parental conflicts or social adversities. With regard to particular life events and their impact, in our analyses the numbers were too low to draw reliable conclusions. We recommend future studies to examine the pathways that lead to impact on child health; taking into account the context in which events take place and are coped with. Meanwhile, for professionals working within pediatric prevention and care it is important to be aware of the impact of life events on the family and specifically the psychosocial health and well-being of young children. An open dialogue with parents is important in order to be able to detect issues timely and refer to specialized care if needed. Early support may prevent long term problems for the child as well as the other family members.

Methodological considerations

Strengths of the study include the longitudinal design among a population-based sample of parents and their children. We were able to assess psychosocial well-being at age 2 and 3 years with

well-validated instruments. Also, a broad range of life events was assessed in the questionnaire.

Parent-report by questionnaire was used to collect data. Self-report by questionnaire is at age 2-years hardly possible and interview methods are also challenging. Therefore, for the purpose of population-based studies among large community samples the use of parent-report questionnaires can be considered best practice. Life events were assessed at child age 2-years only, we were not able to correct for the time that has passed since the life event happened, or events taking place between age 2 and 3 years. Life events were categorized in three groups. Other ways to calculate life events experience and impact are possible, as we also explored using the total number of life events experienced. However, due to the distribution of the frequencies the current approach was considered most appropriate. Future studies with larger sample size and therewith potentially higher numbers of life events experienced may explore the linear association further. Also, larger studies may have the opportunity to study individual life events and psychosocial health impact. This could have resulted in over- or underestimation of the associations observed. The non-response analyses showed selective drop-out of study participants from baseline to follow-up and therefore results should be interpreted with caution.

Conclusion

This study showed half of families with preschool children have experienced one or more life events. Having experienced one or more life events in the family before the child is 2-years old was associated with risk for psychosocial problems of the child at 3-years of age. Professionals working in with families and children should pay attention to the impact that a broad range of life events might have on the health and well-being of both children and the family.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the corresponding author upon reasonable request.

Ethics statement

The Medical Ethical Committee of the Erasmus Medical Center Rotterdam has reviewed the research proposal and declared that the rules laid down in the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) did not apply to this research proposal (number MEC-2014-152). This study was conducted following the guidelines proposed in the World Medical Association Declaration of Helsinki. The parents provided written informed consent to participate in the study.

Author contributions

HR obtained the funding. HR and AG managed the research. EH, CM, IK, and RB undertook data collection. AG, EH, and HR conceived the research described in this paper. JL analyzed the data. AG drafted the manuscript with input of JL and HR. All authors provided input in interpreting the data. All authors critically reviewed and approved the manuscript.

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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.2023.1100261/full#supplementary-material

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Fathers' presence and adolescents' interpersonal relationship quality: Moderated mediation model

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Introduction: Most previous studies focused on the effects of fathers' presence on adolescent development, but rarely examined the mechanisms underlying the presence of fathers on adolescent development. Moreover, previous studies ignored the impact of fathers' way of being present on adolescent interpersonal relationships. Based on social identity theory, the present study introduced adolescents' social responsibility as a mediating variable to explore the influence of father's presence style on adolescents' interpersonal. This study examined the mechanism of fathers' way of being present on father's presence, adolescents' social responsibility, and their quality of interpersonal relationships; if fathers adopt a democratic approach to be present, the study examines whether teenagers are more likely to enhance their sense of social responsibility and achieve harmonious interpersonal relationships.

Methods: Participants were 1,942 senior high school and college students who responded to the Fatherhood Questionnaire, Social Responsibility Questionnaire, and Interpersonal Relationship Quality Diagnosis Scale. This study used PROCESS macro of SPSS 24.0 and Amos 26.0 to examine the hypotheses.

Results: Empirical results demonstrated that (a) fathers' presence is directly and positively related to adolescents' social responsibility, (b) fathers' presence is indirectly and positively related to the quality of adolescents' interpersonal relationships through social responsibility, and (c) parenting styles played a moderating role in the first half of the fathers' presence on social responsibility and the quality of interpersonal relationships. Results demonstrated that more harmonious interpersonal relationships were present among teenagers when fathers adopted a democratic upbringing, and this interaction effect on interpersonal relationships was mediated by teenagers' sense of social responsibility.

Discussion: The findings of this study enrich the literature by exploring the significance of emphasizing fathers' democratic presence on teenagers' sense of social responsibility and interpersonal relationships. The practical implications of this study are that society should encourage more fathers to be present and guide them to adopt a democratic parenting style that will benefit adolescents' development and family well-being.

KEYWORDS

parenting style, fathers' presence, social responsibility, relationship, adolescents in China

1. Introduction

This study investigated the effect of fathers' way of being present on father's presence, adolescents' sense of social responsibility, and their quality of interpersonal relationships in China. Based on social identity theory, the present study introduced adolescents' social responsibility as a mediating variable to explore the influence of the style of father's presence on adolescents' interpersonal quality. Our findings reveal that "fathers' way of being present will influence the effect of their presence." If fathers adopt a democratic approach to be present, teenagers are more likely to enhance their sense of social responsibility. Furthermore, fathers' democratic presence leads to more harmonious interpersonal relationships among teenagers. The purpose of this study was to encourage more fathers to be present in their children's lives and guide them to adopt a democratic parenting style that will benefit adolescents' development and family harmony, happiness, and progress.

In addition, several researchers have examined the key role of fathers in children's growth, in particular with regard to matters such as gender equality, individual mental health, children's early academic success, less truancy, the development of children's autonomy and moral system, etc., (Baker et al., 2018; Papaleontiou-Louca and Al Omari, 2020; Grau et al., 2022; Venta et al., 2022; Waqar et al., 2022). There have also been studies that emphasize the importance of fathers to children's growth from the perspective of the father's absence. For example, the absence of fathers may lead to children's unhappiness, anxiety, poor social skills, physical illness, cognitive impairment, and depression (Billah et al., 2022; Culpin et al., 2022; Farooqui and Barolia, 2022; Gillera et al., 2022; Rodríguez Sánchez, 2022). In particular, to improve fathers' initiative to participate in their children's upbringing, several scholars worldwide have discussed the issue of providing or extending paternity leave (Knoester et al., 2019; Petts et al., 2020; Wray, 2020). Paternity leave is definitely critical, but it only means that fathers will be there to care for their children, and cannot guarantee the quality of father's presence; and the quality of father's presence is the more crucial factor for the development of teenagers.

It is worth noting that before COVID-19, various studies focused on the effects of fathers' presence on adolescent development (Luo, 2020; Shuang, 2020), but few examined the underlying mechanisms. Subsequently, the COVID-19 pandemic forced working fathers back into the home and made their presence mandatory (Gao et al., 2021; Xiaoyi and Duan, 2022). It is extremely important to examine the impact of father presence on adolescent development. This importance is supported by the fact that different parenting styles lead to different educational outcomes. Some styles manifest in prominent family conflicts, with children and parents in a state of antagonistic clash. Others are characterized by a harmonious, happy family atmosphere, where the parents lead the children to grow up together. So what exactly is at play in the middle? Importantly, it is not only the presence of the father that is of relevance, but also the empirically best parenting style for the father to use.

Global research on fathers' presence has advanced and risen to a new stage of "measuring and improving the quality of father-child relationships" (Stgeorge and Freeman, 2017; Palkovitz, 2019). Furthermore, given the importance of family education on fathers' presence, since a long time ago, many policies have been introduced abroad to support family education. For example, Coleman's report (Meier, 1967) published in the US affirmed the role of family education in children's development and proposed that the main factor affecting children's achievement is family, in particular, the family's socioeconomic status (SES), with the influence of school being secondary. The 44th United Nations General Assembly (1989) passed a resolution designating 1994 as the International Year of the Family, and the United Nations Commission for Social Development (United Nations [UN], 1993) declared May 15th as the International Day for Families.

However, compared with other countries, research on fathers' involvement in China remains at a nascent stage. The research on fathers' presence by domestic scholars mainly presents the following characteristics: In China, the role of fathers in family education is placed in an indirect and secondary position. The father's role often needs to rely on the mother to function (Zou et al., 2019; An and Zeng, 2022). For example, in parent-child interactions, the father's influence on the child is mainly conveyed through the mother. Overall, the extent of research is not deep enough and there is a lack of research on the intrinsic action processes underlying fathers' influence on adolescents. Some salient aspects of the current situation of fathers' parenting involvement in China are as follows. First, from the perspective of society, China has followed the tradition of "men dominating the work while women dominate the house"; thus, it is a common occurrence for fathers to be at work and absent from the home (Thobejane and Florence, 2018). Chinese people lack sufficient awareness of the absence of fathers (Jiang, 2018). Second, from the perspective of family structure, the current generation of parents in contemporary Chinese families are mostly only (sole) children, owing to the former one-child policy (1979). Compared with non-only-child children, only-child children tend to be self-centered and lack independence (Rahmani and Ulu, 2021). They are accustomed to giving their children to the older generation to raise, again resulting in children lacking the company of their fathers. Finally, on the individual level, if the father is absent, the mother will take complete responsibility for educating her children. Without fathers' assistance, unitary education of mothers may be isolated and helpless (Karunanayake et al., 2021), frequently leading to physical and mental problems among teenagers (Lee and Allen, 2021). Thus, the topic of fathers' presence in the Chinese context is not outdated, and further research is required. In China, the individual and the mother live in the same brain region, the representation of the Chinese mother is closely related to the self, whereas the Western mother is separated from the individual self (Jing and Li, 2000). Moreover, the relationship between the child and the mother is much closer than that between the father and the child. Fathers remain an important parental figure, however, and also influence the process of their children's development, however, knowledge regarding how fathers should raise their children scientifically and effectively is still developing in China.

2. Literature review and development of hypotheses

2.1. Fathers' presence and adolescents' interpersonal relationship quality

The study of fathers' presence is a new field in father–child relationships. Krampe (2009) proposed a dynamic theoretical model of fathers' presence and defined it as psychological closeness and accessibility to their children. Psychological presence suggests that the father is visible and within reach most of the time (Krampe, 2009; Pu et al., 2011). In a broad sense, the interpersonal relationships of teenagers can refer to their social relationships with all the people associated with them. Interpersonal relationship quality is a measure of the quality degree or rank of an individual's interpersonal relationships, such as high quality or low quality (Seto and Davis, 2021).

Several studies have shown that fathers' presence influences teenagers' interpersonal relationship quality. Yoon et al. (2022) suggested that the presence of a father is conducive to the construction of a positive parent–child relationship, thus effectively buffering the adolescent problem behavior. Gleitsmann (2016) concluded that fathers' presence facilitates the development of father-child relationships. Ying et al. (2021) found that a high paternal presence had obvious advantages for young teenagers' empathy and sympathy and made it easier to establish harmonious interpersonal relationships. Furthermore, Morales-Castillo (2022) showed that parents' perceived involvement (PI) had a significant impact on the school performance (SP) of teenagers, and interpersonal relationships were a crucial evaluation standard of SP; therefore, fathers' parenting also had an impact on teenagers' interpersonal performance in school. In summary, fathers' presence was positively associated with adolescents' interpersonal relationship quality. The higher the quality of father's presence, the more harmonious interpersonal relationships adolescents will exhibit.

However, in extreme circumstances, such as when fathers are in prison and completely absent from their children's lives, their roles are restricted, and it is difficult for them to perform their fatherly duties in their children's daily life, resulting in the absence of education by fathers. This can lead to social problems such as family tension and children's interpersonal difficulties. Therefore, the introduction of social practice work systems in some countries helped maintain good father–child relationships (Liu C. et al., 2022). Another view is that the harm caused to teenagers' interpersonal relationships by the absence of fathers can be compensated by education provided by mothers or others (Liu C.-C. et al., 2022).

Although a high-quality father's presence may help promote teenagers' interpersonal relationships (Palkovitz, 2019), there may not be a direct relationship between fathers' presence and quality of interpersonal relationships. Previous studies have shown that, when fathers are present, teenagers may experience interpersonal crises (Vass and Haj-Yahia, 2022), while when they are absent, adolescents show good interpersonal relationships (Liu C.-C. et al., 2022). Thus, certain factors regarding fathers' presence may impact the quality of interpersonal relationships.

Therefore, we proposed the following research hypothesis:

> Hypothesis 1: Fathers' presence positively affects teenagers' interpersonal relationship quality.

2.2. Mediating role of social responsibility in the relationship between fathers' presence and interpersonal relationship quality

Teenagers' sense of social responsibility refers to a strong emotional and personality trait of concern for themselves, family, others, the collective, the nation, humanity, and nature, which are influenced by various external things in daily life (Chen, 2013). The understanding of social responsibility is a process of deepening through cognition, perception, and action. From the psychological perspective, the sense of social responsibility refers to a relatively stable psychological quality of individuals who actively undertake social responsibility or help others, which has important practical significance (Huang et al., 2016). Previous studies have shown that the sense of responsibility is an effective predictor of a series of positive psychology characteristics and behaviors, such as job performance, academic achievement, sound development of personality, positive self-evaluation, attitude toward setbacks and failures, and altruistic behavior (Wentzel, 1991; Leyton Román et al., 2019; Otto et al., 2022; Rajasekar et al., 2022; Scholten et al., 2022; Zyuzev, 2022). Scholars have confirmed the influence of fathers' presence on teenagers' social responsibility. On the one hand, it has been shown that responsible fathers, who are involved in the development of children as male role models, contribute to the development of a sense of social responsibility in children (Randles, 2020; Donnelly et al., 2022; Kohl et al., 2022). On the other hand,researchers found that absence of fathers may lead to teenagers' depression, self-loathing, and impulsion and increase their probability of random sexual behavior, whereas casual sex reflected teenagers' indifference to a sense of responsibility for marriage and love to a certain extent (Liu, 2017; Hehman and Salmon, 2021). Therefore, to reduce the occurrence of this phenomenon and enhance the sense of responsibility of teenagers, the fathers needed to be present.

Among many factors that affect social responsibility, interpersonal relationship quality has become a crucial predictor (Huang et al., 2016), Social responsibility will affect interpersonal relationship quality (Kim and Kim, 2016). Drawing on the theory of social identity (Sewell et al., 2022), in which it is proposed that every member of society belongs to a group, constructing an effective social identity helped mobilize individual social responsibility, further developing harmonious social group relations. Therefore, some scholars have used social identity theory to test the impact of social responsibility on all kinds of social relations. The results showed that the stronger the sense of social responsibility, the more conducive it is to the construction of benign social relations as opposed to bad ones (Grebenshchikova, 2020;

Paruzel et al., 2020; Silva et al., 2021; Sorour et al., 2021; Blasco, 2022; Brown et al., 2022).

According to family ecosystem theory, the father-child relationship is influenced by many factors. On the one hand, the father's relationship with grandfather affects the father-child relationship through intergenerational transmission; on the other hand, the mother has expectations of the father's image due to the influence of maternal grandfather. The mother's relationship with maternal grandfather will shape the father's relationship with her child (Eppler, 2019). Therefore, some studies have shown that the relationship between mother and grandfather, mothers' support for the father-child relationship, and beliefs about fathers can positively predict the sense of responsibility in marriage and love (Liu, 2017). This shows that while fathers influence teenagers' interpersonal relationships through social responsibility, the relationship between individuals and others can in turn explain their future sense of responsibility.

Therefore, we proposed the following research hypothesis:

> Hypothesis 2: Social responsibility plays an intermediary role in the presence of teenagers' fathers and quality of interpersonal relationships.

2.3. Moderator role of parenting style in the relationship between fathers' presence and interpersonal relationship quality

Generally, fathers' presence affects teenagers' interpersonal relationship to varying degrees, and patterns of father involvement and the quality of father-child relationships tend to be transmitted from generation to generation. Moreover, parenting style plays a key role in determining the quality of transmission (Jessee and Adamsons, 2018). Parenting style can be defined as the method or way of parenting (Azahari and Amir, 2022). Baumrind (1967) divided parenting styles into three types: permissive, authoritative, and authoritarian. "Authoritative" is a democratic parenting style that is more conducive to children's development, whereas an authoritarian parenting style has adverse effects on children (Masitah and Pasaribu, 2022). Parenting style plays a vital role in the development of teenagers' social communication ability (Uma and Manikandan, 2022). Some scholars have verified that fathers' parenting style and attitudes are related to children's positive biases (Ziv and Arbel, 2021) and adaptive behaviors (Sabat et al., 2021); however, no such correlation was found for mothers. In addition, parental rearing patterns shape college students' sense of social responsibility by influencing self-efficacy (Shen and Li, 2020). Fathers' presence promote social responsibility in adolescents, and parenting styles play a moderating role (Liu, 2017; Krohn et al., 2019; Xia et al., 2020; Hehman and Salmon, 2021). Meanwhile, parenting styles play a regulatory role in many fields, such as early puberty and drinking behavior (Ling et al., 2022), perceived father-child facial resemblance and academic performance (Tu et al., 2021), and teenagers' psychological flexibility (Bibi et al., 2022).

Therefore, we proposed the following research hypothesis:

> Hypothesis 3: Parenting styles play a moderating role in the first half of the fathers' presence on social responsibility and the quality of interpersonal relationships.

3. Materials and methods

3.1. Participants and procedure

The sample for this study was drawn from May to June 2020, during the COVID-19 outbreak, when school began to resume. This study investigated high school and college students in Hubei Province by random sampling, including a limited number of participants in their 30 s. Our study was approved by the appropriate research ethics committee, and all participants provided written informed consent to participate. A survey was conducted through offline sampling and online completion among senior high school students and college students using the Comprehensive Diagnosis Scale of Interpersonal Relationship, Social Responsibility- Behavior Scale, Ways of Upbringing Scale, and Fathers' Presence Scale. A total of 1,942 questionnaires were collected, of which 331 showed no effect of fathers on development; thus, the data on fathers' presence were blank (Because this portion of subjects were left-behind children or from single-mother families, they might not have fathers or their fathers might be absent from home for a long time. Therefore, they basically had no impression of their fathers' presence during their growing up, their fathers had little influence on them, and they refused to participate in this part of the data survey). The sample details are shown in **Table 1**.

3.2. Measures

3.2.1. Comprehensive diagnosis scale of interpersonal relationship

The Comprehensive Diagnosis Scale of Interpersonal Relationship was compiled by Professor Zheng Richang of Beijing Normal University (Adapted from SymptomChecklist90, SCL-90; Cattell, sixteen personality factor questionnaire, 16PF; Eysenck Personality Questionnaire, EPQ, etc.). Interpersonal relationship quality is measured using the Interpersonal Relationship Barriers Scale, which reflects the quality of interpersonal relationships by means of reverse scoring; the higher the score on the scale, the more interpersonal barriers there are, and the worse the relationship is. It evaluates four aspects of the current interpersonal status of participants: talking, making friends, interacting with people, and interacting with the opposite sex (Shi, 2017). There are 28 questions with "yes" or "no" answers; "yes" is recorded as 1 point, and "no" as 0 points. The higher the score, the lower the comprehensive evaluation of interpersonal relationships. The consistency reliability of the questionnaire was 0.89, and the construct validity was 0.67.

TABLE 1 Basic participant information.

Variable	Group	*N*	Percent (%)	Variable	Group	*n*	Percent (%)
Home address	City	876	45.1	Learning-working status	In high school	915	47.1
	Village	838	43.2		In college	935	48.1
	Suburbs	228	11.7		At work	92	4.7
Gender	Man	760	39.1	Only child	Yes	821	42.3
	Woman	1,182	60.9		No	1,121	57.7
Age (years)	Under 18	922	47.5	Father's educational level	Primary school or below	222	11.4
	18–24	922	47.5		Junior school	685	35.3
	25–30	76	3.9		High school	587	30.2
	30–40	22	1.1		Junior colleges	187	9.6
					Bachelor or above	261	13.4

$N = 1,942$.

3.2.2. Social responsibility-behavior scale

This questionnaire, compiled by Chen (2013), includes cognition, emotion, and action of social responsibility, self-evaluation, school evaluation, and social evaluation dimensions of college students' social responsibility. The Cronbach's α coefficient was 0.695, with good reliability, content validity, criterion-related validity, and framework validity. This study selected the self-evaluation dimension of social responsibility for the analysis. The scoring scale of the questionnaire is from 1 to 5, and the scores from low to high indicate "very poor, poor, average, good, very good." The higher the score, the stronger the social responsibility of the participants (Chen, 2013). In addition, from a psychological point of view, social responsibility includes cognitive, affective, and behavioral responsibility. However, during the measurement process of the pre-survey, we found that the affective dimension of social responsibility carries very large social approbation, which does not truly reflect social responsibility and hardly supports the investigation process of the scale. Thus, we weaken the affective dimension of social responsibility and emphasize the cognitive and behavioral dimensions.

3.2.3. Ways of upbringing scale

This scale contained a multiple-choice question: "What is your fathers' parenting style?" Options included democratic, authoritative, indifferent, and doting. The multiple-choice question was a category variable. In the data statistics, the democratic parenting style was recorded as 1 and the others were recorded as 0; the category variable was then analyzed.

3.2.4. Fathers' presence scale

There are 31 entries in the Chinese Short Version of Fathers Questionnaire (FPQ-R), which contains three high-order dimensions (relationship with fathers, family intergenerational relations, beliefs about fathers) and eight subscales (feelings for fathers, mothers' support for father–child relations, perceptions of fathers' participation, physical interaction with fathers, parental relations, relationship between mothers and grandfathers, relationship between fathers and grandfathers, and the concept of fathers' influence). The Cronbach's α coefficient of internal consistency reliability of the three high-order dimensions and eight subscales of FPQ-R-B was over 0.73, which indicated that all high-order dimensions and their subscales, as well as the items in each subscale, had good consistency and that the scale had certain discrimination validity and calibration correlation validity (Pu et al., 2012; adapted from Father Presence Questionnaire, FPQ, Krampe and Newton, 2006).

4. Results

This study used PROCESS macro of SPSS 24.0 and Amos 26.0 for data management and analysis. First, SPSS 26.0 was used to process subject base information (see **Table 1**); combining overall description of each variable (see **Table 2**); getting analysis of the correlation between variables (see **Table 3**). Second, AMOS was used to calculate the fit index of the mediation model (see **Table 4**); it was used to construct structural equation modeling and test the mediating effect of social responsibility. Thereafter, the fitted indicators are shown in **Table 4**, and the mediating effect between variables can be shown in **Figure 1**. The magnitude of the effect between the variables can be shown in **Figure 1** (see **Figure 1**). Next, PROCESS was used to build "research model diagram" (see **Figure 2**), to measure the "interactive effect of parenting style and fathers' presence on quality of relationships " and "interactive effect of parenting style and fathers' presence on quality of relationships"e(see **Figures 3**, **4**). Finally, PROCESS and AMOS were applied to test fitting indicators of the adjustment model (see **Table 5**).

4.1. The current situation of fathers' presence, social responsibility, and interpersonal relationship quality

As shown in **Table 2**, the average social responsibility of teenagers was 3.57. Taking the theoretical median value of 3 as the reference point, the single sample *T*-test showed a significant difference between the scores and median values of teenagers' social responsibility. This indicated that teenagers' sense of social responsibility was generally higher than the theoretical median level and was generally at the upper-middle level. Moreover,

TABLE 2 Overall situation of fathers' presence, social responsibility, and comprehensive quality of interpersonal relationships.

Inventory	*n*	Min	Max	*M*	SD	Theoretical median
Social responsibility	1,941	1	5	3.57	0.71	3
Fathers' presence	1,285	1.5	5	3.51	0.71	3
Comprehensive quality of interpersonal relationship	1,942	0	1	0.32	0.20	0.5

$N = 1{,}942$.

TABLE 3 Correlation analysis of fathers' presence, social responsibility, and comprehensive quality of interpersonal relationship.

	1	2	3	4	5	6	7	8
1. Sense of social responsibility	–							
2. Relationship with father	0.44***	–						
3. Family intergenerational relationships	0.34***	0.53***	–					
4. Beliefs about fathers	0.24***	0.36***	0.20***	–				
5. Conversation	−0.23***	−0.22***	−0.18***	−0.23	–			
6. Treatment of people and things	−0.19***	−0.21***	−0.13***	−0.37	0.69***	–		
7. Making friends	−0.16***	−0.13***	−0.13***	0.33	0.57***	0.54***	–	
8. Associating with the opposite sex	−0.16***	−0.15***	−0.12***	0.17	0.57***	0.57***	0.48***	–
M	3.57	3.40	4.00	3.04	0.35	0.48	0.19	0.26
SD	0.71	0.90	0.70	1.13	0.27	0.31	0.21	0.25

$N = 1{,}942$. *$P < 0.05$, **$P < 0.01$, and ***$P < 0.001$, the same below.

TABLE 4 Structural equation model fitting table ($N = 1{,}942$).

Category	χ^2/df	GFI	AGFI	NFI	CFI	RMSEA
Threshold	<3	>0.9	>0.9	>0.9	>0.9	<0.05 good; 0.05–0.10 moderate;>0.1 bad
Mediated model	2.865	0.990	0.980	0.982	0.988	0.038

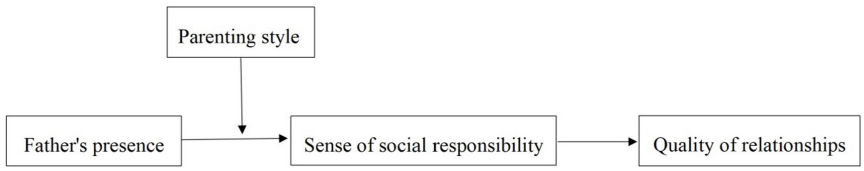

FIGURE 1
Research model diagram.

the standard deviation of 0. 73 indicated that the dispersion of adolescents' sense of social responsibility was greater; that is, the level of adolescents' sense of social responsibility showed large variations, which indicated that teenagers' sense of social responsibility had large individual differences. In addition, among the three factors of fathers' presence, the score for family intergenerational relationships was the highest, the score for relationship with father was the second highest, and the average score for beliefs about one's father was the lowest. Regarding the comprehensive quality of interpersonal relationships, the overall mean value is 0.32, which is better than medium. The results of the single-sample *T*-test showed that the comprehensive quality of teenagers' interpersonal relationships was significantly lower than the theoretical average. Among the four dimensions, the highest-ranked dimension was making friends, followed by heterosexual communication, conversation, and treatment of people and things. Among the types of relationships with fathers, 68.2% of participants reported that they had democratic father–child relationships, and other types of father–child relationships accounted for 31.8%.

4.2. Correlation analysis of fathers' presence, social responsibility, and interpersonal relationship quality

According to Pearson correlation coefficient analysis, there was a pairwise correlation between adolescents' fathers' presence, social responsibility, and interpersonal relationship quality. The presence of teenagers' fathers was positively correlated with social responsibility and negatively correlated with the quality of interpersonal relationships, with the correlation coefficients, r, being 0.44 and −0.16, respectively. Moreover, there was a significant negative correlation between social responsibility and

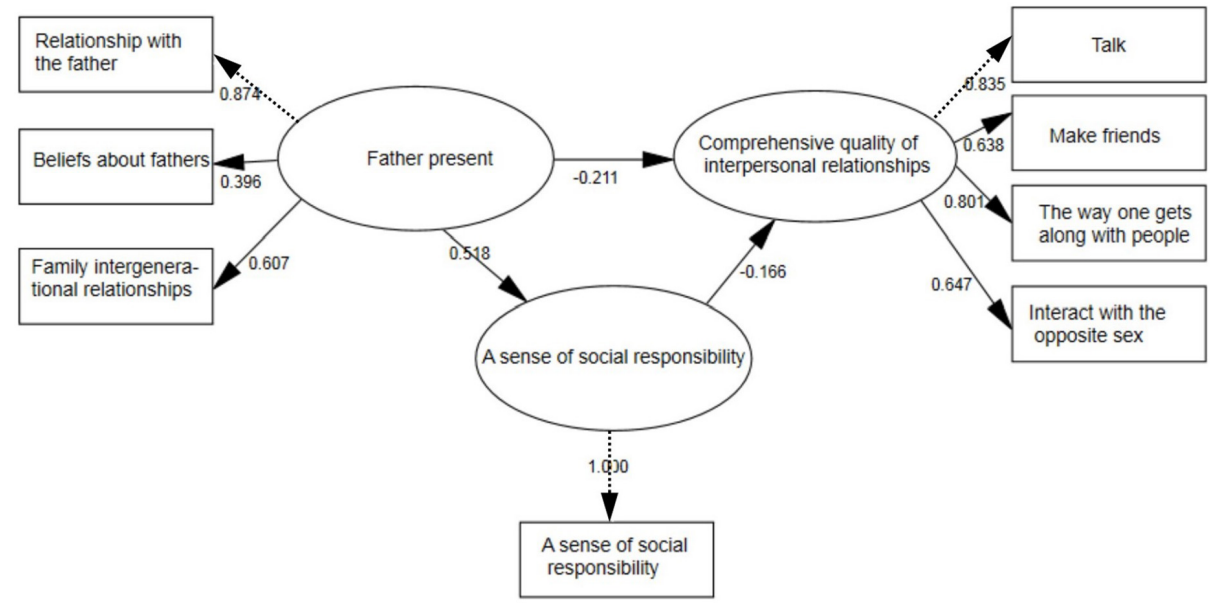

FIGURE 2
Mediating model of social responsibility.

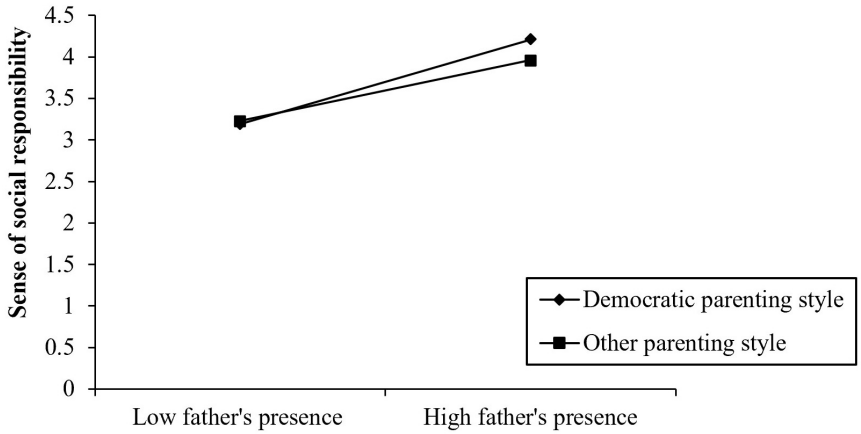

FIGURE 3
Interactive effect of parenting style and fathers' presence on sense of social responsibility.

interpersonal relationship quality, and the correlation coefficient r was −0.23 ($p < 0.001$).

4.2.1. Correlation analysis of fathers' presence, social responsibility, and interpersonal relationship quality in different dimensions

There was a significant positive correlation between the dimensions of teenagers' fathers' presence and social responsibility, and the correlation coefficient was between 0.235 and 0.437. Among them, the correlation coefficient between the dimension of the relationship between teenagers and their fathers and their sense of social responsibility was higher. There was a significant negative correlation in fathers' presence between the dimensions of "adolescent fathers' relationship with their fathers," family intergenerational relationship, and the dimension of the comprehensive quality of interpersonal relationships. And the correlation coefficient was between −0.121 and −0.218. Adolescents' sense of social responsibility was negatively correlated with all dimensions of interpersonal relationship quality, and the correlation coefficient was between −0.158 and 0.234.

There was a close relationship between the teenagers' fathers' presence, social responsibility, and interpersonal quality.

4.2.2. Mediating analysis of social responsibility in the influence of fathers' presence on interpersonal relationship quality

The above conclusion shows a significant correlation between teenagers' fathers' presence, social responsibility, and interpersonal quality, which aligns with the test premise of intermediary utility. To identify how teenagers' sense of social responsibility mediated

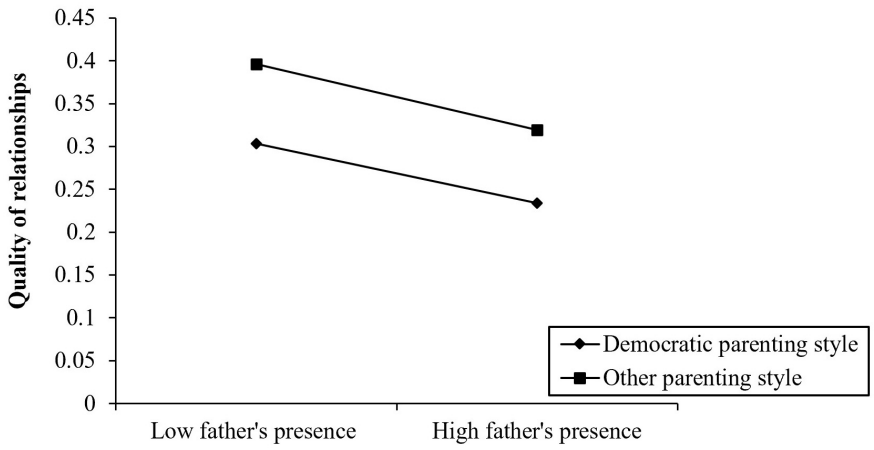

FIGURE 4
Interactive effect of parenting style and fathers' presence on quality of relationships.

TABLE 5 Hierarchical linear regression analysis results.

Variable	First stage (Dependent: Sense of social responsibility)						Second stage (Dependent: Quality of relationships)					
	First step			Second step			Third step			Fourth step		
	β	SE	*t*	β	SE	*t*	β	SE	*t*	β	SE	*T*
Constant	0.03	0.03	1.01	0.01	0.04	0.36						
FP	0.41***	0.03	16.68	0.33	0.05	6.02						
PS	0.06	0.04	1.43	0.07	0.04	1.70						
FP*PS				0.13**	0.06	2.06						
Constant							0.17**	0.05	3.45	0.16**	0.06	2.79
FP							−0.06	0.04	−1.40	−0.09	0.08	−1.05
PS							−0.31***	0.06	−5.29	−0.30***	0.07	−4.64
SSR							−0.29***	0.04	−7.11	−0.29***	0.05	−6.32
FP*PS										0.05	0.09	0.50
R^2	0.19			0.19			0.09			0.09		
AdjR^2	0.19			0.19			0.08			0.08		
F	150.45***			102.60***			39.44***			29.65***		
ΔR^2				0.002						0.000		

FP, fathers' presence; PS, parenting style; SSR, sense of social responsibility. $N = 1{,}942$. *$P < 0.05$, **$P < 0.01$, and ***$P < 0.001$, the same below.

the relationship between fathers' presence and interpersonal relationship quality, this study adopted the structural equation model. In this study, chi-squared ratio degrees of freedom (χ^2/df), Root–Mean–Square Error of Approximation, Goodness-of-Fit Index, Adjusted Goodness-of-Fit Index, Normed Fit Index, and Comparative Fit Index were all in line with the structural equation fit standards (Table 4).

When fathers' presence affected the sense of social responsibility, the standardized path coefficient value was $0.518 > 0$, and this path showed the significance of 0.01 level ($z = 14.463$; $p = 0.000 < 0.01$), thus indicating that fathers' presence had a significant positive influence on the sense of social responsibility. When the father was present, the normalized path coefficient value was $-0.211 < 0$, and this path showed a significant level of 0.01 ($z = -5.108$; $p = 0.000 < 0.01$), which demonstrated that the fathers' presence had a significant negative impact on the overall quality of interpersonal relationships. When social responsibility affected the overall quality of interpersonal relationships, the standardized path coefficient was $0.166 < 0$, and this path showed a significance level of 0.01 ($z = -4.621$; $p = 0.000 < 0.01$), indicating that social responsibility had a significant negative impact on the overall quality of interpersonal relationships.

Teenagers' fathers' presence significantly positively predicted their social responsibility ($\beta = 0.435$, $P < 0.001$) and negatively predicted their interpersonal relationship quality ($\beta = -0.068$, $P < 0.05$), and adolescents' sense of social responsibility significantly negatively predicted the quality of their interpersonal relationships ($\beta = -0.217$, $P < 0.001$). After analyzing social responsibility as an intermediary variable, the negative predictive

effect of fathers' presence on interpersonal relationship quality reached a significant level ($\beta = -0.211$, $P < 0.001$), which indicated that social responsibility played a partial intermediary role between adolescents' fathers' presence and the comprehensive quality of interpersonal relationships, and the intermediary effect was 0.518*0.166/(0.211 + 0.518*0.166) = 29.0%. The mediating role of social responsibility was obvious. The degree of fathers' presence enhanced the social responsibility of teenagers. Teenagers with higher social responsibility had better interpersonal relationship quality.

4.2.3. The moderating effect of fathers' parenting style in social responsibility on fathers' presence and interpersonal relationship

First, fathers' presence, social responsibility, interpersonal quality, and parenting style were standardized, and the parenting style was multiplied by fathers' presence to form a product term. The hierarchical linear regression was then used to test the hypothesis of the adjustment effect of parenting style. The analysis results of the hierarchical linear regression are shown in **Table 5**.

In Equation 1, the regression coefficient of fathers' presence was significant ($\beta = 0.413$, $P < 0.001$), which indicated that fathers' presence positively affects social responsibility. In Equation 2, the interaction between fathers' presence and parenting style had a positive predictive effect on social responsibility ($\beta = 0.218$, $P < 0.05$), and the moderating effect was $\Delta R^2 = 0.002$. At this time, the independent effect of fathers' presence on social responsibility disappeared. In Equations 3 and 4, fathers' parenting style directly affected the quality of teenagers' interpersonal relationships, and a democratic father–child relationship optimized the quality of teenagers' interpersonal relationships, however, parenting style regulated the first half of the intermediary process "fathers' presence → social responsibility → interpersonal relationship quality," that is, the influence of fathers' presence on teenagers' social responsibility was related to fathers' parenting style. If fathers adopted a democratic parenting style, their presence directly promoted children's social responsibility; if fathers adopted other parenting styles, the influence of fathers' presence on children's responsibility was greatly weakened.

According to the test method of intermediary moderating variables put forward by Wen et al. (2006), the regression of parenting style and fathers' presence on interpersonal relationship quality was not significant, and the moderating effect of parenting style was entirely through the intermediary variable of social responsibility. To explain the moderating effect, we set the regression return of social responsibility and interpersonal relationship quality to, respectively, predicted variables as follows:

Social responsibility = 0.128 fathers' presence*parenting style.

Quality of interpersonal relationship = 0.163–0.30 parenting style −0.291 sense of social responsibility = 0.163–0.30 parenting style −0.291*0.128 fathers' presence*parenting style.

5. Discussion

Most previous studies focused on the effects of fathers' presence on adolescent development, but rarely examined the mechanisms underlying the presence of fathers on adolescent development. Moreover, previous studies ignored the impact of fathers' way of being present on adolescent interpersonal relationships. Based on social identity theory, the present study introduced adolescents' social responsibility as a mediating variable to explore the influence of father's presence style on adolescents' interpersonal. Our results showed that fathers' presence was positively related to relationships, but only for participants who adopted democratic parenting styles. This finding corroborates the results of previous studies. Further, we investigated the current situation of fathers' presence, social responsibility, and interpersonal relationship quality and provided the influence mechanism of fathers' presence on interpersonal relations; that is, fathers' presence significantly affected the quality of interpersonal relationships among adolescents by influencing social responsibility, the democratic parenting method played a regulatory role, and the process included a regulated intermediary effect. The findings of this study enrich the literature by exploring the significance of emphasizing fathers' democratic presence on teenagers' sense of social responsibility and interpersonal relationships. The practical implications of this study are that society should encourage more fathers to be present and guide them to adopt a democratic parenting style that will benefit adolescents' development and family wellbeing.

5.1. Theoretical contributions

This study has important implications for both theory and practice. From a theoretical perspective, our results provide the mechanism of influence of fathers' way of being present on teenagers' sense of social responsibility and interpersonal relationships. Fathers' democratic presence had a far-reaching impact on teenagers' sense of social responsibility and the quality of their interpersonal relationships. Kim et al. (2021) studied the parent–child relationships of adolescents in South Africa, emphasizing the importance of fathers in reducing the risk of HIV and drinking behavior in adolescent children. Rivers et al. (2022) elaborated the interactive relationship between patrilineal attachment and anxiety and depression in high-risk adolescents from the perspective of attachment theory. O'Gara et al. (2022) described the unique role of fathers in reducing their daughters' suicidal ideation and trying risky behaviors.

First, fathers' presence includes three high-order dimensions: the highest dimension is that for family intergenerational relationships, which includes the relationship between mother and grandfather and that between father and grandfather; relationship with father takes second place, and the father's influence is the lowest dimension. Research shows that during the growth of teenagers, fathers' presence is not looking good, and its important role is seriously underestimated. Second, according to attachment theory and Paquette's "activation" relationship theory (Paquette et al., 2000), the most basic relationship formed by children is first the mother–child relationship, then the father–child relationship, and social relationships develop later; furthermore, fathers' presence has a significant impact on their children's sense of social responsibility, especially when they interact with the general community. Finally, fathers' presence can promote the quality of teenagers' interpersonal relationships; in other words, the better the relationship with the father, the higher the quality

of interpersonal relationships. Existing research has found the mechanism of the influence of fathers' presence on relationships. Fathers' participation in parenting had a buffering effect on mother's negative parenting, and the buffering effect of fathers' participation in parenting time was particularly obvious (Liu et al., 2013). This study found that parenting style moderated the first half of the pathway of the mediating effect of fathers' presence on the effect of social responsibility on interpersonal relationship quality.

Undemocratic parenting styles tend to counteract the effect of father's presence on adolescents' sense of social responsibility. In turn, this also reduces the role of father's presence in adolescents' interpersonal interactions. In contrast, democratic parenting not only promotes a greater sense of social responsibility among adolescents but also significantly enhances their interpersonal skills. Attachment theory, object relation theory, intrinsic fatherhood theory, and analytical psychology theory all posit that children seek their fathers as an innate attribute (Pu et al., 2017).

5.2. Practical implications

According to a White Paper on the *status quo* of Family Education in China, the data on fathers' presence show that less than 20% of children's family education is dominated by fathers (Jiang, 2018). An investigation on the quality of teenagers' interpersonal relationships finds that what they are most worried about is the dimension of "the way one gets along with people," which is manifested in unnatural communication with strangers, nervousness, embarrassment, worry, lack of confidence, and so on. The phenomenon that fathers' presence is not viewed positively and that their roles are underestimated and negatively judged in the development of adolescents urgently needs to be ameliorated, because it is not conducive to adolescent development.

Adolescents' social responsibility is significantly positively correlated across all three dimensions of father's presence, implying that the quality of father's presence enhances adolescents' sense of social responsibility. To enhance adolescents' sense of social responsibility, we need to encourage them to participate more in social practices and enhance their awareness of group service; however, fathers should fully realize their potential and role and attend to their words and deeds during their children's growth, setting a good example. A good father–child relationship can help children face danger, resist pressure, and dare to survive independently (Yogman and Eppel, 2022). When the father is able to respond to his children in exciting and challenging interactive ways with games (neither too boring nor too scary, but appropriately excited), we can predict that his children will have high social functioning at the ages of 16–22.

If there is sufficient companionship and instruction from the father in the process of growing up, and teenagers receive four aspects of guidance—talking to others, dealing with others, making friends, and interacting with the opposite sex—they will be more confident in interpersonal communication, have a stronger sense of social responsibility, and have a higher quality of interpersonal relationships (Zhu, 2016). Interpersonal responsibility may be a cross-situational personality trait that can be cultivated in three spheres: family, school, and society (He and Huang, 2017). Therefore, improving teenagers' sense of social responsibility can also promote the quality of their interpersonal relationships.

Based on the above conclusions, fathers' presence and social responsibility have a significant impact on the quality of interpersonal relationships among teenagers. Society should encourage fathers to be more present, and a democratic upbringing is beneficial to the establishment of teenagers' sense of social responsibility and the improvement of the quality of their interpersonal relationships. In addition, fathers' participation in children's early life, games, and activities and in raising and educating children plays a decisive role in children's psychological development and social adaptation (Wang et al., 2012). Fathers' positive presence should be based on a harmonious father–child relationship (Hewlett, 2000). Democratic father–child relationships, the idea that fathers and mothers are equally important in the growth of their children (Grossmann et al., 2002), and the idea that fathers should participate in the upbringing of their children need to permeate all aspects of social life, such as schools, hospitals, government agencies, laws and social policies. The recommendations of this paper to the Chinese government, based on the findings of the study, are to improve the Family Education Promotion Act (implemented 1 January 2022), understand the need for fathers to participate in parenting, and implement appropriate guarantee mechanisms. This should encourage fathers to adopt a scientific approach to their children's upbringing. Before participating in parenting, fathers, as well as mothers, should receive professional training and learn scientific parenting models, which is conducive to child development and family wellbeing.

5.3. Limitations and directions for future research

This study had several limitations.

First, the sample size of this study is not sufficient. Our sample was mainly collected from Wuhan, Hubei, and although Wuhan is geographically located in central China, with a medium level of economic development, whether it is representative of the national average level of fathers' presence in parenting is open to be discussed. Therefore, in subsequent studies, researchers can collect data from the whole country, making the findings more generalizable.

Second, the age group coverage of the subjects in this study is not comprehensive enough. Our research subjects are mainly adolescents; the adolescent period is an important stage in a person's life, with physical and intellectual abilities at the peak of life, and is highly researchable. However, other stages of a person's life are also important, such as early childhood, which is the period when an individual's brain is developing fastest and social skills are developing optimally (Uchitel et al., 2022). If fathers are present during this period and administer appropriate early education in the right way to their young children, it is likely that the young children will be better socialized in the future. Therefore, future research could explore the effects of father's presence styles on other aspects of individuals at different ages, leading to more interesting conclusions.

Third, the influence of fathers' presence and social responsibility on the quality of adolescents' interpersonal relationships may be the result of a synergistic effect of multiple

factors. The discussion did not fully explain the reasons behind the influence of father's presence and responsibility on the quality of adolescent interpersonal relations. Is it the growth of teenagers themselves or the family and social environment, or is it the result of joint action? Since our article focuses on the presence of fathers and their role as role models, we do not go further into the reasons behind the findings.

Finally, there was no follow-up study conducted as part of this research. Although our study made feasible recommendations, it remains to be explored whether the quality of fathers' presence for the participating adolescents improved. Therefore, in future studies, researchers can conduct systematic, regular studies on the same cohort of respondents over a relatively long period of time (i.e., longitudinal research) to understand the implementation of countermeasures, provide feedback, and modify and improve countermeasures.

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 human participants were reviewed and approved by the Institutional Review Board at Hubei University of Education of China. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

AL and LS conceived and designed the study and collected the data. AL and SF analyzed and interpreted the data, wrote the manuscript, and were responsible for funding the acquisition. AL, LS, and SF contributed to the revision process of the manuscript. All authors contributed to the article and approved the submitted version.

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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.

Publisher's note

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Social trust and subjective well-being of first-generation college students in China: the multiple mediation effects of self-compassion and social empathy

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Previous studies have found that subjective well-being is associated with social trust, self-compassion, and social empathy. Based on online fieldwork with 662 first-generation college students (54.7% male) in China, this study aimed to investigate the serial mediation effects of self-compassion and social empathy on the relationship between social trust and subjective well-being. The results showed that subjective well-being was significantly positively correlated with social trust, trust in people, self-compassion, and social empathy. Both self-compassion and social empathy partially mediated the relationship between social trust and subjective well-being, and fully mediated the association between trust in people and subjective well-being. We used a serial mediation model to estimate the effect of general social trust, including trust in people, on subjective well-being. The findings that self-compassion and social empathy mediated the relationship between trusting attitudes toward society, especially people, and subjective well-being expand the literature on social trust and the mechanism of social trust on subjective well-being. The results also highlight the significance of improving mental health education and intervention among first-generation college students in China.

KEYWORDS

subjective well-being, social trust, self-compassion, social empathy, first-generation college students (FGCS), COVID-19, China

1. Introduction

First-generation college students are generally defined as those students whose parents have not attained college education or a college degree (Ishitani, 2006; Schwartz et al., 2018). Many scholars have examined the challenges faced by these students at university from a deficit perspective. They suggest that compared to non-first-generation college students, the lack of resources (e.g., financial, social-classical, cultural) of first-generation college students contributes to their difficulties at university, including academic experiences, cultural

adaptation, and career management (see the literature review in Tian and Yu, 2021). However, other scholars have explored the psychosocial advantages of first-generation college students from an advantage perspective. Positive psychosocial forms of capital include mental resilience, self-efficacy, optimism, hope, responsibility, and a sense of purpose (e.g., Wright et al., 2013; Xie, 2016; Tian and Yu, 2021). These complex characteristics may be connected to these students' mental health and well-being (e.g., Ellis et al., 2019; McCarron, 2022). At present, the number of first-generation college students in China accounts for 46.8–75% of all Chinese college students (Jiao, 2020). Some studies have suggested that these Chinese students are also disadvantaged at university, as is also the case for students in other countries (Tian and Yu, 2021; Fang and Lu, 2022). However, few researcher has focused on the positive psychosocial development of first-generation students in China, especially their mental health and well-being during the COVID-19 pandemic. Studies have found that the social life, mental health, life satisfaction and subjective well-being of college students around the world, including China, have been negatively affected by the COVID-19 pandemic since 2020 (Li et al., 2020; Wang and Zhao, 2020; Hagedorn et al., 2022). Thus, it would be useful to investigate the subjective well-being of first-generation college students in China.

The literature has concluded that the lack of family social and cultural capital negatively affects first-generation college students' performance (e.g., academic, communication) at university (Soria and Stebleton, 2012; Lu and Hu, 2015; Fang and Lu, 2022), which may in turn reduce their subjective well-being index. Social capital theory (e.g., Putnam, 1993; Lin, 2001) holds that social capital is positively associated with people's health and well-being. As the core element of social capital (e.g., Putnam, 1993), social trust moderates the negative effects of perceived COVID-19 stress on anxiety (Li and Lyu, 2021) and promotes people's subjective well-being (e.g., Helliwell et al., 2014). Therefore, it seems reasonable to assume that social trust is positively related to subjective well-being among first-generation college students in China.

First-generation college students may experience difficulties with self-cognition and social interaction due to a shortage of family social and cultural capital, which might negatively affect their self-compassion and social empathy (Zhou and Bao, 2013; Lu and Hu, 2015; Fang and Lu, 2022). Healthy and nonjudgmental understanding of oneself is at the core of self-compassion (Neff, 2003a). When individuals have a high level of social trust, this contributes to their engagement in interaction, solidarity, and assistance (Kanovsky and Halamová, 2020), promotes empathy toward others (Bradshaw et al., 2019), and reduces serious conflicts and exclusionism among different groups in society (Thomsen et al., 2021). Moreover, in previous studies subjective well-being was positively related to self-compassion (e.g., Yang et al., 2016) and social empathy (e.g., Wei et al., 2011). These findings show that subjective well-being, social trust, self-compassion, and social empathy are closely associated.

In summary, few study has explored the relationship between trust in society and subjective well-being, as mediated through self-compassion and social empathy. Therefore, this study sought to investigate the serial mediation effects of self-compassion and social empathy on the association between social trust and subjective well-being, based on data from an online questionnaire.

2. Literature review and research hypothesis

2.1. Subjective well-being and social trust

Well-being is one of the ultimate goals of human life. Subjective well-being is defined as the subjective perception, evaluation, and satisfaction of quality of life (Campbell et al., 1976). Easterlin (1974) discussed the relationship between economic growth and income and well-being in 1974. The cross-sectional data showed that economic growth significantly impacted well-being, and that individuals' income levels were positively related to well-being. Since then, different scholars have gradually discovered many complex factors that have an impact on subjective well-being. Alesina et al. (2004) divided these influencing factors of well-being into two categories: personality characteristics, including age, gender, ethnicity, education, health, and marital status; and social characteristics, including unemployment rate, income inequality, politics, and institutions. According to social capital theory (Putnam, 1993; Lin, 2001), social capital resources, which are embedded in various social networks at macro and micro levels and generated through interactions and relationships among people, can enhance people's well-being. One study even concluded that social capital had stronger impact on subjective well-being and life satisfaction than other factors, including income (Bjørnskov, 2003). In addition to academic-related factors, some studies argued that psychosocial capital had significant effects on the subjective well-being of first-generation college students (Wang and Castañeda-Sound, 2011; Wright et al., 2013; McCarron, 2022). First-generation college students perform worse than other college students (e.g., in their academic performance) due to a lack of psychosocial capital, which has a detrimental impact on their life satisfaction and subjective well-being (Pascarella et al., 2004; Soria and Stebleton, 2012; Garriott, 2020).

Social trust is the core of social capital (e.g., Putnam, 1993). According to previous literature (e.g., Lin, 2001; Jing and Yang, 2013; Kye and Hwang, 2020; Li and Lyu, 2021), an individual's attitudes of trust in people at the micro level and trust in organizations at the macro level constitute their overall trust attitudes for society. Trust in people, as the individual's general trust attitude toward most people in society, usually does not mean specific trust in acquaintances (Peng, 2000; Uslaner, 2002; Iacono et al., 2021) and does not depend on people's own interpersonal relationships (Lewis and Weigert, 1985). Trust in organizations refers to people's general trust attitudes toward most organizations in society, including governmental and non-governmental organizations (e.g., Kye and Hwang, 2020). Social trust contributes short-term altruism and long-term self-interest (Putnam, 1993). Trust in people can positively predict an individual's subjective well-being and life satisfaction (e.g., Helliwell et al., 2014). People who reside in cities with high levels of social trust have a higher level of well-being than those who reside in cities with low levels of social trust (Lu et al., 2020). Organizational trust (e.g., government, social groups, and enterprises) has been closely linked to well-being and life/job satisfaction (e.g., Hu and Xiao, 2021; Johannsen and Zak, 2021). Some studies on the relationship between social trust and subjective well-being are considered to suffer from the problems of potential endogeneity (Awaworyi Churchill and Mishra, 2017). However, Lu et al. (2020) confirmed a causal relationship between social trust and subjective well-being based on longitudinal evidence.

Many studies on the association between social trust and well-being have been conducted in developed countries, but there has been an insufficient focus on developing countries. A few scholars have begun to focus on this issue in China in recent years. Bai et al. (2019) concluded that Chinese trust in strangers was positively related to subjective well-being. A longitudinal study argued that social trust significantly positively predicted the subjective well-being of Chinese individuals, including college students (Lu et al., 2020). Additionally, some researchers suggested that trust in organizations (e.g., government and enterprise) was positively associated with Chinese subjective well-being (e.g., Qi and Lai, 2013; Hu and Xiao, 2021; Wang et al., 2021).

On the basis of the above findings, we formulated a hypothesis about the relationship between social trust and subjective well-being.

> *H1*: Social trust, including trust in people and organizations, positively predicts subjective well-being among first-generation college students in China.

2.2. Mediator of self-compassion

Self-compassion is the ability to regard one's feelings of suffering with a sense of warmth, connection, and concern (Neff, 2003a,b). Traditional compassion or pity focuses only on the suffering of others. However, Neff (2003b) argued that self-compassion is a healthy self-attitude, which emphasizes self-kindness, self-concern, and self-understanding. Self-compassion implies a positive self-concept and self-connection. People with self-compassion who encounter difficulties and setbacks can increase their positive emotions and the level of well-being through encouraging themselves to take positive actions (Neff, 2003a; Neff et al., 2008; Bluth et al., 2017). Although first-generation college students suffer from several disadvantages, their positive self-concept has been confirmed to profoundly impact their subjective well-being (Wang and Castañeda-Sound, 2011). Moreover, studies in different cultural contexts, such as China, Thailand, and the United States, demonstrated that self-compassion is positively related to subjective well-being and life satisfaction (Neff, 2003a; Neff et al., 2008; Yang et al., 2016). During the COVID-19 pandemic, self-compassion reduced individuals' fear of the virus and enhanced their subjective well-being (Deniz, 2021).

Although the relationship between social trust and self-compassion has received little attention, some studies have concluded that trust is closely related to self-compassion. Crocker and Canevello (2008) found that interpersonal trust among adolescents was positively related to self-compassion, while a study of Chinese high school students concluded that self-compassion was positively associated with general trust (Yang et al., 2019). Social trust reflects an individual's pro-sociality and goodwill toward society as a whole (Putnam, 1993; Crocker and Canevello, 2008), and includes people' self-kindness and self-concern. Moreover, Kudesia and Reina (2019) concluded that interacting with trustworthy people could predict college students' mindfulness, a core component of self-compassion (Neff, 2003a,b). Extending these findings to the association between social trust and self-compassion, we speculate that social trust contributes to healthy self-concern and self-kindness, as well as reducing negative emotions and enhancing subjective well-being.

On the basis of these evidences, we proposed a hypothesis regarding social trust, self-compassion, and subjective well-being.

> *H2*: Self-compassion mediates the relationship between social trust and subjective well-being among first-generation college students in China.

2.3. Mediator of social empathy

"Social empathy is the ability to understand people by perceiving or experiencing their life situations and as a result gain insight into structural inequalities and disparities" (Segal, 2011, pp. 266–267). Traditionally, interpersonal empathy occurs between individuals or in small groups. However, Segal et al. (2017) claimed that based on a deep understanding of the context, social empathy emphasizes empathy for heterogeneous groups, especially vulnerable or minority groups. Empathy among college students is an altruistic behavior that also promotes other altruistic behaviors (Li et al., 2015; Segal et al., 2017). The empathy-altruism hypothesis holds that the core motivation and ultimate purpose of empathy is altruism, i.e., meeting other people's needs and increasing the spiritual or material well-being of others (Batson et al., 2015). However, some scholars suggest that people have an emotional stake in promoting the welfare of others, i.e., increasing their own life satisfaction and happiness (de Waal, 2008). The faculty of College of New Jersey supported first-generation college students to gain empathy and understanding during the COVID-19 pandemic, helping them to succeed and improving the effectiveness and satisfaction of teaching (Chan et al., 2020). Previous studies have supported the positive association between social empathy and subjective well-being (Segal, 2012). Moreover, Wei et al. (2011) confirmed that the higher the empathy of college students, the higher the level of their subjective well-being.

Little attention has been given to the relationship between social trust and social empathy. Social capital theory holds that social trust implies social understanding and social support for others (Putnam, 1993). Social trust has been suggested to promote acceptance of minorities (see the literature review in Thomsen et al., 2021), which was consistent with the connotation of social empathy. Furthermore, Petrocchi et al. (2021) confirmed that college students' trust beliefs in other people could predict their empathy. People's trust within patient online communities is considered to positively influence their empathy (Zhao et al., 2013). Accordingly, these findings support the positive relationship between social trust and social empathy.

Extrapolating these findings to first-generation college students, social trust could promote their understanding and support for others, enable them to empathize with others, and ultimately enhance their level of life satisfaction and well-being. Thus, we proposed a relationship linking social trust, social empathy, and subjective well-being.

> *H3*: Social empathy mediates the relationship between social trust and subjective well-being among first-generation college students in China.

2.4. Serial mediation effects of self-compassion and social empathy

Social capital theory (Putnam, 1993; Lin, 2001) holds that through social interaction and relations with others, people can gain tangible and intangible resources, i.e., social capital, at the individual, group, and organizational levels; and social capital brings material or spiritual benefits to individuals, groups, organizations, and even nations, including promoting well-being. These social relational networks should also include the connection and relationship with oneself. Self-compassion, as a sense of healthy self-concern, self-attitude, and self-connection (Neff, 2003b), has been closely associated with well-being (Yang et al., 2016; Bluth et al., 2017; Deniz, 2021), and should promote interpersonal interaction and concern, as well as empathy for others (Neff, 2003a). Furthermore, social empathy, built on individual empathy and applied empathy to social systems, emphasizes the deep understanding of different people and communities in society (Segal, 2011). It implies indirect and direct connections and social interaction between individuals and other people or organizations in society, which contribute to the well-being of individuals or the whole society (Wei et al., 2011; Segal, 2012). Thus, we proposed a serial two-mediator model exploring social trust, self-compassion, social empathy, and subjective well-being.

> *H4*: Self-compassion and social empathy serially mediate the relationship between social trust (e.g., trust in people and organizations) and subjective well-being.

3. Materials and methods

3.1. Procedure and participants

In this study, an overall sampling method was used to select students from six colleges at a university in the city of Chongqing, China for participation in a questionnaire survey. The students were informed that their participation in a survey on college students' attitudes toward social life was on a voluntary basis. The survey was conducted anonymously and the students gave their consent for the researchers to use the survey data for scientific research purposes. The researchers sent a link of the online questionnaire to the participants via a professional survey website[1]. All participating students were required to complete five questionnaires, including a basic personal information questionnaire, the Social Trust Questionnaire, the Social Empathy Index Scale, the Self-Compassion Scale (Short Version), and the Index of Subjective Well-being Scale.

We collected a total of 1,049 questionnaires. If only one parent had a bachelor's degree or higher degree ($n = 354$), these data did not meet the requirements and were excluded from the analysis. Then we eliminated the invalid questionnaires ($n = 33$) that were completed too quickly and with invalid answers. Finally, we collected 662 valid surveys of first-generation college students. The participants included 362 male students (54.7%) and 300 female students (45.3%): 321 freshmen (48.5%), 169 sophomores (25.5%), 114 juniors (17.2%), and 58 seniors (8.8%). There were 344 students from rural areas (52%), 212 from towns (32%), and 106 from urban areas (16%). All participants were at least 18 years old.

The Harman one-way test was used to test for the presence of a common method bias effect. Factor analysis was performed on all questionnaire items and the results showed that the variance explained by the first principal component was 20.07% (<40%). Therefore, there were no significant common method bias effects among the variables in this study.

3.2. Measures

3.2.1. Dependent variable

Subjective well-being was measured using the Index of Subjective Well-being Scale (Campbell et al., 1976), which contains nine items across two parts (see Supplementary Appendix): the index of general affect containing eight items (e.g., "What is the affective state you are experiencing now?") and the life satisfactory questionnaire containing one item (i.e., "How satisfied are you with your whole life recently?"). A 7-point rating scale was applied, ranging from "strongly disagree (1)" to "strongly agree (7)." The weighted sum score of the two parts was used to examine the level of overall subjective well-being. A higher score indicates a higher level of subjective well-being. This scale is widely used in China (Shi et al., 2018), and the validity coefficient between the index of general affect and life satisfaction questionnaire was 0.55 (Wang et al., 1999). The Omega coefficient of the Index of Subjective Well-being Scale in this study was 0.919.

3.2.2. Independent variable

Based on the existing literature (e.g., Ma, 2017; Lundberg and Abdelzadeh, 2019; Kye and Hwang, 2020; Iacono et al., 2021; Roychowdhury, 2021), eight questions were developed to measure social trust in this research (see Supplementary Appendix). Trust in people was assessed using six items (e.g., "In general, do you agree that most people can be trusted?"), and trust in organizations was assessed using two items (e.g., "In general, do you agree that most governmental organizations can be trusted?"). The questionnaire was scored on a 5-point Likert scale (1 = completely disagree, 5 = completely agree). We used the sum score of participants' trust in people and organizations as overall social trust. The higher the score, the higher the level of social trust. In our research, the omega coefficient of overall social trust was 0.871.

3.2.3. Mediator variables

One of the mediator variables in this study was self-compassion, which was measured with the Self-Compassion Scale-Short Form (Raes et al., 2011). The scale has 12 items across six sub-dimensions (see Supplementary Appendix): over-identification (two items, e.g., "When I'm feeling down I tend to obsess and fixate on everything that's wrong."), self-kindness (two items, e.g., "When I'm going through a very hard time, I give myself the caring and tenderness I need."), mindfulness (two items, e.g., "When something painful happens, I try to take a balanced view of the situation."), isolation (two items, e.g., "When I'm feeling down, I tend to feel like most other people are probably happier than I am."), common humanity (two items, e.g., "I try to see my failings

1 https://www.wjx.cn

as part of the human condition."), and self-judgment (two items, e.g., "I'm disapproving and judgmental about my own flaws and inadequacies."). The form is scored on a 5-point rating scale (1 = almost never, 5 = almost always). We took the sum scores of all parts of the scale to represent the overall level of self-compassion. Higher scores indicate better self-compassion. This scale showed adequate internal consistency (Cronbach's alpha ≥0.86) and a very good correlation with the long form of the Self-Compassion Scale ($r \geq 0.97$) (Raes et al., 2011). The omega coefficient of the total scale in this study was 0.717.

Social empathy was another mediator variable in this study. It was measured with the Social Empathy Index Scale (Segal et al., 2017). This scale contains 40 items across seven parts (see Supplementary Appendix): affective response (five items, e.g., "When I see someone being publicly embarrassed I cringe a little."), emotion regulation (four items, e.g., "Emotional stability describes me well."), affective mentalizing (four items, e.g., "I am good at understanding other people's emotions."), perspective-taking (five items, e.g., "I can imagine what the character is feeling in a good movie."), self-other awareness (four items, e.g., "I can tell the difference between my friend's feelings and my own."), contextual understanding of systemic barriers (nine items, e.g., "I believe adults who are in poverty deserve social assistance."), and macro self-other awareness/perspective taking (nine items, e.g., "I confront discrimination when I see it."). According to the actual situation in China, we revised some of the items, i.e., "different racial groups" and "in the United States' educational system" were replaced with "different ethnic groups" and "in the Chinese educational system," respectively. It is scored on a 6-point rating scale (1 = never, 6 = always). The sum score of seven parts of the scale was used to indicate the social empathy index. Higher scores indicate higher levels of social empathy. The Social Empathy Index Scale was widely used with college students (Segal, 2012), and the internal consistency of the scale was examined (Cronbach's alpha ≥0.86) (Wagaman et al., 2018). The omega coefficient of this scale in this study was 0.927.

3.2.4. Control variables

Considering the possible important effects of demographic variables, we also controlled for other demographic variables (e.g., gender, grade, and district) to reduce omitted variable bias. The existing literature confirmed that demographic factors, especially gender, were likely to be associated with social trust and subjective well-being (e.g., Bai et al., 2019; Lu et al., 2020). Lu et al. (2020) suggested that the well-being of male and urban residents was more easily influenced by social trust in China, compared with the well-being of female and rural residents. Moreover, some scholars have reported demographic differences among first-generation college students (e.g., gender, grade, and district; review in Jiao, 2020), with some Chinese scholars controlling for demographic variables (e.g., gender) in their studies (Xie, 2016; Jiao, 2020). Therefore, we included gender, grade, and domicile district in the model as control variables, all coded as dummy variables. Gender was coded as 1 = male and 2 = female. Grade was coded as 1 = freshman, 2 = sophomore, 3 = junior, and 4 = senior. Domicile district was coded as 1 = participants from rural areas, 2 = participants who lived in towns, and 3 = participants from urban areas.

3.3. Statistical analysis

We used SPSS 27.0 and AMOS 24.0 to conduct the statistical analysis. First, SPSS was used to conduct descriptive statistics and correlational analysis. Then, AMOS 24.0 was used to conduct a path analysis of the tested model with the maximum likelihood estimation. In addition, the bootstrap method with a sample size of 5,000 was used to test the mediation effects of self-compassion and social empathy on the relationship between social trust and subjective well-being, and the path coefficient of the mediation effect was calculated and reported.

4. Results

4.1. Descriptive statistics and correlation analysis

Table 1 shows the descriptive statistics and correlation coefficients between the variables. The results of the correlation analysis show that the correlation among all of the variables is significantly positive ($p < 0.001$). It indicated that subjective well-being was significantly correlated with overall social trust, trust in people, trust in organizations, self-compassion, and social empathy. The results indicated that the mean value of trust in organizations was greater than the mean value of trust in people ($t = 27.447$, $df = 661$, $p < 0.001$, Cohen's $d = 0.515$) among the first-generation college students in China.

4.2. Serial mediation effects of social trust and subjective well-being

The overall fit of the tested model was analyzed using AMOS 24.0. The results showed acceptable model fit indices ($\chi^2/df = 1.49$, CFI = 0.988, TLI = 0.960, SRMR = 0.024, and RMSEA = 0.027). We included gender, grade, and domicile district as control variables, and used the bootstrap method ($n = 5{,}000$) to test the serial mediation effects of social trust on subjective well-being. Figure 1 shows the results of the path analysis, while Table 2 shows the effect values of the indirect and direct pathways. The results demonstrated that social trust had a significant positive direct effect on subjective well-being ($\beta = 0.142$, $p < 0.001$). Hypothesis 1, that overall social trust positively predicts subjective well-being, was verified.

The path coefficient between social trust and self-compassion was 0.162 ($p < 0.001$), indicating that social trust significantly positively predicted self-compassion. The path coefficient between self-compassion and subjective well-being was 0.291 ($p < 0.001$), showing that self-compassion significantly partially mediated the association between social trust and subjective well-being ($\beta = 0.047$, $p < 0.001$, 95% CI: 0.024, 0.076). Additionally, the mediation effect of self-compassion explained 20% of the total effect. Hypothesis 2 was supported.

The path coefficient between social trust and social empathy was 0.174 ($p < 0.001$), and the path coefficient between social empathy and subjective well-being was 0.224 ($p < 0.001$). This indicates that social empathy partially mediated the relationship between social trust and subjective well-being ($\beta = 0.039$, $p < 0.001$, 95% CI: 0.018, 0.066). The

TABLE 1 Descriptive statistics and correlations among the variables.

Variable	Mean	*SD*	1	2	3	4	5
1. Social trust	24.24	3.89	1				
2. Trust in people	6.89	1.29	0.981***	1			
3. Trust in organizations	24.24	4.87	0.813***	0.684***	1		
4. Self-compassion	159.35	24.99	0.161***	0.162***	0.117***	1	
5. Social empathy	39.46	4.83	0.207***	0.201***	0.178***	0.239***	1
6. Subjective well-being	41.62	8.76	0.238***	0.229***	0.208***	0.327***	0.372***

***$p < 0.001$.

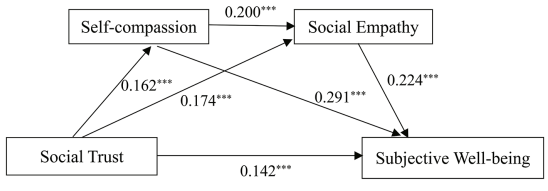

FIGURE 1
Path analysis of social trust, self-compassion, social empathy, and subjective well-being. ***p<0.001.

mediation effect of social empathy explained 16.59% of the total effect. Hypothesis 3 of this study was supported.

The path coefficient between self-compassion and social empathy was 0.200 ($p < 0.001$), indicating that self-compassion was closely associated with social empathy. These results revealed the serial mediation effects of self-compassion and social empathy between social trust and subjective well-being ($\beta = 0.007$, $p < 0.001$, 95% CI: 0.003, 0.014). The serial mediation effects explained 2.98% of the total effect. Hypothesis 4 of this study was supported.

Furthermore, we examined the serial mediation effects of self-compassion and social empathy on the association between trust in people and organizations and subjective well-being. Figure 2 shows the path analysis. The results presented that trust in people did not have a significant direct effect on subjective well-being ($\beta = 0.078$, $p > 0.05$). The path coefficient between trust in people and self-compassion was 0.148 ($p < 0.05$), while the path coefficient between self-compassion and subjective well-being was 0.292 ($p < 0.001$). In addition, trust in people had a marginally significant effect on social empathy ($\beta = 0.100$, $p \leq 0.05$), and had a significant effect on subjective well-being ($\beta = 0.223$, $p < 0.001$).

Considering that the direct effect of trust in people on subjective well-being was not statistically significant, self-compassion and social empathy played fully mediating roles in the relationship between trust in people and subjective well-being ($\beta = 0.043$, $p < 0.05$, 95% *CI*: 0.011, 0.081; $\beta = 0.022$, $p < 0.05$, 95% *CI*: 0.001, 0.050, respectively). Moreover, the path coefficient between self-compassion and social empathy was 0.200 ($p < 0.001$). This revealed that self-compassion and social empathy had serial mediation effects on the relationship between trust in people and subjective well-being ($\beta = 0.007$, $p < 0.01$, 95% CI: 0.002, 0.015). Moreover, compared to trust in people, trust in organizations did not significantly predict self-compassion ($\beta = 0.021$, $p > 0.05$), social empathy ($\beta = 0.093$, $p > 0.05$), and subjective well-being ($\beta = 0.081$, $p > 0.05$).

5. Discussion

The results indicated that both overall social trust and trust in people positively predicted well-being, which is consistent with previous studies (e.g., Helliwell et al., 2014; Awaworyi Churchill and Mishra, 2017; Bai et al., 2019). The results showed that trust attitudes toward the society are a positive psychological resource for Chinese first-generation college students, and that trusting attitudes toward society could promote the students' well-being level (McCarron, 2022). The results of this study also illustrated that organizational trust did not significantly affect self-compassion, social empathy, and subjective well-being, which is inconsistent with the findings of previous studies (Awaworyi Churchill and Mishra, 2017; Hu and Xiao, 2021; Johannsen and Zak, 2021). Based on the interviews with first-generation college students, we found that their interactions with organizations were often characterized by positive interactions with certain special people, including their teachers, classmates, and even strangers who helped them. Giddens (1990) argued that individuals' trust in a social system was related to their trust attitudes toward specific persons. Therefore, we further speculate that, compared to the effects of trust in organizations, Chinese first-generation college students' subjective well-being and mental health are more significantly positively affected by trust beliefs in people.

The results showed that self-compassion partly mediated the relationship between social trust and subjective well-being, and fully mediated the relationship between trust in people and subjective well-being. Previous studies have demonstrated that self-compassion is closely associated with subjective well-being (Yang et al., 2016; Deniz, 2021). Trust in other people can enhance the students' healthy self-conception and self-compassion (Kudesia and Reina, 2019). We contend that first-generation college students developed positive psychosocial capital (e.g., general trust attitude) to overcome the various difficulties in university and improve the level of positive self-compassion and well-being.

The results indicated that social empathy was the partial mediator between social trust and subjective well-being, and fully mediated the association between trust in people and subjective well-being. The results were consistent with past studies (Wei et al., 2011; Segal, 2012; Zhao et al., 2013; Petrocchi et al., 2021). Some scholars have confirmed that social empathy is closely associated with subjective well-being (Wei et al., 2011; Segal, 2012). Social trust, especially trust in people, can positively affect empathy for others (Zhao et al., 2013; Petrocchi et al., 2021), and promote acceptance of minorities (Thomsen et al., 2021). General trust attitudes among first-generation college students indirectly promote the level of their life satisfaction and well-being by

TABLE 2 Analysis of the mediation effects of self-compassion and social empathy.

	β	SE	95% *CI*		Relative Mediating Effect
			Lower	Upper	
Direct effect	0.142	0.039	0.065	0.215	60.43%
Total indirect effect	0.093	0.019	0.058	0.133	39.57%
Indirect effect 1: ST➔SC➔SWB	0.047	0.013	0.024	0.076	20.00%
Indirect effect 2: ST➔SE➔SWB	0.039	0.018	0.018	0.066	16.59%
Indirect effect 3: ST➔SC➔SE➔SWB	0.007	0.003	0.003	0.014	2.98%

ST, social trust; SC, self-compassion; SE, social empathy; SWB, subjective well-being.

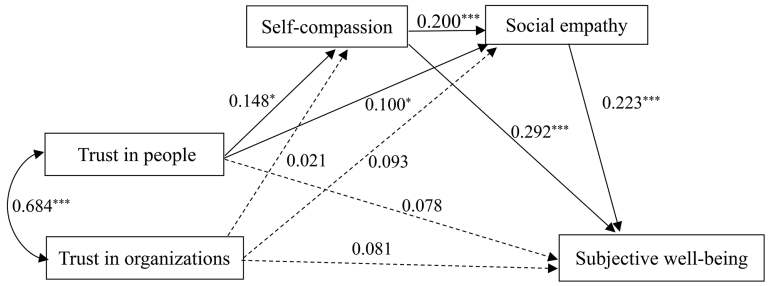

FIGURE 2
Path analysis of social trust in people and organizations, self-compassion, social empathy, and subjective well-being. ***$p<0.001$, *$p\leq0.05$.

improving the understanding, empathy and concern for other people and groups in society. The results of this study accord with but surpass the empathy-altruism hypothesis. Chinese first-generation college students, holding positive attitudes of social trust, have an emotional stake in understanding and empathy for society, thereby indirectly promoting their level of well-being.

The results of this study also indicated that self-compassion and social empathy have serial mediation effects between overall social trust, trust in people, and subjective well-being. The results were consistent with the past study (Neff, 2003a,b). Self-compassion emphasizes seeing one's own experience in light of the common human experience and entails compassion for all people, including oneself and others in society (Neff, 2003a,b). Previous studies suggested that self-compassion could promote feelings of concern and empathy for others (Barnard and Curry, 2011) and foster a sense of social connectedness and responding to others (Neff, 2003a,b). Compared to the situations of other students, the psychosocial and family capital of first-generation college students is more likely to be a disadvantage. However, their positive self-concept, self-care, and self-compassion contribute to the care, understanding, empathy, and support for other people or groups in society, and to improving the level of mental health and subjective well-being. This result is consistent with the viewpoint of social capital theory, which suggests that social capital could bring material or spiritual benefits to individuals, organizations, and even society as a whole. Therefore, enhancing positive trust attitudes toward society and positive self-attitudes among first-generation college students is important in promoting their well-being and empathic interactions with others.

In conclusion, this study has several valuable theoretical and practical implications. We found the serial mediating effects of self-compassion and social empathy on the relationship between trust in society, including in people, and subjective well-being. These findings enrich the mechanism of social trust on subjective well-being, and expand the literature on social trust by developing a model of the association between social trust, self-compassion, and social empathy. It is noted that this study found a stronger effect of trust in people on subjective well-being, rather than trust in organizations; and self-compassion fully mediated the relationship between trust in people and subjective well-being. Therefore, this study used a serial mediation model to examine the effect of common trust beliefs in society, especially in people, on the subjective well-being of first-generation college students in China.

Furthermore, the findings in this study also have valuable implications for university educators and first-generation college students. Helping these students to improve the level of well-being and satisfaction, including in their lives and academic performance, contributes to their mental health. For mental health teachers and other educators, a more focused measure should be developed to enhance the psychosocial capital of first-generation college students. Appropriate interventions may include education on trust in society, self-compassion education, and empathy training. In particular, it is important to help first-generation college students to develop a positive healthy self-concept and learn to be concerned and care for themselves. Therefore, our findings that self-compassion and social empathy fully or partially mediate the association between trust attitudes toward society, especially people, and subjective well-being have implications for the mental health education and interventions among first-generation college students in China.

The present study also has several limitations. First, the participants contained a large number of freshmen and a small number of seniors. Due to the survey being carried out not long before senior students' graduation in a university, many students were too busy to participate in the survey. Therefore, future studies should balance the samples across grades and different universities. Second,

we acknowledge that the data from this cross-sectional study could not examine the causal relationships between variables. Future longitudinal studies need to further validate the results of this study. Third, the results of this study were based on the sample of first-generation students in China. It is meaningful to compare Chinese first-generation college students and second-generation college students and analyze the differences in the later research.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

QW: conceptualization, methodology, and writing a draft of the manuscript. KZ: conceptualization, revise and perfect the thesis, and supervising. BY: reviewing, editing, and supervising. JC: translation and complete manuscript writing. All authors contributed to the article and approved the submitted version.

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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/fpsyg.2023.1091193/full#supplementary-material

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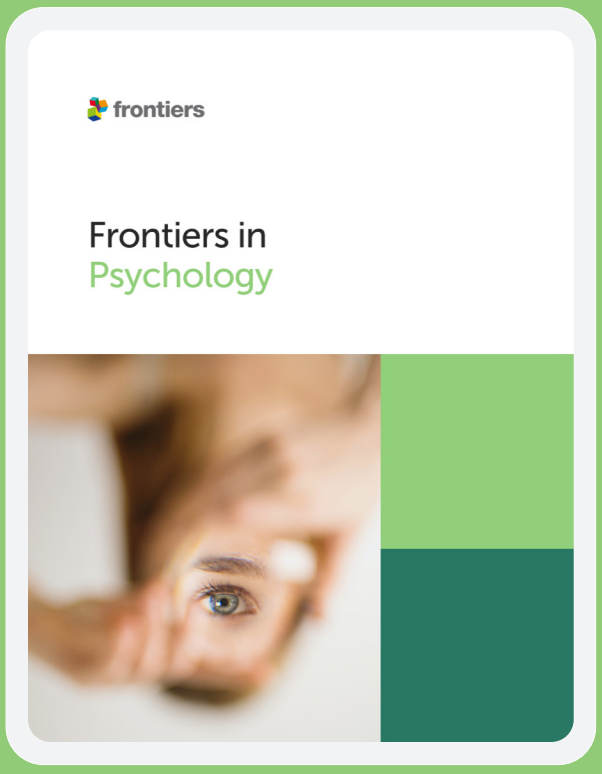

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