The causalities between learning burnout and internet addiction risk: A moderated-mediation model

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Abstract

This study explored how self-control and eudaimonic orientation are associated with learning burnout and internet addiction risk (IAR). Our results demonstrate that learning burnout has a significant and positive impact on IAR. The impulse system and control system play parallel mediating roles in the relationship between learning burnout and IAR. The relationship between learning burnout and IAR is moderated by eudaimonic orientation. Finally, the mediating role of the impulse system on learning burnout and IAR is moderated by eudaimonic orientation. With these findings, our study clarifies the mediating roles of the impulse system and control system in learning burnout and IAR and the moderating effects of hedonic orientation and eudaimonic orientation. Our study not only offers a new perspective for IAR research but also has practical implications for intervening in middle school students' IAR.

Keywords Learning burnout · Internet addiction risk · Self-control dual-system · Happiness orientation

1 Introduction

In the past, pathological network use was widely defined as the use of the internet causing psychological, social, learning or work difficulties in a person's life (Beard & Wolf, 2001). More recently, the internet has become an important part of people's

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daily lives (Pangrazio & Selwyn, 2018) and an important platform for teenagers to acquire knowledge, exchange ideas, and enjoy leisure and entertainment (Daoud et al., 2020). The internet is related to people's learning and work. With increasing use, the possibility of internet addiction risk (IAR) has also increased (Kayiş et al., 2016). A meta-analysis showed that from 1999 to 2021, the global prevalence of IAR increased significantly (Meng et al., 2022). The survey on the prevalence of IAR among adolescents showed that society should pay more attention to this problem. Indian research showed that the prevalences of moderate and severe pathological internet use among adolescents were 21.5% and 2.6% respectively, leading to the estimate that approximately one fifth of school adolescents are at risk of IA (Joseph et al., 2022). A German study examined 1268 adolescents aged 12–17 and found that the average prevalence of pathological network use was 43.69% (Paulus et al., 2022). Additionally, South Korean research showed that the IAR rate of teenagers aged 10 to 19 was 10.4% (677,000 addicts), which was the highest level among all age groups (Sejin & Kim Kyo, 2013). According to the 48th Statistical Report on the Development of Internet in China, as of June 2021, the number of internet users in China aged 6–19 had reached 158 million, accounting for 15.7% of the total number of internet users (CNNIC, 2021).

The internet has a great impact on middle school students. In the past, it has been used as a tool for entertainment for middle school students. They played games or chatted online in their spare time, and learning was a separate activity. However, in the era of the COVID-19 epidemic, schools were closed, and people were generally worried about infection. Many parents reduced their children's outdoor activities and social interactions. Middle school students had to take a large number of online classes, experiencing an unprecedented period of online learning, and spent more time learning, socializing and relaxing on the internet (Amidi Mazaheri et al., 2020; Huang et al., 2022). Therefore, compared with adults, middle school students are more prone to IAR (Amidi Mazaheri et al., 2020; Lu et al., 2018).

We believe that at present, it is not easy to identify IAR. However, in the current context of internet development, people are prone to IAR or overuse, with internet overuse being considered a high-risk or critical stage that precedes IAR. The fundamental difference between internet overuse and addiction is that when individuals end the state of overuse, there is no obvious discomfort or emotional reaction (Choi et al., 2009).

One reason for middle school students' IAR is external pressure, as peer pressure, academic pressure and social environmental pressure are risk factors for IAR. For example, several studies have revealed that peer pressure is the driving force of IAR among students (Muche & Asrese, 2021). Research on academic stress has suggested that high learning stress is positively correlated with the severity of mobile phone addiction (Li et al., 2020). In terms of the social environment, the prevalence of COVID-19 has had a negative impact on internet use, increasing the incidence and severity of IAR (Jahan et al., 2021; Liao et al., 2021). External pressure also affects IAR through individual coping style.

The second reason for middle school students' IAR is individual factors. As they confront many pressures, difficulties and academic challenges, some teenagers are unable to reasonably deal with and adjust to these and therefore project their unmet

concrete needs online to avoid problems and pressures, leading to IAR (Kuss et al., 2014). Recent research has found that individuals' cognitive, emotional and self-control abilities are all influencing factors of IAR (Wu & Li, 2021). The cognitive factors to maintain the excessive use of the internet are related to an individual's way of thinking, beliefs, opinions, and understanding of him-or herself, behavior, and the surrounding environment (Davis, 2001). Among these factors, cognitive control and the executive function of the ego are particularly important because impaired cognitive control may lead to limited and simplified perception of the situation, making it difficult to inhibit the response to the use of the internet (Cudo & Zabielska-Mendyk, 2019; Lopez-Fernandez et al., 2022). Specifically, self-control means consciously controlling one's own cognition, emotions and behaviors, and improving self-control can reduce the risk of internet overuse (Song & Park, 2019).

Adolescent IAR is also closely related to negative emotions. Some studies have shown that academic stress can affect adolescent IAR through negative emotions; specifically, adolescents who have experienced academic stress accompanied by negative emotions (anxiety, depression, burnout) are more likely to be at risk of internet overuse (Ranjan et al., 2021; Yusoff et al., 2021). Research on burnout in the field of education can be divided into three aspects: academic burnout, learning burnout and school burnout (Rahmati, 2015; Wang et al., 2019). The main task of teenagers is learning, which can easily cause learning burnout (Fengjun et al., 2022). Learning burnout, which can be regarded as an extension of general burnout, refers to a negative learning mentality, attitude and behavior, including emotional exhaustion, cynicism and low efficiency, due to pressure or lack of learning motivation (Wang et al., 2020). Academic burnout refers to a state of exhaustion characterized by extreme fatigue, decreased cognitive and emotional adjustment ability, and reduced psychological distance accompanied by depression and complaints (Schaufeli et al., 2020). Most studies on this type of burnout have focused on higher education, with college students as the main research objects (Wang et al., 2022; Yu et al., 2016). School burnout refers to responses to school-related stress that are characterized by emotional exhaustion and dissatisfaction with the school-related environment involving an aversion to the whole school (Parker & Salmela-Aro, 2011). In this study, middle school students were the research participants. Middle school students must attend classes, complete homework and deal with exams every day and are vulnerable to learning burnout (Wenkai et al., 2022). Therefore, in this study, we attempt to understand the relationship between the negative emotional state of middle school students' learning burnout and IAR.

In real life, IAR has a significantly negative influence on the health of middle school students: watching electronic screens for an extended period leads to eye fatigue, sleep problems, back pain and eating disorders (George et al., 2019). IAR will also cause psychological damage to middle school students and increase their risk for depression and anxiety (Jiang et al., 2022; Shan et al., 2021). However, the middle school period is an important stage for students to learn about themselves and determine their direction in life, when they usually undergo a key period of growth. At this time, middle school students also face multiple external pressures, and IAR occupies the time they could be using to study and consider practical problems, reducing their time for thinking about and exploring their life goals. Hence, they eas-

ily lose their direction on the road of life. It is therefore crucial to identify the influence mechanism of middle school students' IAR and provide a basis for the scientific prevention and effective control of middle school students' IAR.

Although previous research on IAR has theoretical and practical value, it also has some deficiencies. First, this research focuses on the impact of self-control on IAR, but self-control involves two forces, the impulse system and the control system. To accurately predict the results of self-control, we must also consider the impacts of these two aspects on IAR behavior. Second, teenagers, who are in a critical period of growth and development, will gradually form their outlook on life and values and establish their own lifestyle and goals under the influence of their family environment, school education and social culture. Do the latest generation of Chinese teenagers, who have grown up amid the impacts of materialism and individualism, want to live a "happy" or "meaningful" life? How will their updated pursuits of happiness affect their important life tasks (such as learning behavior) and IAR? Few extant studies have explored the impact of happiness orientation on middle school students' IAR. Finally, most interventions in middle school students' IAR are external, e.g., family, interpersonal or drug interventions (Khazaei et al., 2017; Lo et al., 2020). However, at present, internet overuse is a common phenomenon for middle school students (Munno et al., 2017). Under high learning pressure, middle school students are addicted to the anxiety of escaping from reality, and they are prone to fall into a vicious circle (Xiao, 2018). There are few opportunities for external intervention. Schools should alleviate students' overuse of the internet by improving their qualities and abilities.

To bridge the research gaps discussed above, we use the dual-system theory of self-control to theoretically and empirically investigate the mediating mechanism of the impulse system and control system between learning burnout and IAR. Based on positive psychology, we emphasize the variable of happiness orientation, discussing its influence mechanism on IAR, enriching the empirical research on this topic. We also explore the relationship between individual motivation and middle school students' IAR, prioritizing the influence of individual strength on altering addiction behavior.

This study thus contributes to several strands of future research. First, it has important theoretical value for enriching the research on happiness orientation and how happiness orientation affects middle school students' IAR behavior, providing a new approach for alleviating middle school students IAR. In addition, this study investigates the mediating mechanism of the impulse system and control system between learning burnout and IAR, facilitating the identification of where the problem of middle school students' IAR originates while providing more detailed information and a clearer direction for intervention. Third, this study focuses on the influence of individual strength on altering addictive behavior, which has a certain utility for intervening in and alleviating middle school students' IAR by cultivating its influencing factors.

1.1 Learning burnout and IAR

The pathological psychological mechanism of the IAR "compensation hypothesis" entails that IAR is occurs among teenagers when their psychological development is blocked. Many investigators have claimed that when teenagers' needs are not met in real life, they obtain a sense of self-identity and belonging by participating in online activities, enhancing their self-esteem and obtaining spiritual compensation (Chu, 2013). Twenty years ago, Chinese teenagers enriched their spiritual life through poetry, playing guitar and sports activities; however, contemporary teenagers are more inclined to indulge in the online world to obtain spiritual compensation. Thus, when teenagers do not meet their interpersonal needs in real life, they seek social communication in the online environment to compensate for their lack of social relations, increasing the possibility of internet overuse (Savci & Aysan, 2017). Middle school students are therefore more likely to indulge on the internet when their development is blocked. In middle school, learning is an important task for students, but learning burnout generally affects contemporary students (Luo et al., 2020; Zhang et al., 2021). The research on burnout originates from the service industry. Burnout refers to the emotional, mental and physical fatigue caused by excessive and long-term stress (Jeung et al., 2018). When burnout affects students, it is called learning burnout. Learning burnout is characterized by the psychological states of emotional exhaustion, depersonalization and a low sense of achievement, which are caused by curriculum pressure or other psychological factors (Ma et al., 2020). As pointed out by some researchers, students with learning burnout do not meet their needs via learning development, and their senses of learning achievement, self-efficacy and mental health are low (Lin & Huang, 2012; Lingard et al., 2007). The internet can thus enable students to obtain a sense of satisfaction and assuage the troubles caused by their learning burnout. However, if not promptly controlled, individuals can easily indulge online. Previous studies have explored the relationship between adult burnout and IAR, and they have found that job burnout is associated with a higher risk of internet addiction (Kuşaslan Avcı & Avni Şahin, 2017). Other studies have predicted that job burnout can serve as a negative coping mechanism for substance abuse or addictive behavior (Toth et al., 2021). Nevertheless, little attention has thus far been paid to the relationship between middle school students' learning burnout and IAR. Based on the "compensation hypothesis" and existing studies, we therefore propose the study's first hypothesis as follows:

H1: Learning burnout has a positive impact on IAR.

1.2 Parallel mediation model

Currently, the dual-system theory of self-control offers a unique method for explaining adolescent developmental problems (Connolly et al., 2020). Some researchers believe that self-control is a process that includes impulse and self-control. When an individual is faced with temptation, he or she needs to confront two hostile forces: the self-control force, which drives reasonable behavior, and the impulse force, which

encourages an individual to perform behaviors that match their desires (Hofmann et al., 2009). The internet offers unique temptations for middle school students whose psychological development remains immature. When middle school students confront the internet, their control system makes them restrain the impulse to indulge and use the internet normally, but their impulse system encourages them to obtain immediate happiness online, rendering them more prone to IAR. Empirical studies have also shown that impulsivity is significantly positively correlated with IAR (Xiao, 2018; Zhang, 2020), while time monitoring, emotion management and other qualities of self-control are significantly negatively correlated with IAR (Altiner Yas et al., 2021). Moreover, the power model of self-control indicates that self-control behaviors (including impulse suppression, emotion regulation, etc.) consume psychological resources and that the consumption of psychological resources partially induces a failure of self-control (Baumeister et al., 2016). Learning burnout causes middle school students to consume energy (Tang et al., 2021). Therefore, middle school students are in a state of emotional exhaustion and feel physically and mentally fatigued when learning burnout occurs. They may inhibit their learning burnout by forcing themselves to learn and completing learning tasks, which consumes psychological resources. When their psychological resources are exhausted, it is easier for them to lose self-control in the face of temptation, which makes it easier to indulge in internet overuse. Accordingly, to test the dual-system theory of self-control and the power model of self-control, we developed second hypothesis as follows:

H2: The dual-system of self-control plays a parallel mediating role between learning burnout and IAR.

1.3 Happiness orientation as a moderator

Although the negative emotional state of middle school students and learning burnout have a negative impact on their healthy development, learning burnout does not necessarily lead to a uniform degree of negative consequences and is affected by moderator variables. With the development of positive psychology 2.0, psychologists pay more attention to the protective factors for problem behavior, emphasizing the promotion of individual mental health by strengthening individual psychological resources and developing individual positive motivation (Keyes, 2007). Positive psychologists thus underscore happiness orientation, stressing that people can obtain happiness in two ways: eudaimonic orientation and hedonic orientation. Eudaimonic orientation refers to achieving happiness by realizing one's potential and completing meaningful activities; hedonic orientation refers to individuals' pursuit of immediate satisfaction to obtain happiness (Peterson et al., 2005). Studies have shown that different ways of pursuing happiness have different effects on middle school students' IAR. Psychological qualities related to eudaimonic orientation, such as achievement motivation, sense of purpose and sense of life meaning, can prevent IAR (González-Angulo et al., 2021; Zhao et al., 2020). Some studies have also shown that high feeling seeking, high impulsivity and other psychological traits associated with a hedonic orientation can reduce the risk for internet addiction (Blinka et al., 2016; Yen et al.,

2021). Accordingly, if students usually pursue meaning after generating negative emotions, they can delay their happiness and satisfaction through constructive activities; they are not prone to indulge online because the internet cannot bring a sense of meaning to their life (Cheng et al., 2012). Nevertheless, individuals who tend toward hedonism will spend more time online to obtain a positive experience after experiencing negative emotions (Vella-Brodrick et al., 2008). Concerning IAR, when middle school students experience learning burnout due to excessive pressure, some of them may attain short-term happiness by indulging online, but some students will enrich their life and achieve long-term happiness through other meaningful activities. In a society experiencing rapid economic development, people tend to pay more attention to immediate happiness and satisfaction without sufficiently focusing on the meaning of life. Moreover, middle school students are in a period of immature emotional regulation and self-control, and thus their pursuit of short-term happiness may increase their maladjustment and impulsive behavior (Wagner et al., 2014). Some studies have thus found a significant relationship between happiness orientation and addictive behavior (Yang et al., 2016), but few attempts have been made to explore the influence mechanism of happiness orientation on middle school students' learning burnout and IAR. Therefore, we propose the third hypothesis as follows:

H3: Happiness orientation moderates the relationship between learning burnout and IAR, and the moderating directions of eudaimonic orientation and hedonic orientation are opposite. That is, hedonic orientation plays a positive role and eudaimonic orientation plays a negative role in the influence of learning burnout on IAR.

1.4 A moderated mediation model

Happiness orientation reflects an individual's various value pursuits and behavior motivations. From the perspective of the relationship with the self, individuals with the hedonic orientation think that happiness is the satisfaction of self-desire, and pay attention to self-enjoyment; whereas individuals with the eudaimonic orientation believe that happiness is fully developing themselves and focus on self-improvement (Yang et al., 2016). From the perspective of the time dimension, happiness for hedonists is an immediate positive sensory experience, while individuals with the meaning orientation obtain more lasting happiness by realizing their potential and completing meaningful activities (Schueller & Seligman, 2010). The expansion construction theory of positive emotion reveals that positive emotions and resources form an interrelated positive feedback loop; positive emotions promote the expansion of thinking and action and help individuals build long-term resources. These resources in turn promote the development of individual mental health (Fredrickson, 2001). Specifically, studies have indicated that students who are satisfied with their performance in school express higher self-esteem, self-confidence and enthusiasm (Dou & Shek, 2021) and that they can thus build long-term resources. Middle school students with learning burnout, however, are in a negative emotional state, which will narrow the scope of their thoughts and actions, hampering their construction of resources.

Different happiness orientations impact individuals' positive emotions, attitudes and behaviors in disparate ways. Specifically, individuals with a hedonic orientation pay more attention to the satisfaction of their immediate happiness and engage in more hedonic and maladaptive behaviors. Their happiness is short-lived and will not lead to the development of lasting resources (Anić, 2014). Studies have found that the hedonic orientation is related to teenagers' IAR (Yang et al., 2016). An individual with a eudaimonic orientation invests more in behaviors that provide a sense of meaning to himself or herself and obtains a long-term sense of happiness, which is conducive to the construction of resources. Therefore, when intervening in problem behavior, we should pay more attention to the mitigation effect of eudaimonic orientation.

Middle school students with a eudaimonic orientation express concern for their self-improvement, pay attention to activities that bring a sense of meaning to their life, and engage in lasting positive emotional experiences. Hence, a eudaimonic orientation can help individuals construct resources and promote self-control. When motivated by a eudaimonic orientation, middle school students with learning burnout can therefore obtain high-level happiness by delaying their satisfaction through meaningful activities amid difficulties or restraining impulses, constructing lasting resources and carrying out self-control, which may help restrain their internet impulses and alleviate IAR. Additionally, researchers have explored whether people with a future-oriented time insight tend to have a stronger self-control ability, which reduces their risk of procrastination and internet addiction (Kim et al., 2017). Future orientation is related to the eudaimonic orientation (Bubić & Erceg, 2016); i.e., people who pay attention to the future are more likely to regard their sacrifice of present gratification as an investment in their future. When they have negative emotions, they can apply self-control to achieve more meaningful long-term goals, and they do not easily fall into IAR. Accordingly, we believe that the mediating effects of the impulse system and control system on the impact of learning burnout on IAR will be affected by a eudaimonic orientation. Thus, we propose the fourth hypothesis as follows:

H4: Eudaimonic orientation negatively moderates the mediating effect of the impulse system/control system on the relationship between learning burnout and IAR. When the level of eudaimonic orientation is high, the weaker the mediating effect of the impulse system/control system on the relationship between learning burnout and IAR will be.
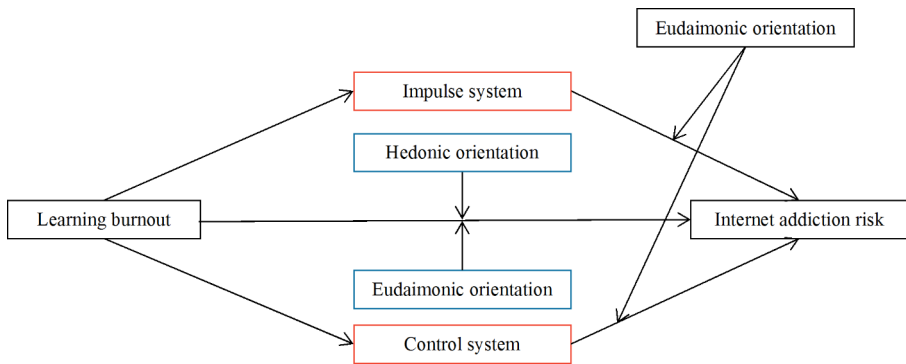
Based on the above analysis, below, Fig. 1 illustrates the study's conceptual framework.

2 Methods

2.1 Participants

This research was approved by the case school's mental health center. An anonymous self-report questionnaire was distributed to a random cluster sample of 554 Chinese

Fig. 1 A hypothetical model of learning burnout affecting internet addiction risk

middle school student volunteers (275 male and 279 female) with an age range of 13–18 years ($M = 14.82$ years, $SD = 1.87$ years) during their elective courses. We distributed the questionnaires in class, and all participants gave their informed consent and spent approximately 20 min completing every questionnaire item.

2.2 Measures

The Internet Addiction Risk Scale, compiled by Young (1998), was used to test the participants'IAR level. The scale includes four dimensions, compulsive internet use, tolerance, interpersonal and health problems and time management problems, with a total of 20 questions. Using the Likert 5-point scoring standard, which ranges from 1 (*almost none*) to 5 (*always*), the higher the total score, the more serious the individual's IAR. In this study, Cronbach's α was 0.73.

Student learning burnout scale. The middle school students' learning burnout scale, compiled by Hu and Dai (2007), has 21 questions comprising four dimensions: emotional exhaustion, low self-efficacy, teacher–student alienation and physiological exhaustion. Using 4-point scoring from 1 (*never*) to 4 (*often*), the higher the total score is, the higher the learning burnout. In this study, Cronbach's α was 0.84.

Dual system of self-control scale. The Chinese version of the adolescent dual system of self-control scale revised by Xie et al. (2014) was adopted. There are 21 questions in the scale, which is divided into two subscales: impulse system and control system. The impulse system subscale includes three dimensions: impulsivity, easy division and low delay satisfaction. The control system subscale includes two dimensions: problem solving and future time view. This scale uses 5-point scoring. Cronbach's α for the impulse system and control system was 0.88.

The orientation to happiness scale. This scale was compiled by Peterson et al. (2005) and revised by Shi et al. (2015). It contains 12 questions that include two dimensions: the eudaimonic orientation and the hedonic orientation. Each dimension contains 6 questions. A 5-point scale is adopted, where 1 represents "completely nonconforming" and 5 represents "fully conforming". The higher the total score of an individual on a certain dimension, the stronger the corresponding happiness orienta-

tion is. In the present study, the Cronbach's α for the eudaimonic orientation was 0.64 and the hedonic orientation was 0.75.

2.3 Statistical analyses

Data collected in this study were recorded on a computer and processed using SPSS 26.0. These data were analyzed in five steps. The first step used factor analysis to conduct common variance analysis to test for common method biases. The second step analyzed the scores of the four questionnaires using descriptive statistics and correlation analysis. The third step used Model 4 of PROCESS to evaluate the parallel mediation effects of the impulse system and control system. Fourth, Model 5 was used to test the moderating effect of happiness orientation on the relationship between learning burnout and IAR. Finally, we used Model 14 of PROCESS to evaluate the moderated mediation model.

3 Results

3.1 Common method biases test

This study used self-reported data, so there could be common methodological bias. The Harman single-factor method is often conducted via exploratory factor analysis (EFA). Through factor analysis, the contrast interpretation percentage of the extracted first common factor is observed to determine whether there is serious common method deviation. In this study, Harman single factor analysis was thus used to statistically test for common method deviation, and all items of our scale were entered into exploratory factor analysis. The results suggested that there were 18 factors with eigenvalues greater than 1 without rotation, which explained 61.42% of the variation and that the first factor explained 20.61% of the variation, which was less than 40% of the critical standard. Consequently, the test suggested that common method bias was not a major concern in this study.

3.2 Descriptive statistics and correlation analysis

Descriptive statistics and the correlation matrix of learning burnout, impulse system, control system, IAR, hedonic orientation and eudaimonic orientation are provided in Table 1. The results of the bivariate correlations showed that learning burnout was positively correlated with IAR ($p < 0.01$) and impulse system ($p < 0.01$), that learning burnout was negatively correlated with control system, that impulse system was positively correlated with IAR ($p < 0.01$) and hedonic orientation ($p < 0.01$), that control system was positively correlated with eudaimonic orientation ($p < 0.01$) and negatively correlated with a hedonic orientation ($p < 0.05$) and IAR. However, eudaimonic orientation was not significantly correlated with learning burnout ($p > 0.05$) and was not significantly correlated with impulse system ($p > 0.05$) and IAR ($p > 0.05$).

Table 1 Descriptive statistics and correlation matrix of variables

Variables	Mean	SD	1	2	3	4	5	6
1.Learning burnout	29.65	13.55	-					
2.Impulse system	29.02	8.47	.55**	-				
3.Control system	28.07	6.73	-.40**	-.45**	-			
4.Hedonic orientation	17.61	4.70	.41**	.42**	-.10*	-		
5.Eudaimonic orientation	16.77	3.34	-.08	.00	.38**	.15**	-	
6.Internet addiction risk	53.50	9.23	.53**	.57**	-.52**	.47**	.02	-

Note. $N = 554$, *p-value< 0.05, ** p-value< 0.01, *** p-value< 0.001

Table 2 The pathways of the parallel mediation model test

Note: all variables in the model have been standardized

Path	Effect value	Relative effect quantity	Bootstrap (95%CI)
Learning burnout→Impulse system→Internet addiction risk	0.58×0.32=0.19	35.19%	[0.14,0.24]
Learning burnout→Impulse system→Internet addiction risk	(-0.42)×(-0.28)=0.12	22.22%	[0.08,0.16]
Total mediating effect	0.31	57.41%	[0.25,0.37]
Direct effect	0.23	42.59%	[0.15,0.31]
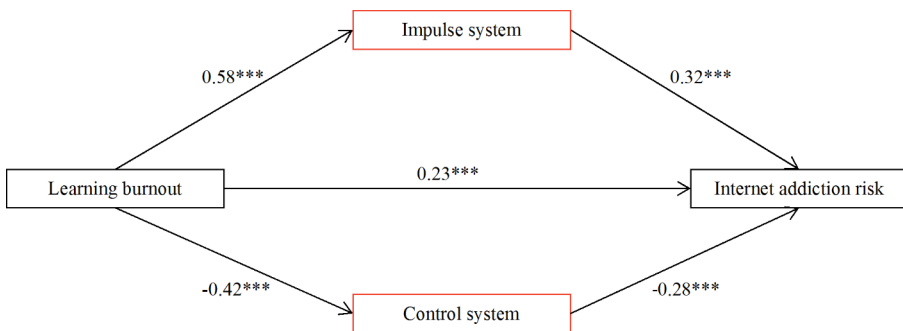
Fig. 2 Parallel mediation model

3.3 Parallel mediating effect of the self-control dual-system

PROCESS for SPSS (Model 4) was used to test the parallel mediation model. Table 2; Fig. 2 show all the results. Gender and grade were included in the control variables, with learning burnout as the independent variable, impulse system and control system as the intermediary variables and IAR as the dependent variable. The results showed that learning burnout can significantly and positively predict IAR ($\beta = 0.23$, $p < .001$). Therefore, H1 is supported. Learning burnout positively predicted the IAR impulse system ($\beta = 0.58$, $p < .001$), and learning burnout negatively affected the pre-

dictive control system (β=- 0.42, $p<.001$). The impulse system positively predicted IAR (β=0.32, 95%CI=[0.14–0.24], $p<.001$), and the control system negatively predicted IAR (β=-0.28, 95%CI=[0.08–0.16], $p<.001$). In addition, the 95% confidence interval of bootstrap does not contain 0. Consequently, the intermediary effect of the impulse system and control system reached a significant level. Hence, H2 is supported. The total mediating effect (0.31) accounted for 57.41% of the total effect (0.54).

3.4 Moderating effect of happiness orientation

3.4.1 Moderating effect of eudaimonic orientation

The moderating effect was analyzed by Model 5 in the PROCESS macro. The results of using learning burnout as the independent variable, impulse system and control system as the intermediary variables, and IAR as the dependent variable and entering the eudaimonic orientation into the model are provided in Table 3. These results show that learning burnout can significantly predict impulse systems and control systems (β=0.58, $p<.001$), that impulse systems can significantly predict network overuse (β=0.28, $p<.001$), and that control systems can significantly predict IAR (β=-0.37, $p<.001$). The product of learning burnout and eudaimonic orientation has a significant predictive effect on IAR (β=-0.10, $p<.001$). Eudaimonic orientation can therefore moderate the relationship between learning burnout and IAR.

To clarify the moderating effect, eudaimonic orientation was divided into high and low groups, and a simple slope analysis was carried out. Figure 3 illustrates how when eudaimonic orientation was low (M-1SD), the increase in IAR was very significantly related to the increase in learning burnout score ($β_{simple}$=0.32, $p<.001$). When eudaimonic orientation was high (M+1SD), amid an increase in learning burnout, IAR still increased, but the increasing trend was not as significant as that of low eudaimonic orientation ($β_{simple}$=0.13, $p<.05$).

Table 3 The moderating effect of the eudaimonic orientation

Dependent variables	Independent variables	R	R^2	F	β	t
Impulse system		0.57	0.32	65.88***		
	Learning burnout				0.58	16.11***
Control system		0.41	0.17	27.74***		
	Learning burnout				-0.42	-10.16***
Internet addiction risk		0.70	0.49	64.96***		
	Impulse system				0.28	6.94***
	Control system				-0.37	-9.51***
	Learning burnout				0.22	5.49***
	Eudaimonic orientation				0.17	4.71***
	Learning burnout× Eudaimonic orientation				-0.10	-2.71**

Note: all variables in the model have been standardized, * p-value<.05, ** p-value<.01, *** p-value<.001
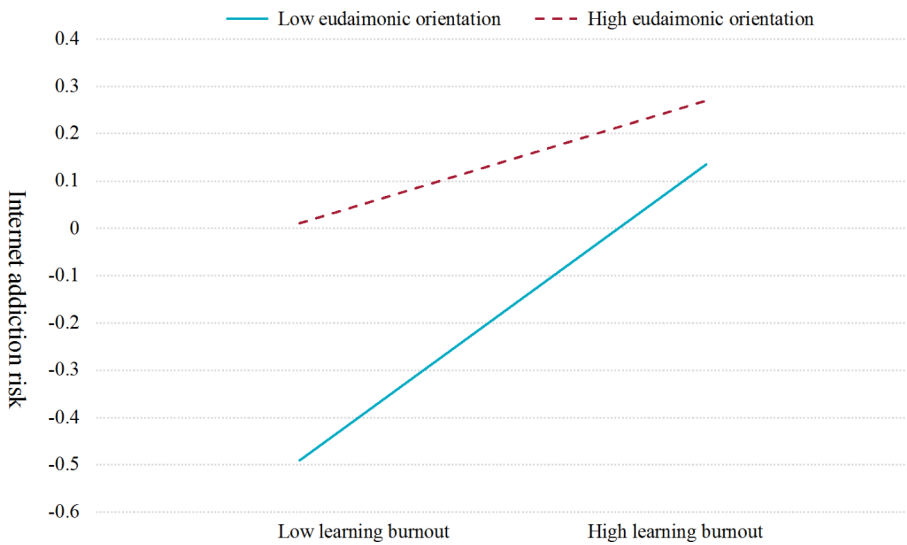
Fig. 3 Moderating effect of eudaimonic orientation on learning burnout and internet addiction risk

Table 4 Moderating effect of the Hedonic orientation

Dependent variables	Independent variables	R	R^2	F	β	t
Impulse system		0.57	0.32	65.88***		
	Learning burnout				0.58	16.11***
Control system		0.41	0.17	27.74***		
	Learning burnout				-0.42	-10.16***
Internet addiction risk		0.72	0.52	72.52***		
	Impulse system				0.23	5.51***
	Control system				-0.32	-9.29***
	Learning burnout				0.17	4.26***
	Hedonic orientation				0.28	7.86***
	Learning burnout× Hedonic orientation				-0.06	-1.86

Note:* p-value<.05, **p-value<.01, *** p-value<.001

### 3.4.2 Moderating effect of hedonic orientation

Model 5 in the PROCESS macro was used to analyze the moderating effect of hedonic orientation. Table 4 shows that hedonic orientation can positively predict IAR (β=-0.28, p<.001), but the product of learning burnout and hedonic orientation had no significant predictive effect on IAR (β=-0.06, p>.05), indicating that hedonic orientation cannot moderate the relationship between learning burnout and IAR.

Therefore, eudaimonic orientation can moderate the effect of learning burnout on IAR, but hedonic orientation cannot. Hence, H3 is partially verified.

Path	Eudaimonic orientation	Effect	Boot SE	Boot LLCI	Boot ULCI
Learning burnout→Impulse system→Internet addiction risk	Low	0.25***	0.03	0.19	0.32
	High	0.08***	0.02	0.02	0.13
	Difference	-0.17	-0.01	-0.17	0.19
Learning burnout→Control system→Internet addiction risk	Low	0.17***	0.02	0.13	0.23
	High	0.13***	0.02	0.09	0.18
	Difference	-0.04	0	-0.04	-0.05

Table 5 Moderated-mediation model

Note:* *p*-value<.05, ** *p*-value<.01, *** *p*-value<.001
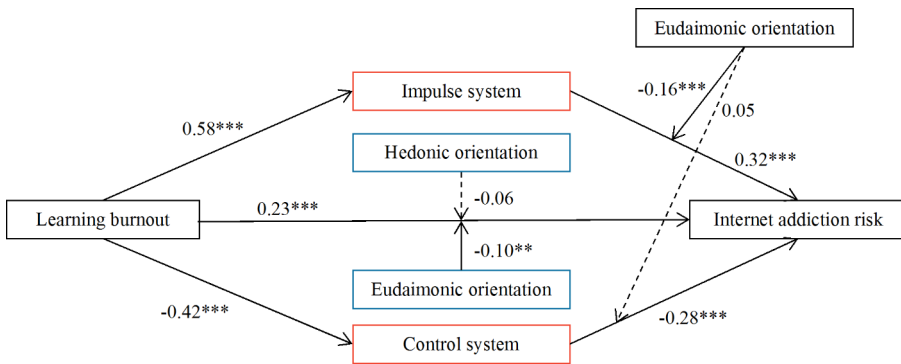
Fig. 4 Moderated-mediation model

3.5 Moderated mediation model test

First, the variables other than demographic variables, such as gender, grade and age, were standardized, and then all variables involved in the model were introduced by using the PROCESS macro program. Combined with the bootstrap test, the model estimation was made within the 95% confidence interval, and the repeated sampling was set to 5000. When the interaction items were significant and the mediating effects of the impulse system and control system were also different for different eudaimonic orientations, the moderating effect was significant. Our test results when using PROCESS Model 14 are shown in Table 5; Fig. 4.

According to these test results, eudaimonic orientation played a negative moderating role in the impact of impulse system on IAR (interaction term $p<.001$), but the moderating role of eudaimonic orientation between control system and IAR was not significant (interaction term $p=.09>.05$). H4 is thus partially verified. Meanwhile, the indirect effect of the impulse system on learning burnout and IAR was significant for low eudaimonic orientation (M-1SD) ($\beta=0.25$, $p<.001$), while for high eudaimonic orientation, the mediating effect of the impulse system on the influence of learning burnout on IAR was significant ($\beta=0.08$, $p<.001$). However, the mediating effects in the two cases were different ($\beta=-0.17$, $p<.01$, 95% CI [-0.13, 0.06]), and the relationship between impulse system and IAR was stronger in low eudaimonic

orientation. Thus, regarding the influence of learning burnout on IAR, eudaimonic orientation negatively moderated the mediation role of the impulse system.

4 Discussion

4.1 Relationship between learning burnout and internet addiction risk

Our findings show that middle school students' learning burnout has a positive predictive effect on IAR. This result is consistent with previous conclusions (Brand et al., 2014; Tomaszek & Muchacka-Cymerman, 2019) and verifies H1. This signifies that an increase in negative emotions, such as learning burnout, makes students more prone to an excessive use of the internet. On the one hand, middle school students face multiple pressures. For them, the internet is not only an information base but also a way to release pressure and obtain happiness. Middle school students can relieve pressure and improve their mood through internet use. They can also temporarily escape the difficulties they encounter in their life by indulging online. If individuals do not take the initiative to control such behavior, it may evolve into IAR. On the other hand, according to the "compensation hypothesis", individuals can use the internet to compensate for their own burnout. This not only suggests that negative emotions are an important influencing factor of IAR (Basri et al., 2022) but also that it is useful to explore the impact of individual negative emotions on middle school students' problem behavior in the internet era.

4.2 Parallel mediating effect of the self-control dual-system

We found that the prediction directions of the dual system of self-control for IAR are opposite: the impulse system positively predicts IAR, the control system negatively predicts IAR, and the impulse system and control system play a parallel intermediary role between learning burnout and IAR. This result verifies H2 as well as the dual system of self-control and power model of self-control (McClure & Bickel, 2014). Specifically, middle school students are eager to obtain instant happiness through the internet after they experience negative emotions but have a variety of learning tasks and exams. When they are addicted to the internet, they also engage two hostile forces, impulse force and control force. Therefore, improving middle school students' self-control ability plays an important role in reducing the negative impact of learning burnout on their IAR. Based on the dual-system theory of self-control, the impulse system and control system should also be considered when intervening in middle school students' IAR in the future. Such interventions should not only encourage middle school students to establish clear goals and improve their motivation and ability to think twice amid temptation but also reduce the intensity of students' impulsive processing. Consequently, we should emphasize self-control training to improve the self-control ability of middle school students to alleviate their IAR and promote their healthy development.

4.3 Moderating role of eudaimonic orientation

By analyzing the moderating effects of two different orientations on happiness, we found that eudaimonic orientation can moderate the effect of learning burnout on IAR and that the moderating effect of hedonic orientation is not significant. These results partially verify H3. Compared with middle school students with a high eudaimonic orientation, the learning burnout of students with a low eudaimonic orientation has a greater impact on IAR. Eudaimonic orientation can therefore alleviate the adverse effects of learning burnout.

The expansion construction theory of positive emotion holds that positive emotion and resources form an interrelated positive feedback loop; thus, positive emotions help individuals build long-term psychological and social resources, promoting individual emotional improvement (Fredrickson, 2001). A eudaimonic orientation is beneficial to human development because it constructs lasting resources for people (Jin et al., 2021). Students with a higher eudaimonic orientation pursue higher-level life meaning and pay attention to the realization of their long-term goals. They can resist current impulses and are not prone to addictive behavior, which is consistent with previous research conclusions (Weinstein et al., 2015). Therefore, middle school students with a high eudaimonic orientation are better able to tolerate IAR when it is accompanied by learning burnout, and IAR will not affect their normal life. Hence, if middle school students primarily guide their actions with a eudaimonic orientation and pursue their ideals, they can avoid becoming addicted to the internet due to negative emotions. When they tire of learning, they can increase their deep-seated happiness and promote self-growth through meaningful activities (Schueller & Seligman, 2010). In contrast, when motivated by a hedonic orientation, people who seek relaxation and enjoyment in life may choose outlets such as the internet and smartphones following learning burnout because the internet can bring them instant happiness and pleasure. However, this is only a short-term emotional improvement, which is not conducive to an individual's construction of long-term positive resources and sustainable development. Some studies, however, have shown that there is a significant positive correlation between hedonic orientation and IAR (Yang et al., 2016). It is possible that IAR behavior includes the motivation of a hedonic orientation. Therefore, hedonic orientation cannot alleviate the impact of middle school students' learning burnout on IAR. In the future, society and parents should thus pay attention to the life meaning education of middle school students, promoting their healthy growth.

This study also demonstrated that during the impact of learning burnout on IAR, eudaimonic orientation negatively moderates the mediating effect of the impulse system, but eudaimonic orientation cannot moderate the mediating effect of the control system. This result partially verifies H4. That is, eudaimonic orientation cannot moderate the mediating effect of the control system, which may be because control behavior is affected by multiple factors, i.e., not only state regulation variables, such as self-regulation resources and cognitive ability (Friese et al., 2008), but also trait regulation variables, such as trait self-control. Additionally, the control system needs to be completed through relatively slow control processing. The behavior of controlling IAR therefore involves the interaction of multiple factors, and the simple motivation factor of eudaimonic orientation cannot be significantly moderated. However, eudai-

monic orientation negatively moderates the mediating role of the impulse system, which suggests that when middle school students have a high eudaimonic orientation, it can reduce the negative impact of learning burnout on them, making it difficult for students to inhibit their impulses and increasing their risk for internet addiction. In contrast, when individuals employ a eudaimonic orientation as their action orientation, they will have a strong sense of life meaning and rich internal motivation. In turn, these individuals can better regulate their external behavior and performance, abandon more instinctive and impulsive life patterns, and surpass the simple and low-level pleasures provided by IAR. To acquire more valuable knowledge, students should constantly enrich and improve themselves and live a more meaningful life. Overall, the results of this study suggest that to alleviate middle school students' tendency to IAR, we should improve their level of self-control, reduce their impulsivity, and encourage middle school students to form a eudaimonic orientation to pursue happiness.

4.4 Limitations and prospects

The present study has some limitations. First, this study is based on existing research and has a relevant theoretical basis, but it is limited by our questionnaire method and cross-sectional research. That is, it is difficult to infer causality. In the future, we can explore the causality between the dual-system of self-control and IAR through experimental methods or use tracking research to investigate the impact of happiness orientation on students' IAR in different stages. Second, although this study examined the mediating effect of individual factors (self-control) and the moderating role of eudaimonic orientation, researchers should continue to investigate the important environmental variables that are closely related to middle school students' IAR, such as family environment and school atmosphere, to comprehensively explain the relationship between learning burnout and IAR. Finally, this study only provides a theoretical approach to and empirical support for the intervention of middle school students' IAR. We do not describe specific intervention measures. Future research can thus track the effect of interventions by carrying out mental health courses or life-meaning education activities.

5 Conclusion

Middle school students' learning burnout can significantly and positively predict their IAR. The impulse system and control system play a parallel mediating role in the relationship between learning burnout and IAR. The direct predictive effect of learning burnout on IAR is moderated by eudaimonic orientation, but the moderating effect of hedonic orientation is not significant. The mediating role of the impulse system in learning burnout and IAR is moderated by hedonic orientation.

Declarations

Ethical approval The submitted paper has not been published previously, that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

CRediT authorship contribution statement Yao Qin: Conceptualization, Data collection, Software, Writing – Original draft, Writing - review & editing. Shun Jia Liu: Conceptualization, Background analysis, Writing - review & editing. Xin Long Xu: Conceptualization, Modeling, Visualization, Organization design, grammar check & polish, Writing - review & editing, Supervision.

Consent to participate All authors read and approved the final manuscript.

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