**Research Article**

# A Qualitative Study On Social Media Overload And Learning Engagement Of Undergraduate Students

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| ARTICLEINFO | ABSTRACT |
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| | In the context of higher education, learning engagement is a critical factor influencing meaningful learning and academic performance, and it is frequently disrupted by social media interference, which has become a prevalent phenomenon. This study aims to explore the impact of social media overload on learning engagement through semi-structured in-depth interviews conducted with 18 undergraduate student participants from China. The interview data was analyzed using Nvivo 14.0 software. The results reveal a significant correlation between social media overload and learning engagement, which is further influenced by ego depletion, willpower beliefs, and time pressure. The study highlights the importance of effectively managing social media usage among undergraduate students to enhance their learning performance.<br><br>**KEYWORDS:** Social media overload, Learning engagement, willpower beliefs, Time pressure, Undergraduate students |

## 1 INTRODUCTION

Distinguished from traditional mass media such as broadcasting, television, and newspapers, social media fundamentally transforms the nature and scope of interpersonal communication in the digital era (Wang et al., 2017). By transcending the limitations of time and space, social media enables synchronous or asynchronous communication, thereby continuously expanding the possibilities of social interaction (Pang, 2018). According to the 49th Statistical Report on Internet Development in China released by the China Internet Network Information Center (CNNIC) in February 2022, the number of internet users in China reached 1.032 billion by December 2021. Among them, the number of social media users reached 1.007 billion, exhibiting an increase of 25.55 million compared to December 2020, accounting for 97.5% of the overall internet user population. Among these users, college students constitute one of the largest user groups, comprising 23.9% (CNNIC, 2022). Contemporary college students, known as "digital natives," have grown up in the information age and continuously experience the transformative effects of digital information. They represent a primary and highly active user base of social media. The renowned social media platform Facebook was initially established to cater to the college student community and has become the most popular social media platform worldwide, thanks to its diverse functionalities and affordable usage costs. Furthermore, social media finds wide application in the daily teaching activities of higher education. For instance, Chinese university professors employ WeChat groups or QQ groups to assign homework and initiate topic discussions, which have become prevalent modes of communication between teachers and students. Multiple studies indicate a significant positive correlation between the number of friends on social media and life satisfaction in individuals' everyday social interactions (Kim et al., 2010; Manago et al., 2012). Additionally, substantial empirical research has discovered that college students' use of social media has a positive impact on their

learning and lives, facilitating knowledge exchange, acquisition of social capital (Kim & Kim, 2017), information retrieval (Guo et al., 2014), and reduction of uncertainty (Gambo & Ozad, 2021).

However, students' frequent use of social media in both classrooms and leisure time blurs the boundaries between studying and living, potentially leading to harm. According to the "China Internet Development Report, 2022" 61.2% of social application users spend more than 2 hours online daily, and 22.8% exceed 6 hours (CCRI, 2022). This indicates a significant number of heavy social media users and the prevalence of excessive usage behavior. Research has found that college students are more inclined to engage in excessive social media use compared to others due to limited external control, extensive free time, and flexible schedules (Turel & Qahri-Saremi, 2016; Xu et al., 2022). The consequences manifest in a range of behavioral and psychological issues, including social media overuse (Fu et al., 2020; Lee et al., 2016), social network addiction (Verduyn et al., 2017), social media fatigue (Zheng & Ling, 2021), fear of missing out (FoMO) (Błachnio & Przepiórka, 2018; Blackwell et al., 2017), compulsive use (Aladwani & Almarzouq, 2016), privacy infringement (Wang et al., 2021; Xie & Karan, 2019), and feelings of loneliness, depression, and anxiety (Kerapetse, 2018; Zheng & Ling, 2021). In particular, excessive social media use exposes college students to a high volume of information and communication demands that require emotional and cognitive engagement, ultimately exceeding their processing capacity (Lee et al., 2016; Xu et al., 2022). Moreover, excessive social media use can encroach upon study time or disrupt normal learning, resulting in poor academic performance (Wentworth & Middleton, 2014). Thus, it is evident that once social media becomes an uncontrollable factor, it can impact self-psychological well-being (Ni & Shao, 2019), and academic performance (Cao et al., 2018; Xu et al., 2022). Moreover, a key variable related to excessive information technology use is overload in the field of ICT research (Fu et al., 2020). Overload refers to the subjective evaluation and perception of individuals regarding the number of things or people that exceed their processing capacity (Zhang et al., 2016). In other words, it is an overloaded state resulting from an imbalance between an individual's coping ability and the demands in the environment. Therefore, excessive social media use can also be referred to as social media overload (SMO).

Based on previous literature findings, the mechanisms by which social media use affects personal development are not yet clear and may act as a double-edged sword, impacting individuals' learning and life (Chen et al., 2018; Chen et al., 2016; Erfani & Abedin, 2018; Pornsakulvanich, 2017). Although various scholars have proposed different perspectives on understanding the potential negative effects of excessive social media use on students, there is a lack of theory-based empirical research on the interrelationships between the psychological and behavioral consequences in higher education (Shi et al., 2020). This dearth of research in the field is detrimental to the high-quality development of higher education and the academic pursuits of college students. To fill this research gap, this study attempts to conduct empirical research to assess the mechanisms through which social media overload influences the psychology and learning engagement of college students.

## 2 RELATED LITERATURES

In the context of social media, social media overload refers to the excessive information or requests that occur during the process of social media use. It leads to a series of changes in individuals' cognition, emotions, and other aspects, subsequently affecting their behavior (Lee et al., 2016). For example, ego depletion (Vanco & Christensen, 2016), information avoidance behavior (Guo et al., 2020), social fatigue (Lee et al., 2016), and discontinuous use behavior (Zhang et al., 2016) are all consequences of social media overload. Currently, the main challenge faced by undergraduate students is not the lack of information, but the redundancy of information (Cao & Sun, 2018). The more information available, the deeper the individual's perception of information overload. Individuals often fear missing important information and feel compelled to access and process this content, leading to information overload. Information overload has negative implications for individuals' subsequent use behavior. For instance, Zhang et al. conducted a study using a combination of situational experiments and questionnaire interviews, and the results showed that information overload increases individuals' social network fatigue, leading to intermittent discontinuation behavior (Zhang et al., 2019). Other studies have found that information overload contributes to fatigue and dissatisfaction among individuals, both of which reduce users' willingness to continue using the platform (Maier et al., 2015). In summary, the explosive growth of digital information results in information overload, which negatively impacts individuals' behavior, emotions, and well-being (Lee et al., 2016).

Communication overload among college students primarily manifests in communication with peers, communication with teachers, and non-friend-related communication when dealing with daily affairs. Communication overload significantly predicts social media fatigue (Lee et al., 2016). In order to stay connected with friends on social media, students often continuously check their mobile phones, computers, and other electronic devices to ensure they don't miss any messages from online acquaintances and promptly respond, thus leading to communication overload. Lee et al. found that the frequency of system updates and the usability of system features significantly influence system feature overload (Lee et al., 2016). System feature overload causes users to experience exhaustion and dissatisfaction, both of which further impact their discontinuous use behavior (Zhang et al., 2016). Delpechitre et al. (2019) found that system feature overload creates role stress for employees, adversely affecting their job performance. In an educational context, system feature overload is a significant antecedent to social media fatigue (Zhang et al., 2019). When users perceive

the cost of learning and using system features outweighing the benefits, they may become tired of using social media and experience fatigue (Lee et al., 2016).

From the literature, research on learning engagement has been relatively concentrated in the United States, with a focus on practical applications, including the reliability and validity of learning engagement surveys and the utilization of survey results. In Europe, research on learning engagement tends to focus more on students' individual learning and the relationship between teaching and learning. Many researchers recognize that learning engagement is an important indicator of students' academic achievement and a key factor influencing their learning success (Xie et al., 2020). It is highly correlated with students' learning persistence, academic satisfaction, academic performance, and academic completion. Academic performance reflects the extent to which students achieve their learning goals (Lepp et al., 2014), specifically referring to the degree to which students increase their knowledge and skills to achieve educational objectives during the educational process. The academic performance of undergraduate students is not only an important reference for measuring the quality of higher education but also a significant indicator of students' abilities and development. Academic performance includes academic grades, performance on academic tasks, and learning interests, typically measured by final exam scores or Grade Point Averages (GPA) or through the Ravens Progressive Matrices test scores (Bruno et al., 2019).

Numerous scholars have conducted extensive research on the antecedents and consequences of learning engagement. Bond and Bedenlier (2019) defined the factors influencing learning engagement, categorizing them as teacher-related, student-related, curriculum/activities, environment/technology, and peer-related. These studies mainly focus on the impact of factors such as academic ability, time management skills, learning strategies, and student characteristics (Paul et al., 2012). Research has found a significant positive relationship between learning engagement and academic performance, indicating that the more engaged students are, the better their academic performance (Cheng, 2016; Marks, 2000). Additionally, students' learning engagement positively predicts their academic motivation and negatively predicts their dropout rates (Galla et al., 2014; Lam et al., 2014). In summary, scholars generally agree that there is a strong positive correlation between students' learning engagement and their academic performance, and high levels of learning engagement are a prerequisite for achieving good academic performance.

The widespread use of social media in higher education has blurred the boundaries between individuals' public activities and private lives, reshaping the boundaries of learning and living for college students. Multiple empirical studies have shown a correlation between social media usage and both personal life and learning engagement among college students (Chen & Li, 2017; Huang, 2017). Recent research has found that social media usage is beneficial for improving students' learning in higher education (Alalwan, 2022). The reasonable use of social media can facilitate knowledge sharing and problem-solving, contributing to enhanced academic performance (Krasilnikov & Smirnova, 2017). As an educational technology integrated into daily teaching activities, social media eliminates the time and space constraints of traditional face-to-face instruction. Additionally, social media enhances learning experiences and performance. Many students use social media platforms to share information, discuss research topics or concepts, and collaborate on assignments or semester projects (Eid & Al-Jabri, 2016; Zhang & Liu, 2018). Moreover, social media provides a convenient and efficient way for peer-to-peer knowledge exchange and collaboration, making it a preferred learning method widely used in higher education (Eid & Al-Jabri, 2016).

However, with the increasing number of studies on social media overload, usage fatigue, smartphone dependency, and information overload, the "double-edged sword" effect of social media usage on academic performance has emerged (Ren & Chen, 2020; Shi et al., 2020). Based on meta-analyses, researchers have concluded that there is only a moderate positive correlation between social media usage and academic performance (Ren & Chen, 2020). A substantial body of research has found that problematic social media use can lead to negative consequences for students' learning. Specifically, social media overload can result in fatigue, exhaustion, diminished interest in communication, and a sense of disengagement (Aladwani & Almarzouq, 2016; Zheng & Ling, 2021). Similarly, excessive personal use of social media not only decreases students' task performance and well-being but also increases their technological stress (Brooks, 2015). Furthermore, if college students frequently use Facebook while studying or doing homework, they spend more time on social media and less time on studying, which is negatively correlated with their GPA (Junco, 2014; Junco et al., 2011). Researchers studying the impact of multitasking on learning found that engaging in multitasking with any form of social media was negatively associated with academic performance (Ren & Chen, 2020). Additionally, there is a statistically significant relationship between the amount of time spent on social media and changes in attention, where an increase in attention level leads to increased time spent on social media. Research has shown that the time spent on social media has a negative impact on academic performance, as evidenced by the fact that college students are distracted by social media participation during the learning process, resulting in lower academic achievements (Giunchiglia et al., 2018; Paul et al., 2012). Hence, our research question as below:

**RQ: What is the impact of social media overload on learning engagement of undergraduate students?**

## 3 METHODS

In social science research, in-depth interview is commonly used in qualitative studies (Cuthbertson et al., 2020). They facilitate the exchange and development of opinions through face-to-face communication between interviewers and interviewees. During the interview process, interviewers discover and analyze the motivations, beliefs, attitudes, behaviors, and viewpoints of the interviewees.

### 3.1 Design

In-depth interviews, researchers, equipped with essential background knowledge of the research topics and interview guidelines, can pose questions to interviewees based on these key points and adjust accordingly to potential emerging questions (Maan et al., 2020). Furthermore, comparative studies have examined face-to-face interviews, online interviews, and telephone interviews, revealing similar interview quality but greater openness and expressive ability in online interviews (Johnson et al., 2021). Online interviews may alleviate interviewees' concerns as people are more willing to disclose personal information online, enabling those who may be silent or shy in face-to-face settings to express themselves with more confidence (Irani, 2019). Therefore, this method was used to interview some undergraduate students from undergraduate colleges in Guangxi.

Interview outline content. Drawing on Whelan et al. (2020) interview questions on the impact of social media overload on learning performance, based on the 5 theoretical foundations in Chapter 2. In this study, a preliminary draft of the interview outline was prepared based on the style of interview questions by McKelvy and Chatterjee (2016) and the background of Chinese college students. This study draws on Whelan et al. (2020) interview questions on the impact of social media overload on learning performance, and follows the style of McKelvy and Chatterjee (2016) interview questions to develop a draft of an interview outline based on the background of Chinese college students.

### 3.2 Study Context

This study employed a qualitative research approach aiming to explore the correlation between social media overload and undergraduate students' learning engagement. The objective was to investigate deeper-level influencing factors and provide insights for promoting the appropriate use of social media, managing time and energy allocation, and enhancing learning performance. The research process encompassed several key aspects. Firstly, previous empirical research findings were utilized to establish the foundation of interview guidelines, confirming the relationship between social media overload and learning engagement, as well as identifying relevant influencing factors. Secondly, in-depth interviews were conducted to gain insights into undergraduate students' experiences and narratives regarding social media usage.

Through pre-interview activities, the interview guidelines were enriched and refined. Lastly, NVIVO 14.0 software was employed to process the textual data, facilitating coding, frequency analysis, cluster analysis, and the formation of themes to attain a deeper understanding.

### 3.3 Procedures

The qualitative research method used in this study employed a constructivist research paradigm and employed purposeful sampling to recruit participants based on the characteristics of the target population. Purposeful sampling was chosen to select undergraduate students as interviewees because this sampling method is considered effective in identifying key factors from information-rich resources and conducting further qualitative research based on existing knowledge (Kallio et al., 2016).

Typically, a sample size of 5-15 participants is sufficient for achieving the requirements of in-depth interviews, although it also depends on the process of data saturation (Chen et al., 2018). Currently, Chinese college students have a high prevalence of social media use, and there is no differentiation in the social media usage policies among various universities. In this study, it is estimated that interviewing approximately 15 students may not yield new information related to the research topic, indicating that the point of saturation may have been reached.

### 3.3.1 Sampling Method and Participants

Purpose sampling process. Guangxi has a total of 26 undergraduate colleges, including 7 comprehensive colleges, 6 normal colleges, 4 medical colleges, 4 science and engineering colleges, and 5 other types of colleges. This study considered the attributes and geographical distribution of the schools to minimize sampling errors and systematic biases (Kallio et al., 2016). Ultimately, 18 undergraduate colleges were selected, including 5 comprehensive colleges, 2 normal colleges, 3 medical colleges, 3 science and engineering colleges, and 5 other types of colleges. One participant was purposefully selected from each school for in-depth interviews.

### 3.3.2 Pilot Study

Researchers often find it challenging to predict how interviewers will interpret the questions in the interview guidelines. Therefore, pilot interviews are usually conducted. Thus, this study selected one undergraduate student from Youjiang Medical University for Nationalities and one from Baise University for pilot interviews before the formal interviews. After the interviews, the interviewers communicated with the interviewees

regarding the interview questions and identified some semantic differences in the interview guidelines. Finally, this study invited professors in the fields of educational communication, psychology, and journalism and communication to modify and confirm the questions raised during the interviews, resulting in the final English, and Chinese versions of the interview guidelines. Please refer to Appendix one for detailed content.

### 3.3.3 Data Collection
The in-depth interviews utilized a semi-structured interview guide in the Chinese language version. The interview activities took place from April 18 to May 20, 2023, resulting in a total of 18 interviews with an average duration of 25 minutes per session. As a token of gratitude, participants were rewarded with 20-30 RMB vouchers after each in-depth interview. Preliminary calculations indicate that the total duration of the 18 interview recordings is approximately 465 minutes, which will be transcribed into text format in the next step. Specifically, prior to the commencement of the interview, the moderator informs the participants about the purpose of the interview, the reasons for audio recording, the method of recording, and the procedure for the disposal of the original recordings after the information has been organized. The in-depth interview can only proceed once the participants have given their consent.

### 3.3.4 Date Analysis
The interview data was processed using NVIVO 14.0 software. This study employed content analysis and word cloud techniques to analyze the thematic text, and further analysis was conducted using word frequency, correlation analysis, and hierarchy analysis. NVIVO is software used for research data analysis, particularly suitable for analyzing textual data from in-depth interviews and repeated interactions (Mortelmans, 2019). Firstly, the researcher converted the interview recordings into textual materials, resulting in approximately 59,300 Chinese characters of text, which were then translated into approximately 40,000 English words. Secondly, the 18 English transcripts were imported into NVIVO 14.0 and processed as individual cases. Subsequently, meaningful information points were categorized, relevant themes were generated, and comparative analysis was conducted with the questionnaire survey to further explain the results obtained from the survey.

## 4 RESULTS

### 4.1 Basic information about the interviewer
**Table 1** Basic Information of Interviewees for the In-depth Interview

| NO. | Gender | Age | Grade | College | College's type | major | daily use time (minutes) |
|---|---|---|---|---|---|---|---|
| ST01 | Female | 23 | Junior | Youjiang Medical University For Nationalities | Medicine | Medical imaging | 60-120 |
| ST02 | Female | 22 | Sophomore | Guangxi University | Comprehensive | Public Utility Management | 540-720 |
| ST03 | Male | 22 | Sophomore | Guangxi Medical University | Medicine | clinical medicine | 180 |
| ST04 | Female | 23 | Junior | Guangxi Minzu University | Comprehensive | administrative management | 360-420 |
| ST05 | Female | 23 | Junior | Guangxi University of Finance and Economics | Finance and Economics | Marketing | 240-300 |
| ST06 | Female | 22 | Junior | Guangxi Normal University | Normal school | Education | 240-300 |
| ST07 | Male | 22 | Junior | Guilin University Of Aerospace Technology | Science and Engineering | computer network | 480 |
| ST08 | Male | 20 | Sophomore | Guangxi University of Science and Technology | Science and Engineering | Applied Chemistry | 480 |
| ST09 | Male | 19 | Freshman | Guilin University of Technology | Science and Engineering | Mechanical manufacturing | 360 |
| ST10 | Female | 22 | Junior | Guangxi University of Chinese Medicine | Medicine | pharmacy | 480-540 |
| ST11 | Male | 19 | Freshman | Guangxi Agricultural Vocational University | Agriculture and forestry | Agricultural management | 180-240 |
| ST12 | Female | 19 | Junior | Guilin Tourism University | Travel | Chinese International Education | 360 |
| ST13 | Male | 20 | Sophomore | Baise university | Comprehensive | economic trade | 240-300 |
| ST14 | Female | 21 | Junior | Guangxi Arts University | Art | Dance performance | 360-420 |
| ST15 | Female | 20 | Sophomore | Hezhou University | Comprehensive | engineering cost | 300 |

| ST16 | Female | 22 | Junior | Yulin Normal University | Normal school | Internet of Things Engineering | 360-480 |
| ST17 | Female | 22 | Senior | Beibu Gulf University | Comprehensive | Mathematics and Applied Mathematics | 300-360 |
| ST18 | Female | 21 | Junior | Hechi University | Comprehensive | Environmental engineering | 240-300 |

According to the information in Table 1, the in-depth interviews involved a total of 18 participants (6 males, 12 females) from various public undergraduate colleges in Guangxi. The average age of the participants was 21.2 years, with 2 participants being freshmen, 5 being sophomores, 10 being juniors, and 1 being seniors. The participants belonged to diverse academic disciplines, with 8 in the humanities and social sciences and 10 in the science, technology, engineering, and mathematics (STEM) fields. These data align well with the comparison of participant characteristics in the quantitative study. Therefore, the interviewed participants represent the typical characteristics of undergraduate students in Guangxi.

### 4.2 Initial codes

Coding analysis: A total of 16 codes were obtained in this study. The sources of documents and references, the number of coding nodes, and examples are shown in Table 2.

**Table 2** The Source of Coding Nodes and Examples

| Coding Nodes | Files | References | Coding Example |
|---|---|---|---|
| Social overload | 10 | 15 | If a friend calls me on WeChat, I can't refuse the request, I play the role of a listener. But it can easily lead to negative emotions, which can affect my normal life (ST06). |
| Information overload | 11 | 23 | I just feel that there are too many notices from the school, and all levels send down notices and receive a lot of information. |
| Communication overload | 10 | 12 | When I use WeChat, I tend to talk a lot and enjoy chatting. I often chat with friends, so I spend more time (ST01). |
| System feature overload | 15 | 17 | Sometimes social media updates, and I think some software updates are quite frequent, which may not take into account the actual needs of users (ST12). |
| Social media use plan | 14 | 19 | the time I allocate to social media and learning tasks is relatively average. I am a sophomore and have a lot of free time. Generally, I don't have classes in the afternoon, so I can use social media freely (ST13). |
| Social media and game | 10 | 12 | If one is only immersed in non-learning information such as entertainment games on social media, it will only have a negative impact on students' learning experience and confidence (ST07). |
| Use frequency | 15 | 16 | I think it takes a lot of time because college students always hold their phones in their hands and respond to any messages, which takes up a lot of time. Even if there is no news, I occasionally open social media apps to check the situation inside (ST16). |
| use Intention | 17 | 24 | Most of it is to meet my communication needs, as well as learning, passing time, understanding new things, and paying attention to current affairs (ST02). |
| Use time | 18 | 23 | I am a severe internet patient myself, and if all social media is added up every day, it should take more than 8 hours (ST08). |
| Mental resource low | 17 | 52 | If used for a long time, it can lead to a lack of concentration and mental exhaustion, which can have a negative impact on my focus and perseverance in learning (ST07). |
| Self-control low | 15 | 31 | I haven't found a particularly good way to regulate it yet, and I may become immersed in social media. I want to change my heart, but my behavior has not been adjusted (ST07). |
| Time pressure | 16 | 47 | Sometimes there are some time pressures in the use of social media and the learning process. It's almost the deadline and we haven't completed the learning task yet (ST14). |
| Willpower beliefs | 17 | 49 | I think social media has a negative impact on my learning. My self-control is not very strong and I am easily influenced by social media (ST04). |
| Absorbing in learning | 15 | 36 | If there is a sudden call or new news that will interrupt my thoughts, it may take a lot of time to get back to my state, or it may not be possible to adjust (ST02). |
| Dedication in learning | 12 | 20 | social media often interrupts my normal learning and reduces my enthusiasm for learning (ST04). |
| Vigor learning in | 13 | 17 | It's also possible that after communicating with them, I feel tired and don't want to study anymore (ST04). |

As shown in the table above, the coding system software reveals the relationships between social media usage and learning engagement among undergraduate students in Guangxi, China. It is associated with social overload, information overload, communication overload, system features overload, social media usage patterns, usage time, usage frequency, usage intentions, gaming, decreased psychological resources, decreased self-control ability, time pressure, willpower beliefs, absorbing on learning, dedication on learning, and vigor on learning.

These codes provide explanations for all research questions. Themes related to social media overload, time pressure, willpower, and learning engagement are referenced most frequently in the files and interview references corresponding to the code nodes, aligning with the research themes. Further summarization and identification of all these code nodes can address the quantitative research questions.

## 4.3 Words Frequency

The word cloud feature generates a word cloud based on the frequency of words in the text. This feature includes a descriptive section related to word frequency and an analytical descriptive section corresponding to interview data coding developed in the literature review (Alam, 2021). This study explored and analyzed the word cloud feature of NVIVO 14.0 for all interview records. In this section, the words from the interview texts include all the interview content of the 18 participants. To encompass all the themes and further observe the thematic coding of this study, the researchers utilized the functionality of synonyms and professional matches when using the word cloud feature. Initially, this study employed synonym matching in the word frequency query, which effectively captured key terms such as social media usage, learning engagement, pressure, willpower, psychological resources, emotions, focus, and persistence, as illustrated in Figure 1 This implies that there are various ways to express the relationship between social media overload and learning engagement among undergraduate students.



**Figure 1** Synonyms Analysis of Lexicon Cloud for Student's Social Media Use and Learning Process

From Figure 1, it can be observed that the core keywords are related to social media and learning, which aligns with the main theme of this study. Communication, information, learning, time, and social software are common issues involved in undergraduate students' use of social media and directly impact their learning engagement. Furthermore, social media usage has both positive and negative effects on undergraduate students' learning engagement. The elements displayed in the figure, including focus, interest, sharing, vigor, and dedication, are closely associated with learning engagement, implying that undergraduate students' learning engagement should consist of these elements. Therefore, this study concludes that the use of social media and learning are central themes in the in-depth interviews. For undergraduate students, both utilizing social media for academic communication and accessing learning-related online resources, and engaging in normal communication with teachers, classmates, and friends are important.

However, when experiencing social media overload, undergraduate students often experience decreased self-control ability and inadequate psychological resources, leading to lower levels of learning engagement and subsequently affecting their academic performance. This phenomenon is known as ego depletion, which refers to the impact of exerting self-control in previous tasks on subsequent tasks, resulting in self-control failure, also known as the ego depletion effect (Muraven & Baumeister, 2000). Similar to the state of fatigue

experienced after repetitive muscle movements, self-control ability declines in the short term but can be restored through adequate rest or sleep, allowing self-control resources to replenish to their original level (DeWall et al., 2008).

Moreover, there is a behavior known as willpower beliefs that regulates the ego depletion phenomenon. Willpower beliefs have been widely applied in research on selfcontrol behavior. They have been shown to moderate the extent to which self-control ability declines after the depletion of self-control resources. In other words, willpower beliefs play a significant regulatory role between ego depletion and its impact (Vohs et al., 2012). Previous studies have demonstrated the malleability of willpower beliefs (Clarkson et al., 2016; Dweck, 2012). The primary difference among individuals in terms of willpower beliefs lies in their sensitivity to the depletion of self-control resources and their desire to preserve remaining self-control resources (Job et al., 2010). Research has shown that students with high willpower beliefs tend to achieve better academic performance, particularly when facing demanding academic tasks. Individuals with high willpower beliefs exhibit better self-regulation when confronted with challenging task demands (Job et al., 2015).

### 4.4 Clustered Analysis
Cluster analysis of the interview texts revealed interesting patterns in the correlations among the 18 interview materials. The cluster analysis tool was used to create correlations between different interviewees in all texts based on word analysis.

Understanding their exact viewpoints and attitudes would lead them to be classified into different groups, as shown in Figure 2.
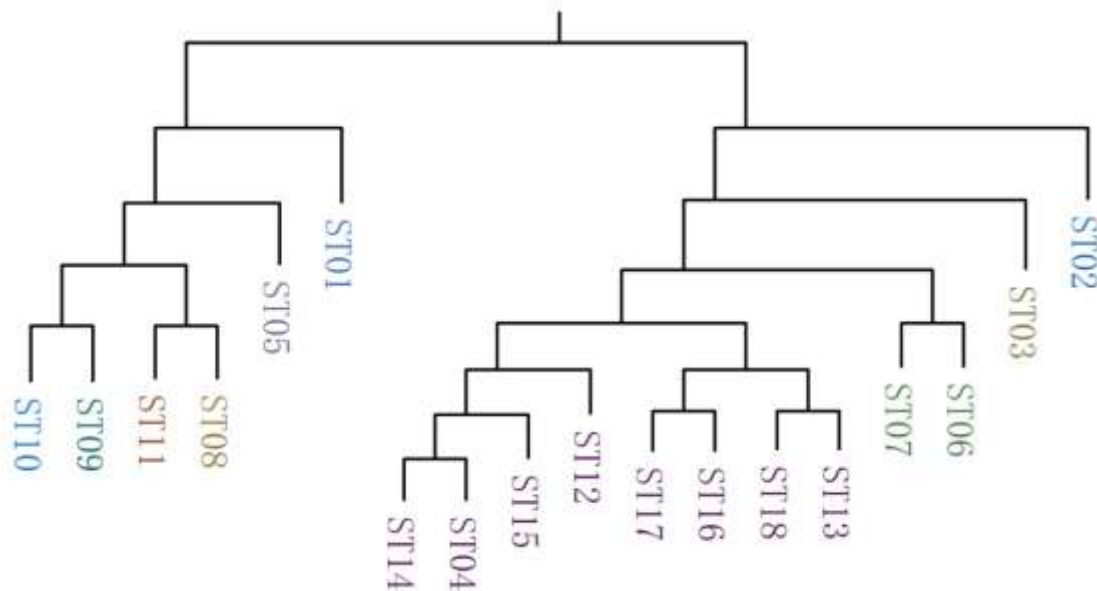


**Figure 2** Item Clustered Based on Word Similarity

Based on Figure 2, this study further analyzed the 18 interview texts (ST01 to ST18 representing different cases) corresponding to the interview records of different participants. The viewpoints and attitudes of different interviewees on key issues provide case clues for exploring the relationship between social media and learning among undergraduate students. The figure divides into two major categories, with ST01, ST05, ST08, ST09, ST10, and ST11 classified as one category, and the other 12 cases classified as another category. There is a co-occurrence between ST09 and ST10, indicating convergent similarities between them. Similarly, there is a co-occurrence between ST04 and ST14. Additionally, the presence of ST15 shows convergent similarities with them. Relevant examples were found in the corresponding interview records of this study.

For example, "After excessive use of social media, I feel eye strain, dizziness when looking away from the screen, and my mental state is not good... If the next learning task is English, I might feel irritated" (ST09) and "After spending too much time on social media on my phone, my stomach hurts, then I might feel dizzy, and I also get anxious because of reduced study time" (ST10). Based on the different expressions in these two texts, it can be observed that social media overload has negative effects on both the physiological and psychological aspects of undergraduate students and their symptom manifestations are similar. "If my self-control is not good, I will keep playing on my phone, and sometimes I realize that I have spent a long time without accomplishing anything. And I forget what I have learned before, so when I go to study, I force myself not to have the phone nearby" (ST04). "If I want to do something, I will set my phone to software-controlled mode and then put it aside to study, using my willpower to force myself not to use it" (ST14). The researchers found that willpower beliefs and self-control ability have become the same keyword in these two cases, and both cases have highly consistent solutions to the problem of excessive use of social media. Similarly, "I use self-control to manage social media usage, either by turning off my phone directly or by putting it aside and ignoring

messages" and "Sometimes negative emotions during chatting affect me and subsequent learning activities. But I also feel that I have good control, and I can adjust my mood in about 10 minutes and focus on studying" (ST15). This example also illustrates how interviewees control their use of social media.

### 4.5 Emotional Attitude Analysis
Emotional attitude analysis is primarily used for sentiment analysis and exploration of emotional attitudes in textual data. It helps researchers understand the emotional tendencies and attitudes expressed in the text, revealing people's emotional viewpoints on specific topics, concepts, or issues. The main features of emotional attitude analysis include sentiment identification, sentiment classification, sentiment distribution analysis, and contextual understanding.
The emotional attitude analysis in NVIVO software provides researchers with tools and methods for sentiment analysis and exploration of emotional attitudes. It enables researchers to extract emotional information from textual data and gain an indepth understanding of the emotional attitudes of the research subjects by analyzing the distribution and context of emotional expressions.

**Table 3** Classification of Emotional Attitudes

| Cases | strongly negative | relatively negative | relatively positive | strongly positive |
|-------|-------------------|---------------------|---------------------|-------------------|
| ST01 | 6 | 9 | 16 | 1 |
| ST02 | 10 | 8 | 11 | 1 |
| ST03 | 14 | 15 | 17 | 1 |
| ST04 | 5 | 15 | 23 | 1 |
| ST05 | 2 | 8 | 14 | 0 |
| ST06 | 4 | 8 | 8 | 2 |
| ST07 | 3 | 9 | 11 | 0 |
| ST08 | 11 | 11 | 23 | 2 |
| ST09 | 7 | 6 | 12 | 0 |
| ST10 | 13 | 14 | 15 | 0 |
| ST11 | 10 | 7 | 17 | 2 |
| ST12 | 2 | 10 | 13 | 1 |
| ST13 | 9 | 16 | 16 | 0 |
| ST14 | 5 | 10 | 15 | 0 |
| ST15 | 5 | 15 | 16 | 1 |
| ST16 | 7 | 18 | 20 | 3 |
| ST17 | 4 | 14 | 14 | 1 |
| ST18 | 11 | 10 | 18 | 3 |
| **Total** | **128** | **203** | **279** | **19** |

Table 3 presents the attitudes of each interviewee (ST01-ST18) towards the relationship between social media and learning engagement, categorized into positive and negative directions along four dimensions. The darker the color in the table, the more occurrences of that type of emotional words. For example, in the case of ST08, there are as many as 23 instances of "relatively positive" words. Overall, negative attitudes (331 instances) are significantly more than positive attitudes (298 instances), especially with 128 instances categorized as " strongly negative" compared to only 19 instances of " strongly positive." This indicates that the interviewees believe that social media overload has a predominantly negative impact on learning engagement. Therefore, while they need social media for learning assistance, they also inevitably get trapped in the entertainment aspect of social media and find it difficult to extricate themselves, which confirms some of the results from the questionnaire survey.

### 4.6 Hierarchical Analysis
By comparing the reference points of different codes, the researchers have identified the levels of various code categories and further refined the research themes.
This study developed a hierarchical diagram that presents the size of each code area based on the number of coding reference points, as shown in Figure 3.
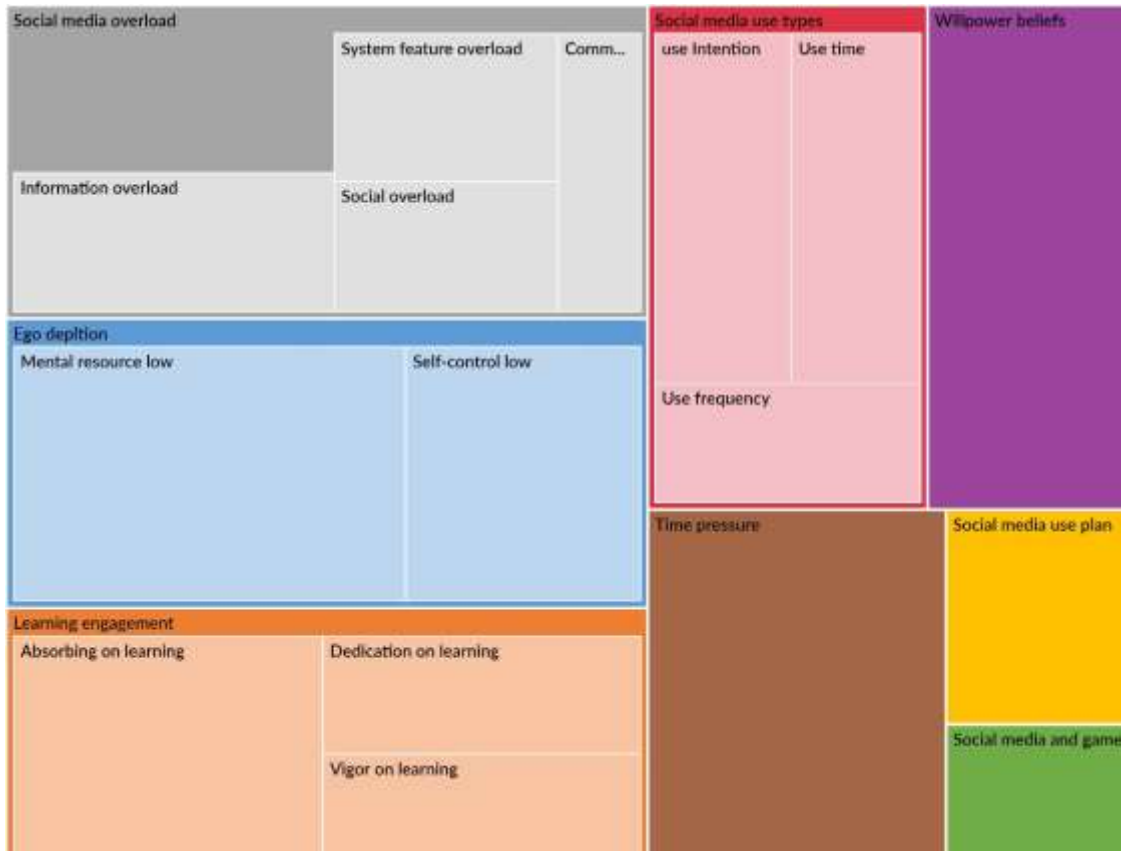
**Figure 3** Coding Hierarchy of Social Media Overload and Learning Engagement

The figure above illustrates that social media overload, ego depletion, and learning engagement have the highest number of code occurrences, indicating that they are the main themes of this study. Therefore, this study can better classify the codes according to different levels. For example, social media overload includes codes related to social overload, information overload, communication overload, and system feature overload. On the other hand, learning engagement includes codes related to absorbing on learning, dedication on learning, and vigor on learning. Based on the above data analysis, this study constructed relevant themes concerning the use of social media and undergraduate students' learning engagement, as shown in Figure 4.
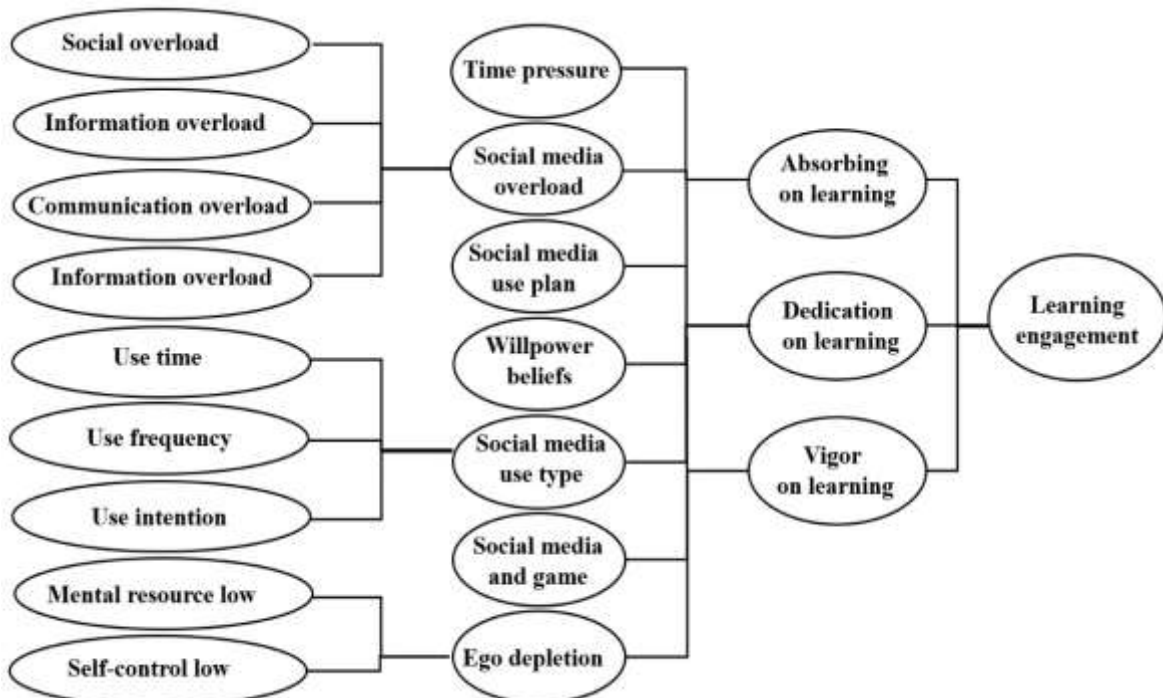


**Figure 4** The Theoretical Framework of Social Media Overload and Learning Engagement

# 5 DISCUSSIONS

With the continuous enrichment of social media functionalities, there is a trend of expansion from a social tool to an educational tool (Zhao et al., 2021). Social media has become an important platform for knowledge sharing and learning at both individual and organizational levels, particularly during the three years of the COVID-19 lockdown in China, where the educational function of social media has become more prominent. However, due to people's unreasonable usage behavior, the potential negative effects of social media have also emerged. Based on the literature review, this study proposes a research framework to clarify the relationship between social media overload and undergraduate students' learning engagement. This study has yielded some research results and meaningful findings, in response to the discussion on four aspects of application based on the three questions raised earlier.

## 5.1 The relationship between social media overload and ego depletion

The study found a significant positive impact of social overload on ego depletion, consistent with the findings of Inzlicht and Schmeichel (2012) but different from those of liu (2022). The higher the degree of social overload, the more severe the individual's ego depletion. When undergraduate students engage in social activities beyond their capacity, it can cause anxiety, unease, irritability, and other emotions, requiring the expenditure of self-control resources for regulation, and leading to ego depletion. Communication overload and system feature overload significantly and positively influence ego depletion, consistent with the findings of Cao and Sun (2018) and Zhang et al. (2016), and in line with the results of liu (2022). The demands of extensive communication and frequent system updates and iterations may interrupt the learning tasks of undergraduate students, increase the cognitive burden, and require the expenditure of self-control resources to shift attention from handling overload demands to the original learning tasks, thereby causing ego depletion. Interestingly, the influence of information overload on ego depletion in this study was not significant, different from the findings of Brooks and Califf (2017) and liu (2022). One possible reason is that undergraduate students often use social media for information searching and knowledge sharing, and the frequent behavior of information acquisition has become normalized, rendering the impact of information overload on ego depletion insignificant. For example, in-depth interviews revealed a participant stating, "Social media platforms adapt to the needs of the times, satisfying some of the contemporary life needs, making it more convenient and faster to learn about events happening nationally and globally. After obtaining this information, I feel satisfied and can sleep peacefully" (ST04). The participant's statement also validates the perspective of the use and gratification theory. Additionally, another undergraduate student mentioned: "Through social media, I don't feel that knowledge sharing and information exchange consume a significant amount of my time and energy. Because some of the social hot topics align with the content we need to study, we can analyze these social hot topics as cases in our studies" (ST13).

## 5.2 The relationship between social media overload and learning engagement

Social overload has a significant negative impact on learning engagement, indicating that excessive social activities affect the time and quality of learning engagement, consistent with the findings of Maier et al. (2015). System feature overload significantly and positively influences work engagement, different from the findings of liu (2022), suggesting that the system features of social media may fulfill the curiosity of undergraduate students, especially during the COVID-19 pandemic when many social media platforms added teaching functions, facilitating communication among teachers, students, and peers, and promoting learning engagement. For example, one interviewee stated, "When I was in my first year of university, I was a discipline officer and needed to remind my classmates to complete tasks on DingTalk (a social media platform). Later, DingTalk updated some features, and it automatically reminded all classmates. At that time, I saved a lot of energy and liked this new feature. I no longer needed to remind my classmates. It's so convenient" (ST16). This to some extent validates the viewpoint of the technology acceptance model.
However, information overload and communication overload do not have a significant impact on learning engagement, consistent with the findings of Hwang et al. (2020). This may be because social media serves as an important channel for students to access valuable information in the era of information. The abundance of information does not overwhelm undergraduate students, and they can still focus their attention on learning tasks without affecting their current level of learning engagement. Moreover, social media communication serves as a guarantee for collaborative learning, so it does not have a significant impact on learning engagement. For example, a participant said, "I communicate with friends every day and have voice calls with family. I think social media and learning can coexist. It's not like using social media less if I want to study well. Sometimes when I'm tired of studying, I share my feelings on social media. Using social media helps me regulate my state" (ST13).

## 5.3 The relationship between ego depletion in learning engagement

This study also found that ego depletion has a significant negative impact on learning engagement, indicating that higher levels of ego depletion are associated with lower levels of learning engagement, consistent with the findings of Garrison et al. (2018) and liu (2022). Learning engagement may require the depletion of

undergraduate students' self-control resources to focus their energy on current learning tasks and goals. Undergraduate students in a state of ego depletion are more likely to have a reduced willingness to exert subsequent self-control. Therefore, when experiencing ego depletion, undergraduate students may struggle to mobilize their selfcontrol resources fully and find it challenging to concentrate on learning tasks. An interviewer said: "Watching short videos on social media can be addictive, and forgetting the time can affect sleep, leading to poor mental health the next day and inability to concentrate on learning. Additionally, sometimes using social media can delay study or work time, disrupting original plans " (ST02).

## 5.4 The role of ego depletion in social media overload and learning engagement
The research findings demonstrate that ego depletion significantly mediates the relationship between social media overload and learning engagement, consistent with the perspectives of Vanco and Christensen (2016), Zhang et al. (2016), and Huang (2017), as well as similar to the findings of Shi et al. (2020) in the context of work engagement. This is one of the most significant discoveries of this study. Therefore, for undergraduate students in higher education, the results of this study indicate that social **overload,** communication overload, and system feature overload can lead undergraduate students to experience ego depletion, making it challenging for them to maintain self-control resources, focus their attention on learning, and sustain high levels of learning engagement. Communication-based on social media is also a necessary condition for collaborative learning among students and between students and teachers. Moreover, communication overload does not directly and significantly impact learning engagement; instead, it negatively affects learning engagement through the complete mediating effect of ego depletion. Therefore, although some aspects of social media overload may not appear to have a negative impact on learning engagement, they primarily influence learning engagement through the mediating effect of ego depletion, which should draw the attention of relevant scholars.

**For example**, one interviewee stated, "I remember that I used social media for more than 8 hours a day basically the previous year. When I spent too much time on it, I would feel lazy, have a foggy mind, and even experience headaches, dizziness, and shortness of breath… If I tried to study during this time, my focus would be poor, and my learning efficiency would decrease. Moreover, I would experience mental blankness while studying, and if the teacher was giving a lecture, I couldn't pay attention" (ST14). **Thus,** this part of the research demonstrates the mediating role of ego depletion in the impact of social media overload on learning engagement, and it validates the interactive principle of environmental stimuli, psychological responses, and behavioral outcomes (S-S-O model). This contributes to a clearer and more comprehensive understanding of the potential mechanisms through which social media overload affects learning engagement among undergraduate students. Therefore, although some social media overload does not seem to have a negative impact on learning engagement, in fact, it mainly affects learning engagement negatively through the mediation of ego depletion, which needs to attract the attention of relevant scholars.

## 5.5 The role of willpower belief in social media overload and learning engagement
As the level of willpower beliefs among undergraduate students increases, the predictive effect of social media overload on learning engagement gradually decreases. Specifically, undergraduate students with high willpower beliefs demonstrate better performance in learning engagement compared to those with low willpower beliefs, and they alleviate the negative impact of ego depletion on learning engagement. This result indicates that willpower beliefs serve as a protective factor against insufficient learning engagement caused by ego depletion, consistent with previous research findings (Job et al., 2015; Lian et al., 2018; Salmon et al., 2014; Vanco & Christensen, 2016). An interviewer said, "I think it's difficult to regulate it solely based on my willpower. Only when I get tired of playing on social media and become bored, will I automatically return to my studies, which can maintain 2-3 hours of study time. Sometimes, excessive use of social media for entertainment can create a sense of guilt, forcing me to refocus my mind on my studies." (ST13)
Undergraduate students' beliefs about self-control resources influence the strength of the ego depletion effect, where individuals with low willpower beliefs are more sensitive to the depletion of self-control resources, while undergraduate students with high willpower beliefs can still maintain a certain level of self-control ability, thereby attenuating the subsequent effects of ego depletion (Job et al., 2015). This indicates that a high level of willpower beliefs partly protects undergraduate students from the negative impact of ego depletion (Savani & Job, 2017). Therefore, even under conditions of social media overload, some undergraduate students can ensure the time and quality of learning engagement and mitigate the negative effects of ego depletion through the moderating role of willpower beliefs.

## 5.6 The role of time pressure in social media overload and learning engagement
Time pressure is negatively associated with learning engagement overall, with undergraduate students experiencing higher time pressure exhibiting lower levels of learning engagement. However, as the level of time pressure among undergraduate students increases, the predictive effect of social media overload on learning engagement gradually intensifies. This result is consistent with the findings of Widmer et al. (2012) but inconsistent with the studies conducted by Naruse et al. (2012), Crescenzi et al. (2016) and Guo et al. (2020). Although time pressure is an important situational factor affecting individuals' ability to make optimal decisions, when individuals perceive that they have less time than they need, it can lead to negative emotional

experiences (Ariely & Zakay, 2001). In the context of social networking, the fragmentation of time affects the continuity of engagement in learning tasks, and users with high time pressure may feel that they don't have enough time to focus on studying. For example, a participant stated, "The information online is fragmented, like a TikTok video that lasts only a few seconds, and the information in it is quickly consumed. This fragmented information is detrimental to our thinking. When we encounter knowledge that requires a lot of time and effort to learn, such as reading articles, our patience is no longer as good as before. Constantly receiving fragmented knowledge wears down our patience" (ST02).

Simultaneously, this study also validates the S-S-O model proposed by Koeske and Koeske (1993). Time pressure, as a challenging stressor, can have a facilitating effect by generating motivation and positive emotions, providing individuals with a sense of challenge, stimulating their motivation level, and serving as a motivating factor, thus generating certain positive effects (Li et al., 2015). Time pressure leads to reduced learning engagement among undergraduate students, but under conditions of severe social media overload, higher time pressure further stimulates their level of learning engagement and improves learning efficiency. Therefore, this study considers individuals' willpower beliefs and time pressure as research perspectives, which to some extent enriches the field of ego depletion research and expands the boundaries of ego depletion theory.

## 6 CONCLUSION AND IMPLICATIONS

This study has yielded significant findings. Firstly, there is a strong correlation between social media usage and learning engagement among undergraduate students. Given the indispensability of social media for knowledge acquisition and life skill development, excessive usage of social media hampers learning engagement by consuming considerable time and energy. Secondly, social media overload, encompassing social overload, information overload, communication overload, and system feature overload, arises from undergraduates' excessive reliance on social media for information exploration and entertainment. Prolonged daily usage and high frequency contribute to overload experiences, which negatively affect learning outcomes. These observations align with the theoretical perspectives of the Uses and Gratifications Theory and the Technology Acceptance Model. Thirdly, undergraduates perceive recreational activities on social media (e.g., gaming, watching short videos, communicating with friends) as forms of relaxation, leading to cognitive biases that deplete psychological resources and impair self-control. Fourthly, undergraduates face conflicts between entertainment and learning while using social media. They exert subjective agency, employing willpower beliefs and time pressure to regulate the effects of social media overload on learning engagement and pursue their academic and personal goals. Lastly, learning engagement encompasses absorption, dedication, and vigor, which are influenced by undergraduates' social media usage and the impact of ego depletion, with the latter exerting a stronger negative effect.

These research findings provide valuable implications for the future. Firstly, school administrators and higher education faculty should actively guide undergraduates in their social media usage. Educators should emphasize the importance of balanced social media use. Secondly, undergraduates should enhance their management of mobile devices, reducing the time and energy allocated to social media activities to mitigate negative impacts. Moreover, cultivating a sense of time management and strengthening willpower beliefs would enhance self-control and minimize detrimental behaviors. Thirdly, social media service providers and technology developers should offer customized services. Minimizing unnecessary updates and utilizing big data technologies to deliver relevant information can reduce undergraduates' likelihood of excessive usage, thereby preventing more serious societal issues from arising.

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