ORIGINAL RESEARCH

The Impact of Mobile Social Media Use on Depressive Mood Among College Students: A Chain Mediating Effect of Upward Social Comparison and Cognitive Overload

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Background: The 18–24 age group has a much higher rate of depression risk than other age groups, and this age group has the highest proportion among users of mobile social media. The relationship between the use of mobile social media and depressive mood is inconsistent and the mechanism of action is controversial.

Purpose: This study explored the relationship among the intensity of social media use, upward social comparison, cognitive overload and depressive mood.

Methods: In this research, we used the Brief Self-rating Depression Scale (PHQ-9), the Social Media Usage Intensity Questionnaire, the Social Comparison Scale on Social Networking Sites and the Social Networking Site Cognitive Overload Scale to investigate the depressive mood and mobile social media use of 568 college students.

Results: The intensity of mobile social media use, social networking site upward social comparison, and social networking site cognitive overload are all positively correlated with depressive mood. The intensity of mobile social media use has a positive predictive effect on depressive mood, with upward social comparison and cognitive overload acting as independent mediators in the relationship between mobile social media use intensity and depressive symptoms, as well as exhibiting a chained mediating effect of upward social comparison-cognitive overload.

Conclusion: The upward social comparison and cognitive load that occur during the use of mobile social media are important predictive factors for the occurrence of depressive mood. This study is a supplement to the mechanism of the relationship between mobile social media use and depression, providing more evidence-based evidence and intervention directions for university teachers, mobile social media developers, and psychologists.

Keywords: mobile social media, upward social comparison, cognitive overload, depressive mood, chain mediation

Background

In China, the "National Mental Health Blue Book" released in 2023 showed that the detection rate of depression risk among the 18–24 age group reached 24.1%, significantly higher than other age groups.[1] According to the survey in the "National Depression Blue Book", 50% of depression patients are students aged 18–24, and 41% have dropped out of school due to depression. The treatment for depression is long and expensive, and it also increases the risk of suicide.[2] The attention to the psychological adaptation of college students, especially to depressive emotions, has gradually increased in various sectors of society.[3,4]

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In today's era of information explosion, mobile social media, as a carrier of information, is being used more and more frequently by individuals. The relationship between mobile social media use and depressive mood has also received widespread attention. Mobile social media refers to software that facilitates interpersonal communication, information browsing, and information sharing through mobile smart devices, such as WeChat, Weibo, Xiaohongshu, and Facebook.[5] The most significant function of mobile social media is socializing, which provides convenience for users to obtain information and showcase themselves.[6] Currently, there is no unified conclusion in the research on the relationship between the intensity of mobile social media usage and depressive emotions. With increased use time, individuals experience more negative emotions, especially depressive emotions,[7] and social comparisons and envy on social media can increase the likelihood of depressive emotions.[8] Some studies have shown a negative relationship between mobile social media usage and depressive emotions. For example, the mediation effect of the number of friends, suggesting that using mobile social media can reduce the occurrence of depressive emotions,[8,9] improve individuals' subjective well-being.[10] Inconsistent results may be related to differences in the population and intensity of use in the study. And it is necessary to simultaneously consider specific behaviors and emotional experiences during mobile social media usage.

According to 2022 "China Internet Development Status Statistical Report", which indicates that China has 1.05 billion internet users, with the age group of 20–29 accounting for 17.2% of internet users. College students are in a transitional stage from adolescence to adulthood. When receiving a large amount of information during interpersonal communication and information browsing via mobile social media, the upward social comparison and cognitive overload are more likely to occur.

Social comparison refers to the behavior of individuals comparing themselves with others who are similar to themselves when they cannot judge their own opinions and abilities using absolute objective standards, in order to obtain relative self-evaluation.[11] Upward social comparison refers to the behavior of individuals comparing themselves with those who are better off than themselves.[12] Studies have shown a significant positive correlation between the intensity of mobile social media use and upward social comparison Mobile social media has become a new place for individuals to engage in social comparison.[13–15] Individuals' self-disclosure on mobile social media tends to be positive,[16] and users are more likely to receive positive and advantageous information displayed by others, leading individuals to have the illusion that other people's lives are better than their own.[16,17] In the use of mobile social media, upward social comparison is an unconscious behavior that occurs automatically when presenting information about others.[18–20] People engage in social comparison in areas such as physical health status,[21] mental health status,[22] external image,[23] and so on. Upward social comparison can lead to envy,[24] anxiety,[25] and other negative emotional experiences, which can further trigger depressive mood.

Mobile social media cognitive overload includes two dimensions: social overload and information technology overload. It is a psychological phenomenon of cognitive overload experienced by users in the process of using mobile social media to maintain complex interpersonal relationships and adapt to information communication technology.[26] Cognitive overload theory believes that individuals' cognitive and emotional resources are limited, and excessive information reception and processing is positively related to depression. Social comparison during the use of mobile social media will produce non-adaptive cognition,[27] and will also occupy individual cognitive resources,[26] leading to physical fatigue and stress.[28] The dual-system theory of motivation believes that cognitive overload is due to the individual processing too much information, which puts the individual in a state of multitasking. The competition between different tasks requires the individual's cognitive resources to be occupied, leading to the individual's self-protection. Mechanisms begin to work, and depressive mood occurs as a result of the failure of the individual's self-protective mechanisms.[29,30]

In this study, we explored the relationship between mobile social media use intensity and depression in the college student population, and further examines the mechanism of upward social comparison and cognitive overload in the use of mobile social media on the relationship between mobile social media use intensity and depressive mood. The aim is to provide theoretical and empirical evidence for the prevention and intervention of depression among college students in the Internet era and to guide college students in the correct use of mobile social media.

In summary, we propose the following hypotheses:

H1: The intensity of mobile social media usage will positively affect depressive mood.

H2: Upward social comparison and cognitive overload play a mediating role respectively in the relationship between mobile social media use and depressive mood among college students.

H3: The intensity of mobile social media use will affect depressive mood through the chain mediating effect of upward social comparison-cognitive overload.

Participants and Methods

Participants

By employing a convenient sampling method, the questionnaire was distributed through the Wenjuanxing platform to select students from over ten universities as the research participants. According to the calculation of the sample size formula, a minimum of 383 questionnaires were required. Eventually, 602 questionnaires were collected. After excluding participants who were experiencing depression, had a family history of mental illness within two or three generations, submitted responses in less than three minutes, or provided irregular answers, a total of 568 questionnaires remained, with an effective rate of 94.49%. Among the participants, there were 125 males and 443 females. In terms of grade variables, there were 186 freshmen, 80 sophomores, 93 juniors, 94 seniors and fifth-year students, and 115 master's students. Additionally, 291 participants came from urban areas, while 277 participants came from rural areas. Ethical approval for this study was granted by the Medical Ethics Committee of Xi'an International Medical Center Hospital with an approval number of 2021009. Informed consent was obtained from all participants included in the study. All procedures conducted in our study were in adherence with the ethical guidelines of the institutional and/or national research committee and the ethical standards of the Helsinki Declaration.

Tools

Mobile Social Media Usage Intensity Questionnaire

The Social Media Usage Intensity Questionnaire developed by Ellison[31] and adapted by Sun Xiaojun[17] was used. This questionnaire consists of eight items. The first item measures the proportion of online friends to offline friends on mobile social media platforms. The second item measures the average time adolescents spend on mobile social media per day. The remaining six items measure the emotional and life-related connection between participants and mobile social media. These six items were measured using a 5-point Likert scale (1="not at all" to 5="extremely"). After standardizing the scores of all items and summing them, the Mobile Social Media Usage Intensity score was obtained. This score represents the intensity of individual mobile social media usage, with higher scores indicating greater intensity among university students. The Cronbach's α coefficient of this questionnaire is 0.83.

Brief Self-Rating Depression Scale

The Brief Self-rating Depression Scale PHQ-9 (Patient Health Questionnaire), developed by Robert Spitzer was selected.[32] This scale is used to assess the frequency of symptoms and evaluate the depressive state in nine aspects over the past two weeks. It consists of nine items, with a 4-level scoring system ranging from 0 to 3. Higher scores indicate a higher degree of depression. In China, this scale is applied in clinical depression diagnosis, evaluation of intervention effectiveness, and survey research on the general population.[33] In this study, the Cronbach's α coefficient of this questionnaire is 0.92.

Social Comparison Scale on Social Networking Sites

The Social Comparison Scale on Social Networking Sites, adapted by Lian Shuailei,[24] is a modified version of the Iowa-Netherlands Comparison Orientation Measure developed by Gibbons.[34] translated and revised by Bai Xuejun.[35] The original scale consists of three subscales: social comparison orientation, upward social comparison, and downward social comparison, totaling 23 items. The subscale for upward social comparison consists of six items, measuring the tendency of individuals to compare themselves with those who are better off in life. Lian Shuailei specifically focuses on upward social comparison in the context of mobile social media usage, making it more targeted and relevant.[24] The scale adopts

a 5-point scoring system (ranging from 1 to 5), with higher scores indicating a greater tendency for upward social comparison in the context of mobile social media usage. The Cronbach's α coefficient of this questionnaire is 0.94.

Cognitive Overload Scale on Social Networking Sites

The social networking site cognitive overload scale developed by Choi and Lim,[36] and adapted and localized by Chen Chunyu,[37] was utilized in this study. The scale consists of two dimensions: social and information technological overload, with six and four items respectively. A 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was employed for rating. Higher scores indicate a higher level of cognitive overload experienced by individuals in mobile social media. The Cronbach's α coefficient for this questionnaire is 0.95.

Statistical Analysis

This study uses SPSS 22 for analysis as follows: First, descriptive statistics are performed on the main variables. Secondly, a regression analysis was conducted on the impact of mobile social media usage intensity on college students' depression. Third, a mediating effect model was used to examine the mechanism of upward social comparison and cognitive load in the impact of mobile social media use on college students' depressive mood.

Results

Common Method Bias Test

The data for this study were collected through self-report measures from participants. Therefore, a Harman's single-factor test was conducted to examine the potential presence of common method bias.[38] All items from the questionnaires were combined and subjected to factor analysis using SPSS 22.0. The results revealed that there were five factors with eigenvalues greater than 1. The first common factor accounted for 24.58% of the variance, which is less than 40%. Thus, the common method bias in this study was not significant.

Correlation Analysis

The means, standard deviations, and correlation matrix of mobile social media usage intensity, social comparison on social networking sites, cognitive overload on social networking sites, and depressive emotions are shown in Table 1. The results of the correlation analysis indicate that there are significant correlations among mobile social media usage intensity, social comparison on social networking sites, cognitive overload on social networking sites, and depressive emotions.

Mediation Analysis of Social Comparison on Social Networking Sites and Social Networking Site Cognitive Overload

Significant correlations were found among mobile social media use intensity, social comparison on social networking sites, social networking site cognitive overload, and depressive mood. Therefore, the next step is to conduct a mediation analysis for social comparison on social networking sites and social networking site cognitive overload.[39] In this study, the SPSS macro developed by Hayes (http://www.afhayes.com) was used to analyze the mediating effects of social

Table 1 Correlation Matrix Among Variables

	M	*SD*	**UI**	**SC**	**CO**	**DE**
UI	3.85	0.76	–			
SC	3.26	0.95	0.49**	–		
CO	3.63	1.50	0.36**	0.65**	–	
DE	0.83	0.62	0.19**	0.44**	0.58**	–

Note: **p< 0.01.
Abbreviations: UI, mobile social media usage intensity; SC, social comparison on social networking sites; CO, cognitive overload on social networking sites; DE, depressive mood.

comparison on social networking sites and cognitive overload while controlling for gender, age, and hometown. The regression analysis results are presented in Table 2.

The regression analysis results indicate that mobile social media use intensity has a significant positive predictive effect on depressive mood (B=0.20, p<0.001). However, when mobile social media use intensity, social comparison on social networking sites, and social networking site cognitive overload are included in the regression equation together, the predictive effect of mobile social media use intensity on depressive mood becomes non-significant (B=−0.08, p>0.05). Mobile social media use intensity directly and positively predicts social comparison on social networking sites and social networking site cognitive overload (B=0.52, p<0.001; B=0.89, p<0.05, respectively). Social comparison on social networking sites directly and positively predicts social networking site cognitive overload (B=0.61, p<0.001), and both social comparison on social networking sites and social networking site cognitive overload have a direct positive predictive effect on depressive mood (B=0.15, p<0.01; B=0.50, p<0.001, respectively).

After conducting a mediation analysis of social comparison on social networking sites and cognitive overload (Table 3), it was found that social comparison on social networking sites and cognitive overload play a full mediating role between mobile social media use intensity and depressive mood, with a total mediating effect value of 0.26. The mediating effect is composed of three indirect paths (Figure 1): indirect effect 1 (0.07) represents the path from mobile social media use intensity to social comparison on social networking sites to depressive mood; indirect effect 2 (0.04) represents the path from mobile social media use intensity to cognitive overload on social networking sites to depressive mood; indirect effect 3 (0.15) represents the path from mobile social media use intensity to social comparison on social networking sites to cognitive overload on social networking sites to depressive mood. The 95% bootstrap confidence intervals for all three indirect effects do not include zero, indicating statistical significance.

Table 2 Regression Analysis of Variables in the Model

Regression Equation		Overall Fit Index			Significance	
Outcome Variable	Predictive Variables	R	R²	$F_{(df)}$	B	t
DE		0.27	0.07	11.16 (4) ***		
	Gender				−0.70	−1.64
	Age				−0.79	−1.92
	Hometown				0.16	3.83***
	UI				0.20	4.76***
SC		0.51	0.26	45.50 (4) ***		
	Gender				−0.01	−2.68**
	Age				0.06	1.51
	Hometown				0.07	2.00*
	UI				0.52	13.66***
CO		0.66	0.44	88.45 (5) ***		
	Gender				−0.11	−3.24***
	Age				−0.05	−1.41
	Hometown				0.58	1.80
	UI				0.89	2.31*
	SC				0.61	16.67***
DE		0.61	0.37	54.42 (6) ***		
	Gender				0.03	0.87
	Age				−0.08	−2.39*
	Hometown				0.09	2.77**
	UI				−0.08	−1.9
	SC				0.15	3.06**
	CO				0.50	11.23***

Notes: All variables in the model have been standardized. *p< 0.05, **p< 0.01, ***p< 0.001.
Abbreviations: UI, mobile social media usage intensity; SC, social comparison on social networking sites; CO, cognitive overload on social networking sites; DE, depressive mood.

Table 3 Decomposition of Effects of Variables in Structural Equation Modeling (N=568)

Path	Effect	BootSE[a]	BootLLCI[b]	BootULCI[c]
Total effect	0.19	0.04	0.00	0.11
Direct effects	−0.72	0.38	0.58	−0.08
Indirect effects				
Total indirect effects	0.26	0.03	0.20	0.32
Indirect effect 1[d]	0.07	0.02	0.03	0.12
Indirect effect 2[e]	0.04	0.02	0.01	0.08
Indirect effect 3[f]	0.15	0.02	0.11	0.19
Indirect 1 versus Indirect 2	0.03	0.03	−0.03	0.09
Indirect 1 versus Indirect 3	−0.08	0.03	−0.14	−0.02
Indirect 2 versus Indirect 3	−0.11	0.03	−0.16	−0.06

Notes: All variables in the model have been standardized. Indirect effect path 1[d]: mobile social media usage intensity→ social comparison → depressive emotions. Indirect effect path 2[e]: mobile social media usage intensity→ cognitive overload → depressive emotions. Indirect effect path 3[f]: mobile social media usage intensity→ social comparison → cognitive overload → depressive emotions.
Abbreviations: BootSE[a], bootstrap standard error; BootLLCI[b], bootstrap lower limit of confidence interval; BootULCI[c], bootstrap upper limit of confidence interval.

To determine whether there are significant differences between the indirect effects of different paths, a comparison was made pairwise between indirect effects (Table 3). When the difference between two indirect effects has a 95% bootstrap confidence interval that includes zero, it indicates that there is no significant difference between the two paths. Conversely, when the difference between two indirect effects has a 95% bootstrap confidence interval that does not include zero, it indicates a significant difference between the two paths. The results show that there is no significant difference between indirect effect 1 and indirect effect 2 (comparison 1); however, there is a significant difference between indirect effect 1 and indirect effect 3 (comparison 2), as well as between indirect effect 2 and indirect effect 3 (comparison 3).

Discussion

This study examines the relationship between mobile social media usage intensity and depressive mood among college students using a chain-mediated model involving upward social comparison on social networking sites and cognitive overload. The results indicate a positive correlation between mobile social media usage intensity and depressive mood among college students. Further regression analysis reveals that mobile social media usage intensity can directly predict depressive mood among college students, which supports the research hypothesis. However, after incorporating upward social comparison and cognitive overload into the regression equation, the direct predictive effect of mobile social media
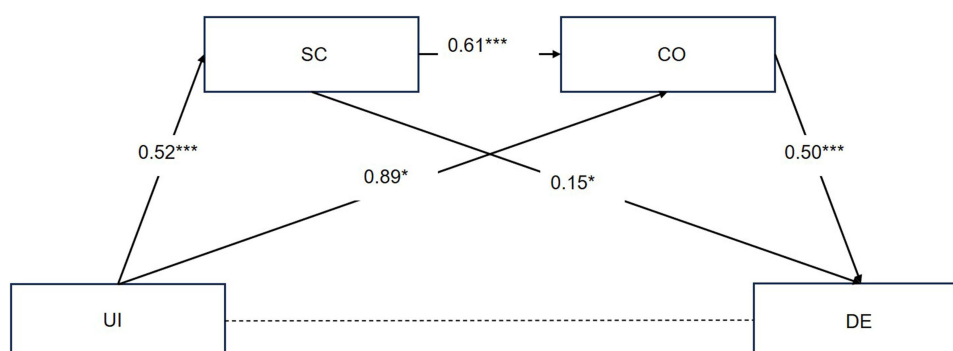
Figure 1 The chain mediating effect of social comparison and cognitive overload on social networking sites (N=568).
Notes: *p< 0.05, *** p< 0.001.

usage intensity on depressive mood among college students becomes non-significant. The results of the mediation analysis demonstrate that upward social comparison on social networking sites and cognitive overload fully mediate the relationship between mobile social media usage intensity and depressive mood among college students. These findings validate the research hypotheses.

In this study, it was found that mobile social media usage intensity significantly and positively predicts depressive mood. This result supports previous research indicating the negative impact of high mobile social media usage intensity on individuals' psychological well-being.[37,40] On one hand, individuals with depressive mood tend to rely more on mobile social media for daily social interactions, resulting in higher scores of mobile social media usage intensity. Studies have shown that using mobile social media provides a safe and comfortable environment for individuals with depressive mood to share their feelings, making them more likely to perceive social support.[41,42] Moreover, using mobile social media for social interactions requires fewer social skills compared to offline interactions, which may explain why individuals with depressive mood are more inclined to use mobile social media for information browsing and inter-personal communication.[42] On the other hand, the high intensity of mobile social media usage is indicative of social media addiction, and research has demonstrated a significant positive correlation between mobile social media addiction and depressive mood ($r=0.14$, $p<0.001$).[43] Addictive behaviors can also lead to negative effects on physical and mental well-being, subsequently contributing to the occurrence of depressive mood.[44] Additionally, research shows that individual personality traits such as anxiety, mood disorders, and obsessive-compulsive behaviors also contribute to problematic mobile social media use.[45–47] Understanding the relationship between personality traits and mobile social media use is also critical for developing interventions to mitigate the adverse effects of excessive smartphone use.

Research results indicate that the intensity of mobile social media use can impact depressive mood among college students through the separate mediating roles of upward social comparison and cognitive overload. This suggests that upward social comparison and cognitive overload are important factors that contribute to poor psychological adaptation in the process of mobile social media use. The results support the research hypothesis that upward social comparison plays a mediating role between the intensity of mobile social media use and depressive mood, while cognitive overload also plays a mediating role between the intensity of mobile social media use and depressive mood.

In the Internet age, mobile social media has become an important platform for social comparison. Individuals who heavily use mobile social media invest more time and emotions, and have more opportunities to encounter shared information from others. Upward social comparison decreases self-evaluation and self-esteem levels, leading to negative emotional experiences. The algorithm for pushing information on mobile social media is designed to recommend similar information based on individual browsing habits,[48] increasing the chances of encountering others' advantageous information. Consequently, individuals experience lower self-worth and self-esteem, which can trigger depressive mood.[49] Therefore, the intensity of mobile social media use negatively affects the psychological adaptation of college students through the mediating role of upward social comparison.

The abundance and attractiveness of information in mobile social media often lead individuals with high usage intensity to resort to browsing and interpersonal communication through mobile social media as a means of stress relief. However, this behavior increases the amount of information intake, resulting in an imbalance between the amount of information the brain can handle and the actual information received.[50] Emotions play a role in the information processing process, and when faced with excessive information, individuals may feel a sense of loss of control, causing mental stress and even leading to the development of depressive mood.[51,52] The Limited Capacity Model of Cognition suggests that individuals can allocate moderate resources to process a certain amount of information. However, when information overload occurs, individuals will allocate more resources to handle the excess information, leading to an increase in resource usage during task switching and a corresponding decrease in resources allocated to other aspects.[29,53] This triggers the individual's self-protective mechanism, and when the self-protective warning system fails to function properly, depressive mood may occur. Therefore, the intensity of mobile social media use negatively affects the psychological adaptation of college students through the mediating role of cognitive overload.

This study confirms, from the perspective of upward social comparison and cognitive overload on mobile social media, that the intensity of mobile social media usage can affect depressive mood among college students through the chain mediating effect of upward social comparison and cognitive overload. As a behavior that occupies cognitive

resources, upward social comparison leads to cognitive overload and generates an experience of stress. The variety of information on mobile social media is abundant and more likely to elicit social comparison.[54] Unconscious upward social comparison switches between various types of information, and the competitive relationship between different tasks consumes limited cognitive resources and even requires additional cognitive resources, leading to cognitive overload and triggering individuals' self-protective mechanisms, resulting in depressive mood.[29,30] The negative information processing theory of information processing bias suggests that individuals are at increased risk of depressive mood due to biased processing of negative information.[55] For example, when individuals receive advantageous information from others on mobile social media, it triggers upward social comparison and generates negative emotional experiences. In addition, information processing bias causes individuals in a state of depression to excessively focus on and process negative information, further exacerbating depressive mood through rumination, forming a vicious cycle of high intensity of mobile social media use → negative emotions caused by upward social comparison → increased cognitive overload → depressive mood.

This study found that the intensity of mobile social media usage does not directly lead to depressive mood, but rather influences it through the separate mediating effects of upward social comparison and cognitive overload, as well as the chain mediating effect of upward social comparison → cognitive overload. This indicates that upward social comparison and cognitive overload during mobile social media usage are crucial factors in causing depressive mood. This study extends the research on psychological adaptation of college students to mobile social media usage and provides theoretical support for guiding the practical handling of depressive mood resulting from mobile social media usage among college students. In the mental health education of college students, corresponding courses can be planned based on the mechanisms of depressive mood identified in this study, aiming to guide students in the rational use of mobile social media and the establishment of correct values and life perspectives. For mobile social media platforms, they should optimize information recommendation algorithms and promote features such as time limits, allowing users to have control over the information they receive by enabling actions like clicking "do not show similar information again" and selecting reasons for not receiving certain recommendations. On the part of the college students themselves, they should approach the information presented by others on mobile social media with rationality, be aware of the excessive mental resources invested while using mobile social media, and increase offline interactions with friends.

However, it should be noted that this study also has certain limitations. This study is cross-sectional and cannot establish a causal relationship between the intensity of mobile social media usage and depressive mood. Additionally, the participants were Chinese college students, and further research is needed to determine the applicability of these conclusions to adolescents or other populations.

Future research should involve longitudinal studies to further explore the relationship and mechanisms between the intensity of mobile social media usage and depressive mood. More detailed research should also be conducted on the relationship and mechanisms between different types of mobile social media and depressive mood.

Conclusion

There are significant positive correlations between the intensity of mobile social media usage, upward social comparison, cognitive overload, and depressive mood. The intensity of mobile social media usage has a significant positive predictive effect on depressive mood.

Upward social comparison and cognitive overload during mobile social media usage play a complete mediating role between the intensity of mobile social media usage and depressive mood. Specifically, mobile social media affects depressive mood among college students through three paths: the separate mediating role of upward social comparison, the separate mediating role of cognitive overload, and the chain mediating role of upward social comparison → cognitive overload.

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Disclosure

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