



## Research article

# The relationship between short-form video use and depression among Chinese adolescents: Examining the mediating roles of need gratification and short-form video addiction

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## ABSTRACT

Short-form video apps, such as TikTok, have become popular worldwide. Compared to traditional social media, they have powerful push algorithms and are more entertaining, which might lead to some negative effects. Research has attempted to identify the relationship between short-form video use and depression, but the processes mechanism underly the relationship was few in number. The present study explored the association between short-form video use and depression among Chinese adolescents and analyzed the mediating roles of need gratification and short-form video addiction. The participants included 1302 senior high school students ( $M_{age} = 16.03$ ,  $SD = 0.76$ , 42.6 % boys). And a structure equation model with chain mediating was established using Mplus. The results showed (1) a direct association between short-form video use and adolescent depression, (2) that entertainment need gratification, social-related need gratification, and short-form video addiction acted as chain mediating factors, and (3) no gender difference in the model. The present study's findings revealed the important mediating role of addictive behavior between normal use behavior and depression and suggested that preventative and interventional plans based on need gratification should be developed to reduce short-form video addiction and improve mental health.

## 1. Introduction

Depression is one of the most commonly occurring mental disorders. In China, the problem of adolescent depression has become increasingly severe. According to the "Report on National Mental Health Development in China (2019–2020)", the detection rate of depressive symptoms in adolescents was as high as 24.6 % [1]. Adolescence is a time when depression develops rapidly and is an important period for early detection, early prevention and early treatment. To develop effective intervention and prevention programs, it is necessary to explore the influencing factors and mechanisms of depression.

Many factors are associated with depression [2–4], and internet-related usage (such as on computers and smartphones and social media use) has been proven to be an important factor that can lead to depression [5–7]. As researchers have obtained a further

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understanding of internet-related usage, they have begun to emphasize the distinct impacts of different internet applications [8–12]. Brand and his colleagues suggested an Interaction of the Person-Affect-Cognition-Execution model (I-PACE model) of specific internet use disorders [13]. The I-PACE model and Use and Gratification theory (U & G) both contend that need gratifications play a significant role in media use [13,14]. Different media are designed with a variety of features for diverse needs, including entertainment need and social interaction need. Therefore, people use specific internet applications rather than the general internet to meet their various psychological needs. However, when peoples' needs were met through the media, they develop the expectations of potential pleasure from more media use, which could lead to specific internet-use disorders and affect people's mental health [13,15]. Therefore, it is necessary to explore separately the different effects of specific internet applications and different needs.

Recently, short-form videos as a new kind of social media application (such as TikTok) have quickly gained popularity around the world, particularly among teenagers [16,17]. In contrast to traditional social media (such as Facebook and Instagram), short-form video apps are more entertaining and have powerful push algorithms [18], and offer highly engaging online world [19]. These apps focus on entertainment, rather than interpersonal interaction [20]. Therefore, short-form video might be more addictive than traditional social media and more likely to have negative effects on people's mental health [18,21,22]. However, to date, the effects of short-form video use on adolescent depression are still poorly understood [16,20,23,24]. In addition, more research is needed to explore the influence mechanism between short-form video use and depression. Short-form video addiction might play an important mediating role, and many previous studies have proven the positive association between internet-related addictive behaviors and mental health problems [25,26]. However, addictive behaviors and mental health problems are both nonadaptive, so they are supposed to be related. The more important task is to determine the mechanisms by which normal behavior (i.e., internet-related usage) turns into addictive behavior and even mental problems. According to the I-PACE model, psychological needs, as significant intrinsic drivers, might play an important role in the mechanisms [13]. However, previous studies mostly paid attention to entertainment needs and social needs while ignoring other needs, such as information need [15,19,27]. In addition, the gender difference got little attention in short-form video research. Therefore, to further our understanding of the influences of short-form video use, this study focused on the association between short-form video use and depression, explored the mediating roles of different need gratifications and short-form video addiction and discussed the gender difference.

### 1.1. Short-form video use and adolescent depression

As a new type of social media platform, TikTok and other short-form video apps have functions similar to social media and allow users to create and share various content [28]. Currently, people regularly use social media to contact others, share their lives, obtain information and find enjoyment [29]. According to the displacement hypothesis, time is a kind of limited resource; when people spend too much time on the internet, they reduce their time for learning, work, face-to-face communications and other beneficial events, which affects their mental and physical health [30–32]. Therefore, using short-form video apps might occupy the time of other beneficial activities and result in adverse consequences. For example, Liang and her colleagues found that short-form videos use was significantly positively related to depression among female college students [33], and Smith and Short found a positive association between short-form video use and loneliness among college students [21]. Therefore, we propose Hypothesis 1: Short-form video use is positively associated with adolescent depression.

### 1.2. The mediating role of need gratification

Need is a state reflecting a physical or mental deficiency that motivates a person to take action toward a goal [34]. The psychological needs gratified by using media are similar and overlap [35,36], including cognitive needs (such as information seeking), emotional needs (such as enjoyment and entertainment), social needs (such as communication and sharing) and tension-releasing needs (such as killing time) [14,37–39]. According to the characteristics of social media, researchers have summarized four kinds of needs that can be gratified by social media: entertainment needs, socializing needs, self-status-seeking needs and information-seeking needs [38,40]. As an emerging form of social media, short-form video apps can gratify entertainment need and socializing need [15,19,41].

Use and gratification theory (U&G) states that people use media to meet their needs, and media can meet peoples' various needs [14,37,42,43]. In addition, the I-PACE model predicts that after using the internet to meet needs, people will expect that continuing to use can lead to further gratification [13]. Need gratification may have a significant impact on the relationship between media use and mental health. Psychological needs that are gratified may help improve peoples' mental health; however, unmet needs might lead to a decrease in happiness, which is detrimental to mental health. Studies have found that using short-form video apps is positively associated with socializing needs [15,22]. Additionally, using short-form video can also make people experience flow, which meant intrinsically pleasant experience, and can result in people's entertainment needs being gratified [19,41,44,45]. When people's needs are met, their mental health may be influenced [46]. However, there are conflicting findings addressing how different psychological needs affect mental health. Some studies have shown that social need gratification can negatively predict adolescent depression [47, 48]. But Stockdale and Coyne found a relationship between entertainment need gratification and subsequent anxiety, which is harmful to mental health [49]. Moreover, Roberts & David found that for TikTok users, experiencing more flow state was related with higher levels of depression and anxiety [45]. Based on the U&G and related empirical studies, we propose Hypothesis 2: Need gratification plays a mediating role in the relationship between short-form video use and depression among adolescents, and different needs have different effects.

### 1.3. The mediating role of short-form video addiction

Short-form video addiction refers to the uncontrollable use of short videos, which has adverse consequences on real life [22]. Previous studies have found a positive relationship between the long-term use of digital devices and addiction-related behaviors [50, 51]. The strong entertainment function and powerful push algorithm based on big data make using short-form video apps extremely addictive [22]. Addictive behaviors might have various mental health comorbidities, such as depression, anxiety and attention-deficit/hyperactivity disorder (ADHD) [13].

The I-PACE model predicts that specific internet-use disorder will stabilize and intensify peoples' psychopathology, such as depression [13]. Zhang et al. found that college students who use more short-form video apps had a higher level of internet addiction than those who use less [52]. And Chao et al. found that addictive TikTok users had worse mental health conditions than nonusers and moderate users, including higher levels of depression, anxiety and many other problems [20]. Also, many studies on smartphone addiction and social media addiction have shown a significant positive association between internet addictive behaviors and depression [6,12,53–56]. Therefore, we propose Hypothesis 3: Short-form video addiction plays a mediating role in the relationship between short-form video use and adolescents depression.

### 1.4. The chain mediating effect of need gratification and short-form video addiction

According to the I-PACE model, when people use internet apps to satisfy their needs, they tend to have expectations that continued use of those apps can lead to further gratification. These expectations then drive individuals to become gradually addicted to the specific apps they use, which in turn exacerbates their depression and other psychological problems [13]. Therefore, need gratification and short-form video addiction might have a chain mediating effect on the relationship between short-form video use and depression. Studies have found that using social media can fulfill adolescents' needs for social communication and self-presentation and increase their comfort in the virtual environment, but at the same time, lead to social media addiction [22,57–59]. The gratification of entertainment needs also causes teenagers to continuously and habitually use social media [57,60], which is highly related to social media addiction. And recent studies of TikTok found that flow experience, playful experiences and sense of belonging were positive associated with problematic use of TikTok [15,19,41,45]. Therefore, we propose Hypothesis 4: Needs gratification and short-form video addiction have a chain mediating effect on the relationship between short-form video use and depression.

### 1.5. Gender differences

In internet-related research, such as game, smartphone usage, and social media, gender differences have been a primary focus of researchers. Some studies have found that males tend to exhibit higher levels of game and internet addiction than females [10,61]. Conversely, other studies have found that females are more likely to experience social media addiction than males [62,63], and the relationship between the passive use of social media and depression is particularly pronounced among adolescent girls [64]. Researchers have also explored gender differences in the need gratification through internet use. Dhir and Torsheim found that there may not be a significant difference between men and women regarding the internet their needs [65]. However, Chen et al. found that the influence of sensory enjoyment need on smartphone addiction was stronger in females and weaker in males [66]. In the present study, we propose Hypothesis 5: There are gender differences in the relationship between short-form video use and depression and in the chain mediating mechanism of need gratification and short-form video addiction.

Fig. 1 presents our theoretical model.

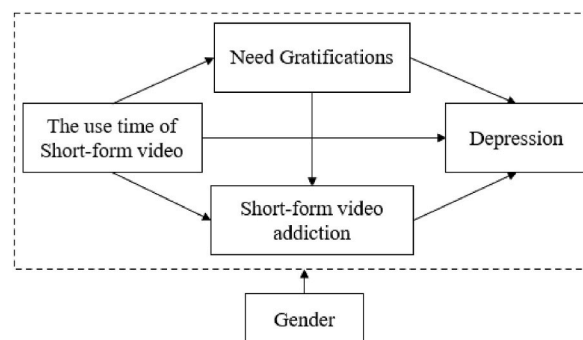


Fig. 1. The theoretical model.

## 2. Method

### 2.1. Participants and procedures

The participants of this study included 1624 high school students from three high schools in Hohhot, Inner Mongolia, China. Among all participants, 1431 students used short-form video apps, and after excluding invalid questionnaires (contradictory answers), we obtained valid data on 1302 students. The average age of the participants was 16.03 years ( $SD = 0.76$ ). Participants included 555 boys (42.6 %) and 747 girls (57.4 %), 807 10th-grade students (62.0 %) and 495 11th-grade students (38.0 %). 12th-grade students were not included in the present study because of the college entrance examination.

The data were collected through an online questionnaire, and students answered the questionnaire in their schools' information technology classrooms. A trained teacher visited the classes while the data were being collected. It took the participants approximately 30 min to complete the questionnaire. Each participant completed the measures independently in a self-administered format to safeguard confidentiality. All participation was voluntary, and the data were kept completely confidential.

### 2.2. Measures

#### 2.2.1. Short-form video use

The present study collected the use time of short-form video apps to reflect students' general use of short-form videos, an approach commonly used in social media studies [5,40,67,68]. We used two items to investigate the use time of short-form videos on weekdays and weekends. The items were "During the weekdays/weekend, how much time do you spend on short-form video apps on average". The answers ranged from 1 (*less than 10 min*) to 6 (*more than 3 h*). In a later analysis, we converted the scale point into a continuous time variable: "less than 10 min" was recorded as 0.08 h, "11 min–30 min" was recorded as 0.33 h, "more than 3 h" was recorded as 3 h and so on. Then, we calculated the daily average use time ( $= (\text{weekdays time} * 5 + \text{weekend time} * 2) / 7$ ).

#### 2.2.2. Adolescent depression

We used the Patient Health Questionnaire-9 (PHQ-9) to assess adolescent depression [69]. The questionnaire included 9 items (e.g., "Little interest or pleasure in doing things"). The items were answered from 0 (*not at all*) to 3 (*nearly every day*). A higher summed score represented higher depression ( $\alpha = 0.94$ ), and the CFA indicates that the fit was acceptable ( $\chi^2/df = 9.90$ , CFI = 0.970, TLI = 0.960, RMSEA = 0.083).

#### 2.2.3. Short-form video addiction

We adapted the Facebook addiction scale and converted "using Facebook" into "using short-form video" [70]. The scale included 8 items (e.g., "The first thing I think about when I get up is opening the short video apps", "If I cannot use short video software, I feel anxious"). The items were answered using a 5-point Likert scale, which ranged from 1 (*not true at all*) to 5 (*completely true*). A higher average score represented higher short-form addiction ( $\alpha = 0.91$ ), and the CFA indicated that the fit was acceptable ( $\chi^2/df = 10.76$ , CFI = 0.975, TLI = 0.959, RMSEA = 0.087).

#### 2.2.4. The need gratification of short-form video

We adapted the Facebook Groups uses and gratifications scale and the Weibo-use gratification scale [38,40]. We chose 12 items from these two scales based on the importance (i.e., the questions used in both scales) and consistency (i.e., the contents of the questions are consistent with the characteristics of short video apps) and adapted "Facebook/Weibo" into "short-form video apps". We added a new item (Making short videos makes me feel happy) based on the characteristics of the making function of short-form video apps. The final scale included 13 items assessing entertainment need gratification (4 items, e.g., "Using short-form video apps makes me feel happy"), socialize need gratification (3 items, e.g., "Using short-form video apps makes me feel supported by others"), self-presentation need gratification (3 items, e.g., "Using short-form video apps allows me to show myself") and information need gratification (3 items, e.g., "Using short-form video allows me to get useful information"). The questions were answered using a 5-point Likert scale ranging from 1 (*very much disagree*) to 5 (*very much agree*). The higher average scores of the subscales represented higher need gratifications (the  $\alpha$ s of subscales range from 0.72 to 0.93). CFA indicated that the fit was acceptable ( $\chi^2/df = 9.98$ , CFI = 0.959, TLI = 0.943, RMSEA = 0.083).

### 2.3. Data analysis

We used SPSS 23.0 to perform descriptive statistics and  $t$  tests, and Mplus 8 to test the chain mediating model. And according to Van de Schoot et al. TLI and CFI should be above 0.9 and RMSEA should be below 0.08 for a good model [71]. Then, we tested the measurement invariance to ensure that boys and girls used the scales in a comparable way. When all restrictions were set in the measurement model, the  $ps$  of  $\Delta\chi^2/\Delta df$  of the model changes were all above 0.10, and the decreases in CFI were less than 0.01; therefore, it could be confirmed that there was no measurement invariance problem [71,72]. After that, multigroup analysis was conducted, and through model comparison, we verified the path differences between the unconstrained and the constrained model using chi-squared difference scores ( $\Delta\chi^2$ ).

### 3. Result

The descriptive statistical results and correlations are shown in Table 1. As we can see, information need gratification had no relationship with short-form video use, short-form video addiction and depression. Adolescents' short-form video use was positively associated with depression, short-form video addiction and other need gratifications. Additionally, depression was positively correlated with short video addiction and other need gratifications. Since there is a high correlation between socializing need gratification and self-presentation need gratification ( $r = 0.81$ ) and there are similarities between the two subscales' items, in the subsequent analysis, we combined the two dimensions into social-related need gratification.

#### 3.1. The chain mediating model of need gratification and short-form addiction

We used structural equation modeling (SEM) to test our chain mediating model and 5000 bootstrap replications to test the significance of the hypothesized mediation effects. After controlling for gender, grade and SES, the result of our model provided a good fit to the data:  $\chi^2/df = 5.48$ , CFI = 0.981, TLI = 0.941, RMSEA = 0.059,  $R^2_{depression} = 0.19$ . Fig. 2 shows the results of the chain mediating model, including the standardized path coefficients. Table 2 shows the standardized results of the mediating effect analysis.

As shown in Fig. 2, short-form video use ( $\beta = 0.08$ ,  $p < 0.01$ ), social-related need gratification ( $\beta = 0.08$ ,  $p < 0.05$ ) and short-form video addiction ( $\beta = 0.36$ ,  $p < 0.001$ ) were positively related to adolescent depression. Short-form video use ( $\beta = 0.23$ ,  $p < 0.001$ ), entertainment need gratification ( $\beta = 0.26$ ,  $p < 0.001$ ) and social-related need gratification ( $\beta = 0.18$ ,  $p < 0.001$ ) were positively related to short-form video addiction, while information need gratification was negatively related to short-form video addiction. The results in Table 2 show that the chain mediating effects of entertainment need gratification and short-form video addiction, as well as social-related need gratification and short-form video addiction, were significant, with 95 % CIs of [0.01, 0.03] and [0.01, 0.02], which did not include zero. Meanwhile, the mediating effects of short-form video addiction were significant, with 95 % CIs of [0.06, 0.11].

#### 3.2. Gender differences

Table 3 presents the descriptive statistical results of boys and girls and the results of the  $t$  tests of gender. The present study found that boys had a higher level of short-form video use and addiction than girls but that girls' information need gratification was higher than that of boys.

We applied a multigroup structural equation model to test the gender difference in the influencing mechanism. We first analyzed separately the chain mediation model of boys and girls, and the results provided good fits (boys:  $\chi^2/df = 2.00$ , CFI = 0.981, TLI = 0.960, RMSEA = 0.042,  $R^2_{depression} = 0.24$ ; girls:  $\chi^2/df = 2.78$ , CFI = 0.972, TLI = 0.938, RMSEA = 0.049,  $R^2_{depression} = 0.17$ ). Then, the unconstrained Model M1 and the path constrained Model M2 were established. The model fitting results are shown in Table 4. However, the results of the multigroup analysis revealed no significant difference in the chain mediation model between genders.

### 4. Discussion

This study aimed to test the associations among short-form video use, needs gratification, short-form video addiction, and depression in adolescents. Results showed that short-form video addiction mediated the positive association between short-form video use and depression. Furthermore, we found the chained mediation mechanism of entertainment need gratification, social-related need gratification, and short-form video addiction in the model. However, the model didn't exhibit any gender differences.

#### 4.1. The influence of short-form video use on adolescent depression

In this study, we found that short-form video use had a positive association with depression; the more adolescents used short-form video apps, the higher was the depression they might have. This result is consistent with previous studies on smartphone and social media use [30,32]. However, we also found that the direct influence of short-form video use is weak, which was also mentioned in

**Table 1**  
Descriptive statistics and correlation matrix.

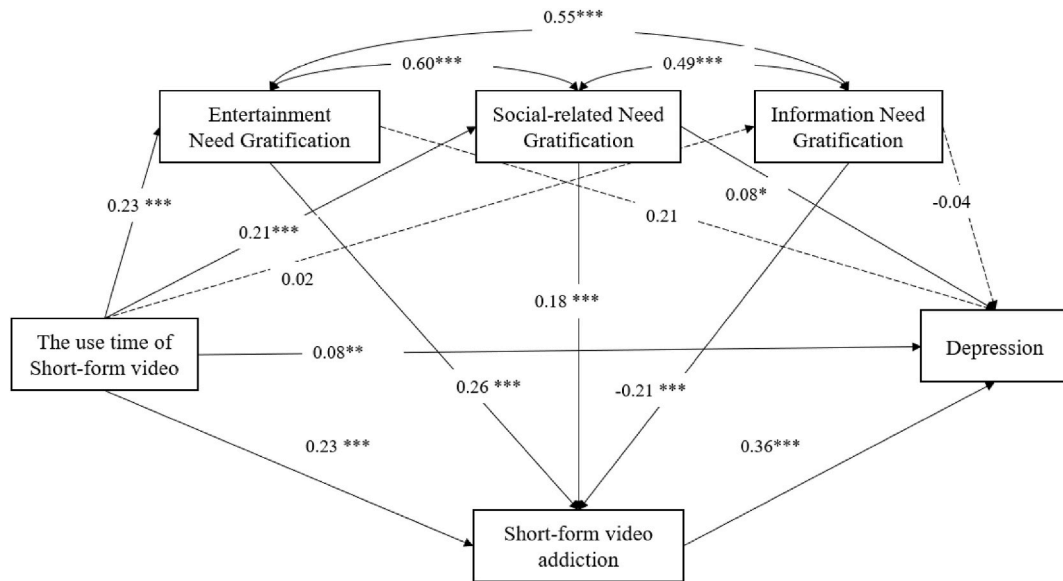
	Mean	SD	1	2	3	4	5	6
1.short-form video use	0.76	0.73						
2.depression	6.08	5.83	0.22 <sup>c</sup>					
3.short-form video addiction	2.35	0.89	0.33 <sup>c</sup>	0.42 <sup>c</sup>				
4.entertainment gratification	3.50	0.83	0.22 <sup>c</sup>	0.19 <sup>c</sup>	0.32 <sup>c</sup>			
5.socialize gratification	3.13	1.06	0.19 <sup>c</sup>	0.19 <sup>c</sup>	0.28 <sup>c</sup>	0.64 <sup>c</sup>		
6.self-presentation gratification	2.91	1.16	0.19 <sup>c</sup>	0.20 <sup>c</sup>	0.29 <sup>c</sup>	0.55 <sup>c</sup>	0.81 <sup>c</sup>	
7.information gratification	3.97	0.91	0.02	0.03	0.03	0.54 <sup>c</sup>	0.50 <sup>c</sup>	0.43 <sup>c</sup>

Note.

$p < 0.05$ .

$p < 0.01$ .

$p < 0.001$ .



**Fig. 2.** The results of the hypothesized chain mediating model  
 Note. \* $p < 00.05$ , \*\* $p < 00.01$ , \*\*\* $p < 00.001$ . The coefficients in the figure are standardized coefficients. The dotted line indicates that path is not significant.

**Table 2**  
 Mediating effects of the chain mediating model.

Path	$\beta$	SE	Boot LL 95 % CI	Boot UL 95 % CI
SVU-DEP	0.08	0.03	0.03	0.14
SVU-ENG-DEP	0.01	0.01	-0.01	0.02
SVU-SNG-DEP	0.02	0.01	0.00	0.03
SVU-ING-DEP	-0.00	0.00	-0.00	0.00
SVU-SVA-DEP	0.08	0.01	0.06	0.11
SVU-ENG-SVA-DEP	0.02	0.00	0.01	0.03
SVU-SNG-SVA-DEP	0.01	0.00	0.01	0.02
SVU-ING-SVA-DEP	-0.00	0.00	-0.01	0.00
Total mediating effect	0.14	0.02	0.11	0.17
Total effect	0.22	0.03	0.16	0.28

Note. A Bootstrap simulation with 5000 replications was used to compute the 95 % CIs around the estimate. SVU = Short-form video use, DEP = depression, ENG = entertainment need gratification, SNG = social-related need gratification, ING = information need gratification, SVA = short-form video addiction.

**Table 3**  
 Gender differences in all study variables.

Variables	Boys		Girls		t	p
	M	SD	M	SD		
Short-form video use	0.82	0.77	0.72	0.69	2.29	0.02
Depression	6.25	6.29	5.96	5.46	0.90	0.37
Short-form video addiction	2.41	0.98	2.31	0.83	2.02	0.04
Entertainment gratification	3.46	0.90	3.53	0.78	-1.55	0.12
Socialize gratification	3.15	1.12	3.12	1.02	0.50	0.62
Self-presentation gratification	2.96	1.19	2.87	1.13	1.41	0.16
Information gratification	3.87	0.99	4.04	0.84	-3.36	0.00

previous smartphone studies [73]. The weak direct association between use behavior and depression might indicate that simply reducing and controlling students’ use time may be insufficient for their mental health. However, limiting students’ access to short-form videos is still a crucial step in promoting their well-being. Hunt et al. has found that limiting social media use time to 60 min per day is an effective way to reduce depression [27]. Therefore, when researchers aim to enhance students’ mental health, it is imperative to combine media use restrictions with other interventions, such as emphasizing students’ psychological needs.

**Table 4**  
The results of gender multigroup SEM analysis.

	$\chi^2$	df	CFI	TLI	RMSEA	$\Delta\chi^2/\Delta df$	p
M1	76.73	32	0.976	0.948	0.046		
M2	88.56	44	0.976	0.962	0.039	0.99	0.46

#### 4.2. The mediating roles of need gratification and short-form video addiction

In this study, we found that the chain mediating effect of entertainment need gratification and short-form video addiction was significant; however, the sole mediating effect of entertainment need gratification was not significant. This result indicated that, rather than directly affecting teenagers' depression mode, entertainment need gratification can lead to increases students' short-form video addiction, which ultimately harms their mental health. This may be because when teenagers use short-form video for entertainment and leisure, their willpower decreases, making it more challenging for them to abstain from using short-form video apps and resulting in addictive behaviors [42,58,74]. Furthermore, the I-PACE model suggests that the gratification derived from using short-form video apps may gradually diminish over time [13]. Consequently, individuals may become increasingly addicted to these apps as a way to compensate for this loss of enjoyment. When using short-form video apps, adolescents might face such a situation: on the one hand, the benefits brought by need gratification diminish over time because of the decreasing gratification; on the other hand, their addictive behaviors continue to increase, leading to adverse consequences; and eventually, adolescents' mental health gradually deteriorates.

Meanwhile, the present study found a chain mediating effect of social-presentation need gratification. Social-related need gratification was found to be positively associated with adolescent depression, which was different from the results of previous studies. Previous research has found that active use methods, such as sharing content and social communication, were negatively related to depression and anxiety because active use can make people feel supported by others [15,75,76]. The distinction between short-form video apps and traditional social media may account for the discrepancy between this study and previous studies. The core element of traditional social media is social interaction, while the core element of short-form video apps is entertainment [20,21]. Therefore, when adolescents use short-form video apps for social-related purposes, their primary intention may still be entertainment rather than genuine social interaction. Due to the entertainment factor, social-related need gratification may also reduce self-control and lead to addictive behaviors and depression [15].

There was no significant association between short-form video use and information need gratification, which indicated that short-form video apps might not be an effective tool for teenagers to obtain useful information. However, we found a negative relationship between information need gratification and short-form video addiction, indicating that information need gratification might have an indirect protective effect on adolescents' emotional health. The protective effect might be because information need gratification means that students obtain more knowledge, expand their horizons, generate a sense of achievement and growth and have increased interest and awareness of the real world [57,59]. Such feelings and gains can mitigate students' online addictive behaviors and promote their emotional health.

The positive impact of information need gratification highlights the multifaceted nature of digital influence. Similarly, Xie et al. have also discussed the mixed outcomes of digital learning tools [77]: on the one hand, using digital tools in learning can enhance learners' motivation, particularly young children; on the other hand, such a learning approach may not effectively promote knowledge retention, comprehension, and transfer due to the potential increase in external cognitive load. We must acknowledge that it is virtually impossible to completely shield students from the internet or smartphone in the modern world. Therefore, in future studies, it is necessary to pay attention to the complexity of the digital influence. While exploring how to reduce the negative influence of short-form video apps, researchers also need to try to expand their beneficial influence.

In order to reduce the negative influence of using short-form video, it is very important for parents and teachers to pay attention to students' psychological needs. On the one hand, they should encourage students to participate more in real world activities, such as sports and reading, and to establish stronger offline interpersonal relationship, such as having more family and team activities. On the other hand, parental monitoring plays an important role in students media use [20]. Hunt et al. found that when using social media, following actual friends is beneficial, while following strangers can be harmful [27]. Parents should pay close attention to the strangers and bloggers their children follow on apps, and make sure their children could receive positive information and keep away from negative and harmful content.

We also found that in the mediating model of the present study, short-form video addiction was the most important mediating factor. All factors, including the use time of short-form video and all need gratifications, were mediated through short-form video addiction and then affected adolescent depression. Some previous studies have found that the use time of social media had only a small or unstable effect on individuals; therefore, some researchers have noted that the negative influences of screen or internet use were overstated or overestimated [73,78]. We showed that even though screen use time might have a small, direct effect on adolescent depression, the mediating effects of addictive behaviors could not be ignored, which might be a crucial mechanism between screen use and emotional health. In future research, the negative effects of screen time still deserve researchers' concern, and more attention needs to be paid to the effects of addictive behaviors.

#### 4.3. Gender differences

The present study revealed disparities in the usage of short-form videos between boys and girls. Specifically, male adolescents

demonstrated significantly higher levels of short-form video usage and addiction compared to female adolescents. These results were consistent with those of previous studies on internet games, but contrasted with those of studies on social media [10,61,62]. This could be attributed to the entertainment nature of short-form video apps: compared with girls, boys may exhibit a greater inclination towards entertainment apps such as games and are more prone to becoming addicted to them. However, the multigroup comparison revealed no significant gender differences in the model, which meant boys and girls had similar mediating mechanisms between short-form video use and depression.

## 5. The implications

From the theoretical point of view, our findings have enriched the I-PACE model by discovering the potential positive impact of information need gratification, underscoring the multifaceted nature of digital influence. Therefore, within the framework of the I-PACE model, it may be worthwhile to focus on the beneficial effects of digital influences for future research. Besides, we examined the roles of different needs gratification in the relationship between short-form video use and adolescent depression, discovering that addictive behavior acted as the most significant mediator between these two variables, which expanded previous research on this topic.

The results of the present study have important implications for future research on intervention. First, it is crucial for parents to monitor kids' media usage, both in terms of use time and content [27]. They should adopt appropriate strategies to mediate adolescents' media usage, such as active mediation and co-using mediation [79]. Second, it is important to consider adolescents' psychological needs. Families and schools should support teenagers in adopting healthy habits, such as establishing offline relationships and taking part in family entertainment activities, to satisfy their needs. This will help prevent adolescents from simply relying on online apps to satisfy their requirements. Also, parents and educators should give close attention to adolescents' information needs, which can be beneficial for their growth and mental well-being. Finally, short-form video app companies and relevant government departments should work together with families and schools to prevent youth from short video addiction. On the one hand, companies should not excessively prioritize meeting the entertainment needs of adolescents and should develop an optimized algorithm specifically designed for young users that reduces exposure to entertainment-related content. On the other hand, governments and companies should encourage video creators to produce high-quality content, including knowledge, information and current affairs, making short-form video apps more beneficial tools than solely entertaining products.

## 6. The limitations and future study

The present study has several limitations. This study is based on cross-sectional data; therefore, we cannot explore the causal relationships between short-form video use, need gratification, short-form video addiction, and depression. Some previous studies have found possible bidirectional correlations among variables such as smartphone use, smartphone addiction and depression [6,80,81]. The present study posits that the increased use of short-form video leads to addiction and gratifies teenagers' needs. However, it is also possible that individuals with higher levels of addiction may spend more time watching short videos. Also, from the perspective of motivation, teenagers may utilize short-form video apps to fulfill their needs. Therefore, it is necessary for future studies to explore the causal relationships among these variables from a longitudinal perspective. In addition, this study did not consider the impact of the social environment. According to social cognitive theory [82], the peer environment is an important factor affecting individuals and behaviors. For example, Zhou et al. found that peers' internet use could affect adolescents' internet use [83]. Therefore, by focusing on peers' short-form video usage environment, the future study can gain further insights into the underlying mechanism of short video use and devise more targeted intervention programs. Besides, we developed a new scale to measure adolescents' need gratifications of short-form video, and this new tool should be further validated in future studies.

### Ethical approval statement

This study has ethics approval by the Institutional Review Board (IRB) at the Collaborative Innovation Center of Assessment toward Basic Education Quality at Beijing Normal University (approval number: 2022–58). All schools received a letter of information that detailed the study's purpose and procedures, and all participants and their parents received the written informed consent. All participants and their parents agreed that they could take part in the program and consented to use the data and publish relevant results for scientific research.

### Data availability statement

This research is based on data from the Regional Education Quality Monitoring Project. In accordance with the confidentiality principles governing the use of project data, the database is not publicly available.

### CRedit authorship contribution statement

**Chengwei Zhu:** Writing – review & editing, Writing – original draft, Formal analysis, Conceptualization. **Yiru Jiang:** Writing – review & editing. **Hanning Lei:** Data curation. **Haitao Wang:** Data curation. **Cai Zhang:** Writing – review & editing, Resources, Methodology, Conceptualization.



## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e30346>.

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