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# Exploring the influence of excessive social media use on academic performance through media multitasking and attention problems: a three-dimension usage perspective

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**Abstract**
The use of social media among students has gained significant attention due to its potential impact on academic performance, characterized by both positive and negative effects. However, limited research exists regarding the different types of excessive social media use and their influence on academic performance. In this innovative study, we aim to differentiate excessive social, hedonic and cognitive use of social media and investigate the mediating role of media multitasking and attention problems in predicting academic performance. The survey data from 887 high school students were analyzed using PLS-SEM techniques. The results revealed that both excessive social and hedonic media usages were positively associated with media multitasking, but excessive cognitive use had a negative impact on media multitasking. This tendency to engage in multitasking was found to be linked to attention problems, which ultimately led to decreased academic performance. These findings highlight the potential pitfalls of excessive social media use, encouraging students to focus on a single task can help mitigate the negative effects associated with social media use. These findings emphasize the risks of excessive social media use and the benefits of concentrating on singular tasks. Moreover, they enrich our understanding of students' social media usage types and underscore the importance of fostering more productive digital habits, ultimately bolstering academic achievements.

**Keywords** Excessive social media use · Media multitasking · Attention problems · Academic performance · Adolescent · Uses & gratification (U&G) theory

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## 1 Introduction

Social media has become an integral part of modern life, offering benefits such as facilitating communication, providing online social support, and seeking information to solve problems (Chu, 2020; Hu et al., 2022a; Nduhura & Prieler, 2017). In the context of education, research suggests that social media can be a helpful tool for students, promoting interaction and collaboration that can enhance academic performance (Ali et al., 2017; Michikyan et al., 2015; Chang et al., 2019). Evidence from previous research underlines the potential positive impact of regular social media on everyday life (Karr-Wisniewski & Lu, 2010; Andreassen, 2015; Oksa et al., 2021). However, due to its inherently captivating nature, frequent use of social media can also lead to overuse (Leftheriotis & Giannakos, 2014; Castrén et al., 2022), a behavior we refer to as excessive social media use in this study. Especially during the COVID-19, the social distancing measures prompted, people to engaged more on online interactions and made users more likely to be addicted to social media (Yu et al., 2022). Simultaneously, technology also began to play a significant role in the learning process (Maqsood et al., 2021).

With the rise of portable devices and constant intent access, students can connect online from almost anywhere anytime (Uzun & Kilis, 2019). However, the negative effects of social media use has on behavior outweigh the positive aspect (Abbas et al., 2019). Students are increasingly dependent on information and data that is easily accessible on social networking sites and the internet, causing the decline of their learning skills and research capabilities (Abbas et al., 2019). Moreover, this convenience has been associated with an increase in multitasking, especially in the context of media consumption (Jacobsen & Forste, 2011; Karpinski et al., 2013; Sun & Zhong, 2020). Media multitasking, defined here as engaging in two or more types of media or using media while engaging in non-media activities (Jeong & Hwang, 2012), is most effective for tasks requiring little cognitive effort (Kirschner & Karpinski, 2010). Studies have shown that multitasking can be detrimental to academic performance, with multitaskers frequently being distracted by unrelated information, resulting in lower grades (Martín-Perpiñá et al., 2019; Van Der Schuur et al., 2020). In the context of China, academic performance holds significant weight for high school students as it serves as a pivotal criterion for their success in the college entrance examination, a crucial determinant of their future educational opportunities.

There is considerable evidence linking high levels of social media use to negative academic outcomes (Brooks, 2015; Whelan et al., 2020; Evers et al., 2020). Overuse of social media can lead to attention deficits (Boer et al., 2020; Moqbel & Kock, 2018) and academic distraction (Feng et al., 2019). In addition, attention problems are closely related to decreased academic performance among adolescents (Visser et al., 2020). Therefore, it becomes evident that a potential avenue for research lies in investigating the mechanism of the negative impact of media multitasking on academic performance, which is due to increased attention problems.

Moreover, in studying the effect of social media use and media multitasking, research has not differentiated between different types of social media use, but collectively referred to as excessive social media use or problematic social media use (Saleem et al., 2021; Xie et al., 2021). A single conceptualization of user behavior

fails to fully capture the range of consequences associated with distinct social media activities. Consequently, it remains uncertain whether different modes of engagement with social media yield disparate outcomes. Therefore, this study aims to examine the relationships between different types of social media use, multitasking, attention problems and academic performance. We propose two research questions:

1. How does excessive social media use, differentiated by usage types, affect student's academic performance?
2. Whether the Negative effects of media multitasking on academic performance operate through increased attention problems?

By exploring these questions, this study identified three dimensions of excessive social media use based on the uses and gratifications (U&G) theory. By differentiating these dimensions, we aim to capture the diverse nature of social media usage and enhance our understanding of this phenomenon. Subsequently, we employ a quantitative approach and develop a research model suggesting that these three types of excessive social media use can lead to increased media multitasking, which, in turn, may contribute to attention problems and reduced academic performance among high school students.

This study uses the potential research gaps discussed in previous section. Previous studies have demonstrated the detrimental effects of excessive social media use on academic performance, limited research has focused on the specific influence of different types of social media usage. Moreover, our study explored the relationship between excessive social media use and media multitasking, and the effects of media multitasking on attention and academic performance, we advanced our understanding of the complex interplay between excessive social media use and students' academic outcomes. In addition, this research shed light on the importance of attention focusing in relation to academic performance, contributing to the broader understanding of the complex relationships between excessive social media use, attention, and academic performance.

## 2 Literature review

The Uses & Gratification (U&G) Theory explains the concept of why people use social media to meet their requirements based on the origins of social and psychological needs (Ruggiero, 2000). Four major assumptions underlie the U&G Theory: (i) media use is driven by goals and motivations, (ii) individuals employ media platforms to fulfill their needs and desires, (iii) social and psychological factors play a mediating role in media usage, and (iv) there is a correlation between media use and interpersonal communication (Rubin, 1993). The U&G theory is widely used to explain the gratifications obtained from social media and investigate the underlying factors driving individuals' engagement with social media platforms (Alhabash et al., 2014; Grellhesl & Punyanunt-Carter, 2012). Recent research has utilized the U&G theory to identify that individuals with diverse personalities possess distinct needs for

social media. As a result, they opt for various social media platforms in order to fulfill these needs (Kircaburun et al., 2020; Chen & Peng, 2022).

According to the U&G theory, students use social media for different motives, such as satisfying their social need, hedonic need, and cognitive need (Han et al., 2015; Ryan & Xenos, 2011; Sutcliffe et al., 2018; Chang et al., 2019; Vaghefi et al., 2023). In this study, we focus on three dimensions of excessive social media use related to these needs: excessive social, hedonic, and cognitive usages (Cao & Yu, 2019). The widespread availability of social media has granted individuals the freedom to engage in activities of their choice at any time and from any location. However, this boundary-blurring effect of social media can also lead to a blurring of boundaries between learning and personal life. Consequently, students often find themselves switching between various tasks while studying (Jacobsen & Forste, 2011; Le Roux et al., 2021). Unfortunately, this tendency to multitasking has adverse effect, including attention problems (van der Schuur et al., 2015; Fisher et al., 2022) and a negative impact on academic performance (Frein et al., 2013; Zhao, 2023).

Based on the preceding discussion, our research model is depicted in Fig. 1. Although numerous studies have documented the detrimental consequences of excessive social media usage on students, we propose that three forms of excessive social media use can trigger media multitasking, which, in turn, result in attention problems and ultimately contribute to a decline in academic performance. Additionally, our model incorporates demographic variables such as gender and age as control variables.

### 2.1 Excessive social use and media multitasking

Excessive social use is characterized by devoting substantial time and energy to maintaining and enhancing social connections, such as liking posts, updating status and chatting in group chats (Ryan & Xenos, 2011). Given that social media platforms are designed to foster relationship building and maintenance (Billedo et al., 2015; Kim & Kim, 2022), students can use them to establish new connects or keep in touch with existing friends (Feng et al., 2019). For individuals with difficulties in face-to-face

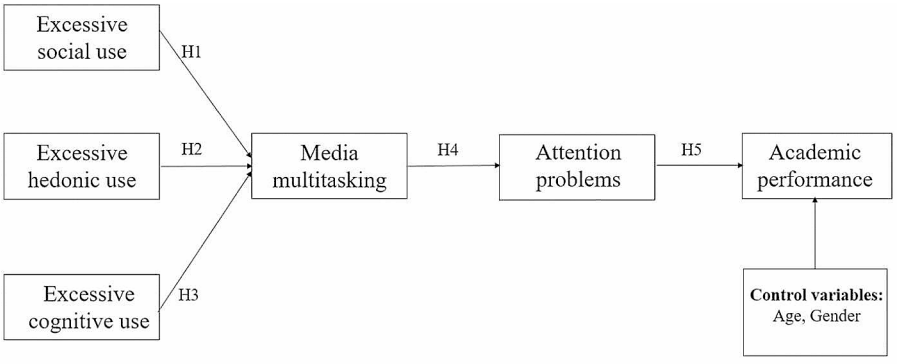


**Fig. 1** Research model

interactions, social media provides an additional platform to increase users' social capital (Reer & Krämer, 2017), and to gratify the unmet needs of socializing in this alternative context (Chan & Cheng, 2016; Cheng et al., 2019). Several studies have noted a positive correlation between the intensity of social media use and a sense of attachment to the platform, which can manifest as an obsessive compulsion to remain online for extended periods (Kaye, 2019; Brailovskaia et al., 2020). While individuals can easily receive social support from online friends, they may also encounter an increasing volume of social requests due to the reciprocity inherent in social relationships (Maier et al., 2015; Hu et al., 2022b).

Data from the 2009 and 2018 Programme of International Student Assessment (PISA) surveys showed a growing trend of online communication in daily life (Luyten, 2022). Students have been found to spend significant time chatting online while studying (Junco & Cotten, 2012; Deng et al., 2022). It is plausible that students' commitment to maintaining social connections prompts them to remain online, available to respond to friends even during learning tasks, leading to frequent interruptions. Hence, we propose the following hypothesis:

**H1.** Excessive social use of social media is positively related to media multitasking.

### 2.2 Excessive hedonic use and media multitasking

Excessive hedonic use implies devoting excessive time and effort to social media use for hedonic purposes, such as playing online games, watching video, and listening to music (Müller et al., 2016; Barta et al., 2023; Vaghefi et al., 2023). With the increasing ubiquity of social media, these platforms have become integral to everyday activities (Y.-S. Cheng & Cho, 2021), transforming internet surfing into a commonplace leisure activity (Kim et al., 2017). Recent studies have suggested that social media break activities can enhance recovery and reduce stress (Rhee & Kim, 2016; Y.-S. Cheng & Cho, 2021; Nie et al., 2023), with micro-break activities inducing positive affect at work (Kim et al., 2015, 2018; Albulescu et al., 2022). However, students often struggle with self-control when balancing social media use with other goals (Hofmann et al., 2012; Du et al., 2018). The hedonic appeal of the technologies along with the pleasurable experience they provide create a powerful impetus for their use, even during work or personal time (Leftheriotis & Giannakos, 2014; Brooks, 2015; Vaghefi et al., 2023). Feng and Wong (2019) found that increased hedonic use could result in more multitasking, negatively impacting academic performance. Therefore, we hypothesize that:

**H2.** Excessive hedonic use of social media is positively related to media multitasking.

### 2.3 Excessive cognitive use and media multitasking

Excessive cognitive use pertains to the disproportionate time and effort spent on social media to search for educational materials, interaction and collaboration (Ali et al., 2017). The surge of information sharing via social media in the past decade has fundamentally changed the manner in which individuals access learning resources ( Rahmi et al., 2014). Prior studies have evidenced that social media, when used for

academic purposes, can enhance learning skill as well as performance (Michikyan et al., 2015; Al-Rahmi et al., 2021). For instance, using social media for information-seeking purposes assists students concentrating on exploration and critical thinking, ultimately equipping them for academic learning (Meng et al., 2023). Nonetheless, there are concerns regarding the cognitive repercussions of social media use, such as cognitive overload leading to diminished efficiency (Whelan et al., 2020).

According to cognitive load theory (Sweller, 1988), human memory comprises two components—working memory and long-term memory. Cognitive overload arises when the cognitive resources required to solve problems exceed the total available resources in working memory (Whelan et al., 2020). Thus, every cognitive activity utilizes cognitive resources, and due to their limited nature, students cannot simultaneously undertake multiple cognitive activities without cognitive overload. Recent research confirmed that the excessive cognitive use of Facebook can lead to cognitive overload, resulting in the decision to quit the platform (Luqmanet al., 2017). Therefore, we assumed that students would avoid multitasking during cognitive activities. However, despite the negative outcomes of multitasking reported in some research (Karpinski et al., 2013; Lau, 2017), there are students who genuinely believe in their ability to effectively multitasking (Brooks, 2015; Deng et al., 2022) and persist doing so (Terry et al., 2016). In addition, previous research has indicated that individuals with high levels of multitasking self-efficacy can effectively manage cognitive load in an environment with frequent interruptions (Basoglu et al., 2009; Islam et al., 2021). Consequently, students who possess confidence in their capacity to simultaneously engage in multiple tasks are more likely to exhibit multitasking behavior. Therefore, we propose the following hypotheses:

**H3a.** Excessive cognitive use of social media is negatively related to media multitasking.

**H3b.** Excessive cognitive use of social media is positively related to media multitasking.

### 2.4 Media multitasking and attention problems

Existing research typically posits that those accustomed to frequently shifting between tasks may display deficits in cognitive control (Ophir et al., 2009; van der Schuur et al., 2015; May & Elder, 2018). Task completion relies heavily on effectively engaging cognition, a top-down mechanism includes several control processes, such as formation, maintenance, and updating of goal representations (Miller & Cohen, 2001). These abilities are crucial for adolescents' focus and include processing goal-relevant information, filtering irrelevant information, and detecting conflicts between them (O'Reilly, 2006; Boucher et al., 2007; Miller & Cohen, 2001). Previous studies have shown that people with weak cognitive control have trouble staying focused (Kane et al., 2007; DeRonda et al., 2021; Kokoç, 2021).

The scan-and-shift hypothesis suggests that individuals exposed consistently to various media activities might develop a "breadth-biased" cognitive control—a cognitive processing style in which people become accustomed to processing information from multiple sources simultaneously (Nikkelen et al., 2014; van der Schuur et al., 2015). Additionally, the fast pace of social media makes it challenging for

individuals to filter out irrelevant information, thereby impeding the development of attentional focusing skills (Zimmerman & Christakis, 2007; Uncapher & Wagner, 2018; Kokoç, 2021). This constant exposure also compels individuals to attend to both relevant and irrelevant information (Ophir et al., 2009; Kong et al., 2023), resulting in an attentional style characterized by scanning and shifting (Jensen et al., 1997; Zhang et al., 2022). This form of attention might disrupt adolescents' performance in activities requiring sustained attention, such as careful listening in class or completing homework (Nikkelen et al., 2014). As such, we posit the following hypothesis:

**H4.** Media multitasking is positively related to attention problems.

### 2.5 Attention problems and academic performance

In this study, Attention Deficit Hyperactivity Disorder (ADHD) symptoms were utilized as indicators of attention problems among adolescents. The rationale for this approach is based on the established association between ADHD and attention difficulties in the literature. Numerous studies have demonstrated that ADHD symptoms, such as inattention and hyperactivity-impulsivity, are indicative of attention problems in adolescents (Dunn & Kronenberger, 2005; Lehn et al., 2007; Fabio & Urso, 2014). ADHD is a common neuropsychiatric condition associated with impaired school performance. Its core symptoms—comprising inattention, impulsivity, and hyperactivity (Barkley et al., 2006; Wu & Gau, 2013), are related to adverse outcomes such as poorer academic grades, higher dropout rates, higher rates of unemployment, and reduced quality of life (Henning et al., 2022; Zendarski et al., 2022).Existing studies have established that current achievement correlates with learning abilities, particularly in reading comprehension and math fluency (Gallen et al., 2023). These ADHD symptoms have been found to interfere with the acquisition of such ability, thereby leading to learning difficulties and poor performance (Spira & Fischel, 2005; Efron et al., 2020; DuPaul et al., 2021). Therefore, we propose the following hypothesis:

**H5.** Attention problems are negatively related to academic performance.

## 3 Data and methodology

### 3.1 Study participants and procedures

The study utilized an online survey to gather data from high school students in China between February and March 2023. Quantitative method weas utilized for data collection due to the cost-effectiveness and time efficiency associated with online survey. Teachers from various high schools shared the survey link with their students, resulting in a total of 984 student responses. After excluding participants who failed the attention check items and provided unrealistic social media usage times, a final sample of 887 valid responses was obtained. As the participants had to finish every answer before they submitted the questionnaire, there were no missing values in the final data. We assumed that all variables in our analysis followed a normal distribution. The sample included 577 females (65.1%) and 310 males (34.9%). The partici-

pants' ages ranged from 14 to 20 years, with a mean age of 16.65 years ($SD$=0.953). The whole sample consisted of 44.8% students in the first grade, 27.3% students in the second grade, and 28.0% students in the third grade. The research received approval from the ethics committee of Tianjin Normal University, China.

### 3.2 Measures

*Measures of excessive social media use.* The measurements for different excessive social media use types in this study were adapted from Cao and Yu (2019) including four questions of excessive social use, three questions of excessive hedonic use and four questions of excessive cognitive use. A 5-point Likert scale ranging from 1 being "strongly disagree" to 5 being "strongly agree" was utilized. The measurement items used are presented in Appendix A.

*Measures of media multitasking.* Media multitasking was assessed using two items from Lau's (2017) study, which were rated on a 5-point Likert scale ranging from 1("strongly disagree") to 5("strongly agree"). The items include "I multitask with my social media account while studying" and "I remain online with my social media site(s) while doing homework."

*Measures of attention problems.* Adult ADHD Self-Report Screening Scale for DSM-5 (ASRS-5) was used to measure attention problems (Ustun et al., 2017). The scale has been validated for adolescents(Somma et al., 2021). The scale consisting of six items, each item was rated on a 5-point Likert scale, ranging from 0 being "never" to 4 being "very often". The questions measured dimensions of DSM-5 symptom of inattention, non–DSM-5 symptoms of executive dysfunction, and DSM-5 symptoms of hyperactivity and impulsivity. In the current study, we used the resulting 0–24 continuous score as a predictor without having a clinical threshold.

*Measures of academic performance.* We used the self-reported grade as an indicator of academic performance. Specifically, we asked the participants to rate their general class rank on a five-point scale from 1=very low, 2=relatively low, 3=middle, 4=relatively high, and 5=very high. The rate was used as a continuous variable. A higher score represents better academic performance. In the current study, the Mean of the rank was 2.89, $SD$ was 0.914, Skewness was −0.006, and Kurtosis was −0.127.

### 3.3 Data analysis

Statistical Package for Social Science (SPSS) and SmartPLS 4 were used to analysis data. Specifically, we conducted confirmatory factor analysis and partial least squares structural equation modelling (PLS-SEM) to address the hypotheses. The method of SEM is a set of statistical techniques that permits us to study relationships among independent and dependent variables (Abbas et al., 2020). PLS is a second-generation regression method that allows for the simultaneous evaluation of the validity of the research model and the hypothesized relationships within it (Whelan et al., 2020).

To ensure the adequacy of our sample size, it is recommended in Partial Least Squares (PLS) analysis that the sample size should be at least ten times larger than the most complex multiple regression in the model (Hair, 2018). In our study, with a sample size of 887 participants, this criterion is satisfied. Additionally, our model

incorporates gender and age as control variables. Furthermore, we conducted 5000 bootstrap samples to determine the significance of the path coefficients.

The construct validity of the measurement model was assessed by examining its reliability and discriminant validity. To evaluate the overall fit of the model to the data, the recommended parameters by Byrne (2016) were calculated in the present study: Standardized Root Mean Square Residual (SRMR). Goodness-of-fit criteria were used in the current study that acknowledged the potential for acceptable (SRMR < 0.08).

## 4 Results

### 4.1 Measurement model

To examine the proposed hypotheses, confirmatory factor analysis was conducted to assess reliability and validity, mirroring the methodology employed in prior research study (Abbas et al., 2023). Reliability, which measures the consistency of measurements for a construct, was evaluated prior to assessing validity. Following the suggestion by Fornell and Larcker (1981), reliability was assessed by examining whether Cronbach's alpha and composite reliability (*CR*) values exceed 0.70. Convergent validity was assessed using the average variance extracted (*AVE*), which should be higher than 0.50 (Fornell & Larcker, 1981).Moreover, the indicator loading were examined to ensure they exceed 0.50.

Table 1 presents the results, indicating that all items loading exceeded 0.50. Furthermore, Cronbach's alpha and *CR* values for each construct were greater than 0.70, demonstrating satisfactory reliability. The *AVE* ranged from 0.549 to 0.878, surpassing the threshold of 0.50, thereby confirming convergent validity of the instrument.

Discriminant validity assesses the extent to which one construct differs from another construct, and it can be evaluated using the Heterotrait-monotrait (*HTMT*) ratio. A value close to 1 suggests a lack of discriminant validity, while a value below the common threshold of $HTMT_{.85}$ indicates acceptable discriminant validity. As shown in Table 2, the *HTMT* ratios for excessive social use, excessive hedonic use, excessive cognitive use, media multitasking, attention problems, academic performance all fall below the threshold of $HTMT_{.85}$. This finding suggests that discriminant validity has been established among these constructs.

### 4.2 Structural model

Table 3 shows that all hypotheses were supported. Specifically, excessive social and hedonic uses had the significantly positive effects on media multitasking, which supported H1 and H2 (H1: $\beta = 0.237$, $p < 0.001$; H2: $\beta = 0.254$, $p < 0.001$). Excessive cognitive use was negatively related to media multitasking, supporting H3a ($\beta$=-0.117, $p < 0.01$) and rejecting H3b. The influence of media multitasking on attention problems was significantly positive, thereby validating H4 ($\beta = 0.200$, $p < 0.001$). Furthermore, attention problems was negatively related to academic performance. Thus, H5 was supported ($\beta$=-0.123, $p < 0.01$). The variances explained by media multitasking,

**Table 1** Measurement model results

| Construct/Item | Mean | Standard Deviation | Standard Loading | Cron-bach's Alpha | CR | AVE |
|---|---|---|---|---|---|---|
| *Excessive social use (ESU)* | | | | 0.843 | 0.848 | 0.679 |
| ESU1 | 2.90 | 1.068 | 0.842 | | | |
| ESU2 | 2.90 | 1.087 | 0.856 | | | |
| ESU3 | 3.39 | 1.026 | 0.785 | | | |
| ESU4 | 3.38 | 1.043 | 0.821 | | | |
| *Excessive hedonic use (EHU)* | | | | 0.854 | 0.854 | 0.775 |
| EHU1 | 3.82 | 0.881 | 0.902 | | | |
| EHU2 | 3.75 | 0.889 | 0.896 | | | |
| EHU3 | 3.55 | 0.979 | 0.842 | | | |
| *Excessive cognitive use (ECU)* | | | | 0.916 | 0.942 | 0.797 |
| ECU1 | 3.46 | 0.976 | 0.895 | | | |
| ECU2 | 3.27 | 0.979 | 0.918 | | | |
| ECU3 | 3.23 | 0.982 | 0.914 | | | |
| ECU4 | 3.52 | 0.904 | 0.842 | | | |
| *Media multitasking (MUL)* | | | | 0.861 | 0.864 | 0.878 |
| MUL1 | 3.37 | 1.126 | 0.932 | | | |
| MUL2 | 3.14 | 1.177 | 0.941 | | | |
| *Attention problems (ADHD)* | | | | 0.841 | 0.905 | 0.545 |
| ADHD1 | 1.37 | 1.041 | 0.702 | | | |
| ADHD2 | 0.95 | 1.049 | 0.705 | | | |
| ADHD3 | 1.50 | 1.189 | 0.658 | | | |
| ADHD4 | 1.09 | 1.051 | 0.741 | | | |
| ADHD5 | 1.73 | 1.179 | 0.801 | | | |
| ADHD6 | 1.37 | 1.179 | 0.812 | | | |
| *Academic performance (PER)* | | | | | | |
| PER1 | 2.89 | 0.914 | 1.000 | | | |

**Table 2** *HTMT* discriminant validity results

| | ESU | EHU | ECU | MUL | ADHD | PER |
|---|---|---|---|---|---|---|
| ESU | - | | | | | |
| EHU | 0.520 | - | | | | |
| ECU | 0.528 | 0.581 | - | | | |
| MUL | 0.342 | 0.349 | 0.140 | - | | |
| ADHD | 0.212 | 0.151 | 0.078 | 0.201 | - | |
| PER | 0.052 | 0.051 | 0.086 | 0.032 | 0.129 | - |

*Note* ESU=excessive social use EHU=excessive hedonic use ECU=excessive cognitive use MUL=media multitasking ADHD=attention problems PER=academic performance

attention problems, and academic performance were13.1%, 4.0%, and 4.2%, respectively. Figure 2 shows the PLS test results of the structural model.

Moreover, we examined the special indirect effects in our model. The findings, as presented in Table 4, indicated a significant relationship ($p<0.05$) from media multitasking to attention problems, and subsequently academic performance, and a significant direct path ($p<0.05$) between media multitasking and academic perfor-

**Table 3** Results of direct effect testing

| | β | t-value | *p*-value | Results |
|---|---|---|---|---|
| H1: ESU→MUL | 0.237 | 5.819 | 0.000 | Supported |
| H2: EHU→ MUL | 0.254 | 8.806 | 0.000 | Supported |
| H3a: ECU→ MUL | -0.117 | 2.651 | 0.008 | Supported |
| H4: MUL→ADHD | 0.200 | 5.717 | 0.000 | Supported |
| H5: ADHD→PER | -0.123 | 3.462 | 0.001 | Supported |

*Note* ESU=excessive social use EHU=excessive hedonic use ECU=excessive cognitive use MUL=media multitasking ADHD=attention problems PER=academic performance

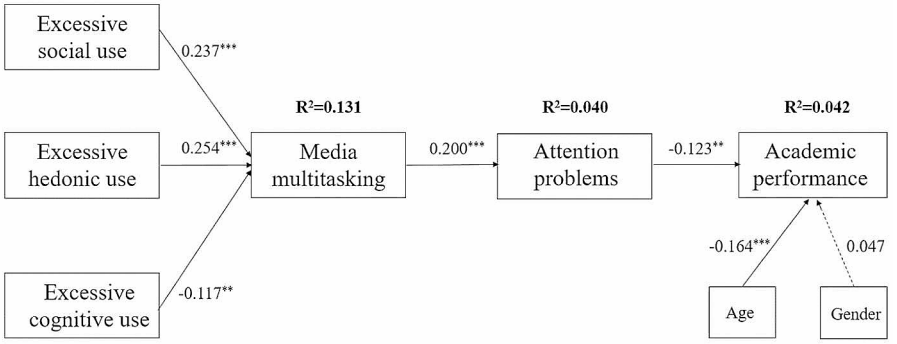


**Fig. 2** PLS results of the structural model. Notes: *$p<0.05$; ** $p<0.01$; ***$p<0.001$

**Table 4** Test for mediating effects

| | M | T | CI | *P* value |
|---|---|---|---|---|
| MUL→PER | -0.025 | 3.138 | -0.042~-0.011 | 0.002 |
| MUL→ADHD→PER | -0.025 | 3.138 | -0.042~-0.011 | 0.002 |
| ESU→MUL→ADHD→PER | -0.006 | 2.533 | -0.011~-0.002 | 0.011 |
| EHU→MUL→ADHD→PER | -0.006 | 2.613 | -0.012~-0.002 | 0.009 |
| ECU→MUL→ADHD→PER | 0.003 | 1.849 | 0.000~0.006 | 0.065 |

*Note* ESU=excessive social use EHU=excessive hedonic use ECU=excessive cognitive use MUL=media multitasking ADHD=attention problems PER=academic performance

mance was observed. This suggests that the impact of media multitasking on academic performance is partially mediated by attention problems. Furthermore, the results demonstrated a statistically significant path ($p<0.05$) from excessive social and hedonic uses to academic performance. This relationship was mediated by media multitasking and attention problems. Conversely, the link between excessive cognitive use and academic performance was not significant. Thus, media multitasking and attention problems failed to mediate the relationship between excessive cognitive use and academic performance.

In the next step, we removed the control variables from our model to verify the correctness of our results and compared the results to the original findings. The result showed that the hypothesis significance and directional effects remain consistent with

the original findings. Therefore, the predictive validity and robustness of our model were confirmed.

## 5 Discussion and conclusion

The omnipresence of social media in our lives has instigated extensive research into its impacts, particularly the consequences of excessive use (Chang et al., 2019; Feng et al., 2019). This study explores the effects of different dimensions of excessive social media use on academic performance, specifically investigating the influence of social media use for socialization, hedonic, and cognitive engagement on academic performance through media multitasking and attention problems. Several finding can be derived from the result of this study.

The result indicate that excessive social and hedonic uses significantly positively influence media multitasking, while excessive cognitive use has a significantly negative influence. These findings suggest that students frequently multitask between studying and socializing or indulging in hedonic activities on social media. This is consistent with previous findings that students dedicate a considerable amount of time to communication technologies while studying (Junco & Cotten, 2012; Vahedi et al., 2021; Zhao et al., 2021). Similar findings have been reported in studies conducted in working contexts. For instance, Cao and Yu (2019) reported that employees frequently check their social media to respond quickly, thereby interrupting their work tasks and potentially instigating conflicts with work.

Additionally, social exchange theory provides a theoretical basis for the instant reply phenomenon. According to this theory, people must reciprocate with support to gain social capital (Yang et al., 2016). Consequently, students might engage in multitasking behaviors to maintain personal relationships. Moreover, when students use social media for hedonic, they may experience immediate gratification, potentially struggling to resist its allure (Xu et al., 2023). Sun and Zhang (2021) found that people with low autonomy are particularly vulnerable to addictive use of social media. The hedonic and relaxing nature of social media has been found to predict social media addiction (Klobas et al., 2018). Based on the cognitive-behavioral model (Davis, 2001), excessive social networking site (SNS) use can be regarded as a distal cause, while cognitive emotional preoccupation (CEP) can be regarded as the proximal cause of negative consequences (Saleem et al., 2021), CEP refers to a state in which people feel a strong compulsive to use social media (Hofmann et al., 2009). Given the strong desire to use social media for pleasure, students may engage in multitasking behavior on social media despite the need to complete their after-school homework.

The acceptance of H3a implies that people cannot engage in multiple cognitive activities simultaneously, thus reducing the likelihood of media multitasking. One plausible explanation for this finding, as per the cognitive load theory (Sweller, 1988), is the phenomenon of information overload. The overload is a stressor that can induce social media fatigue (Gao et al., 2018) and occurs when the amount of information that needs processing surpasses one's cognitive capabilities (Whelan et al., 2020; Zhao, 2023). As a result, when students attempt to multitask, they could

overload their cognitive capacities, causing them to discontinue social media use (Ravindran et al., 2014).

Finally, we found that media multitasking has a significantly negative influence on academic performance through attention problems. This aligns with previous studies, such as Ralph and Smilek (2017), which reported that heavy multitaskers perform worse on working memory tasks. Similarly, Uncapher et al. (2016) found that chronic media multitasking is associated with a broader attentional scope and increased attentional impulsivity, leading to cognitive deficits. A recent study which used electroencephalography and pupilometer to measure attention have concluded that heavier media multitasking is associated with an increased propensity for attention lapses and forgetfulness (Madore et al., 2020). Moreover, many studies have proved that students who have trouble staying focus have poor performance at school (Berdida & Grande, 2023; Gallen et al., 2023). Our conclusions are supported by all of these empirical facts, which suggest that negative effects of media multitasking on academic performance arise through increased attention problems.

In conclusion, the current study explored excessive social media use among students and investigated how different usage types impact academic performance. A survey conducted among social media users in Chinese adolescents revealed that excessive social and hedonic use of social media positively affected media multitasking, while excessive cognitive use had a negative effect. Media multitasking, in turn, had a positive influence on attention problems, ultimately leading to lower academic performance.

### 5.1 Theoretical implication

This study offers two main contributions. Firstly, unlike previous studies that primarily employed broad concepts, such as task-related and non-related social media use (Chang et al., 2019), our study classified excessive social media use into three distinct types and investigated their special effects on individuals in academic context. The existing social media research has investigated the adverse consequences of pervasive technology use on student's academic career (Feng et al., 2019; Xie et al., 2021; Xu et al., 2023). Our study's results indicate that excessive social and hedonic uses have a significantly impact on media multitasking, whereas excessive cognitive use is only negatively associated with media multitasking. That highlights the varying effects of different types of excessive usage.

Secondly, this study sheds light on the underlying mechanism of how dimensions of excessive social media use influence individual academic performance. Our findings demonstrate that different usage types affect media multitasking and attention problems, consequently impacting academic performance. This finding further deepens our understanding of the relationship between excessive social media use and individual academic performance. Additionally, it underscores the crucial role of attention focus in determining academic performance.

### 5.2 Practical implications

This study provides empirical evidence that media multitasking can lead to attention problems, subsequently impacting academic performance negatively. By highlighting the negative consequences of media multitasking, this study raises awareness among students about the potential pitfalls of excessive social media use. Encouraging students to focus on a single task while using digital technology can help mitigate attention problems caused by media multitasking, thus improving academic performance. Students can actively manage their behavior by reducing unnecessary socializing online, controlling usage time and frequency, and logging out from social media applications when not necessary. Furthermore, when students feel overwhelmed by a significant amount of information, they can take breaks and prioritize the main task at hand.

Moreover, it is important for educators to acknowledge the dual nature of students' pervasive use of social media. On the one hand, social media can be used for cognitive purposes, and schools can support and promote the appropriate use of social media for educational activities. On the other hand, educators should be aware that students' social and hedonic uses of social media may result in distractions and potentially negative outcomes. The implementation of educational interventions has shown a notable enhancement in students' perceived severity and cues to action (Azadi et al., 2021). Teachers can provide guidelines to educate students on appropriate ways, timings, and purposes of social media usage, as well as the activities that should be avoided. Implementing such policies not only promotes responsible social media use among students but also helps to mitigate the negative effects of excessive social media use.

### 5.3 Limitations

Despite the implications of the results in this study, there are several limitations that should be acknowledged. Firstly, the current study employed a cross-sectional design, which may limit the establishment of causal relationship. Future studies could use longitudinal designs to better understand the temporal dynamics of the associations between social media use and academic performance. Second, academic performance was assessed using a single self-reported item, which may be susceptible to social desirability and students' confidence levels. To address this issue, future studies could use more objective data or actual performance tests to measure academic performance. Thirdly, the investigation into the relationship between media multitasking and attention issues was based on questionnaire responses. While questionnaires provide valuable insights, future research could benefit from incorporating experimental methodologies. Experimental designs would allow for more controlled manipulation of variables and provide stronger evidence for the proposed associations.

Additionally, the measurement of excessive social media use was based on students' perceptions rather than an objective criteria, which may introduce potential bias (Mahalinghamet al., 2023). To gain a more holistic perspective, future research should consider a hybrid approach that combine both subjective perceptions and objective criteria in the measurement process. Moreover, our use of only two items to measure media multitasking may result in a less comprehensive representation (Leung & Xu, 2013), highlighting the need for future research to employ a multiple-item approach for more detailed

insights. It's also important to recognize that variables such as socio-economic status, parental involvement, and students' personality-driven motivations for social media usage could influence these relationships (Poulain et al., 2019; Holmgren et al., 2022; Kircaburun et al., 2020). Exploring these factors in future research is essential for a comprehensive understanding.

## Appendix A. Measurement items

| Measurements | Sources |
|---|---|
| **Excessive social use (ESU)** | (Cao & Yu, 2019) |
| In daily life, I spend a large amount of time using social media to… | |
| ESU1…create new relationships at school. | |
| ESU2…get to know people I would otherwise not meet at school. | |
| ESU3…maintain close social relationships with people at school. | |
| ESU4…get acquainted with classmates who share my interests. | |
| **Excessive hedonic use (EHU)** | (Cao & Yu, 2019) |
| In daily life, I spend a large amount of time using social media to… | |
| EHU1…enjoy my break. | |
| EHU2…take a break and relax from study. | |
| EHU3…entertain myself. | |
| **Excessive cognitive use (ECU)** | (Cao & Yu, 2019) |
| In daily life, I spend a large amount of time using social media to… | |
| ECU1…share content with classmates. | |
| ECU2…create content in collaboration with classmates. | |
| ECU3…create content for study. | |
| ECU4…access content created by my classmates. | |
| **Media multitasking (MUL)** | (Lau, 2017) |
| MUL1 I multitask with my social media account while studying. | |
| MUL2 I remain online with my social media site(s) while doing homework. | |
| **Attention problems (ADHD)** | (Ustun et al., 2017) |
| ADHD1 How often do you have difficulty concentrating on what people are saying to you even when they are speaking to you directly? | |
| ADHD2 How often do you leave your seat in meetings or other situations in which you are expected to remain seated? | |
| ADHD3 How often do you have difficulty unwinding and relaxing when you have time to yourself? | |
| ADHD4 When you're in a conversation, how often do you find yourself finishing the sentences of the people you are talking to before they can finish them themselves? | |
| ADHD5 How often do you put things off until the last minute? | |
| ADHD6 How often do you depend on others to keep your life in order and attend to details? | |
| **Academic performance (PER)** | |
| PER1 What is your ranking in school? | |

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**Data availability** The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Conflict of interest** All authors declare that they have no conflicts of interest with this study.

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