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"Off Orbit" or "Into the Wilderness": The Effect of Mentor-Student Relationship on Smartphone Dependence of Z-Generation Graduate Students

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Abstract: Z-Generation (Gen Z) students have access to more information than any other generation at their age. Mentor-student relationship is the core interpersonal relationship during the graduate stage. How do Gen Z graduate students perceive the role of their mentor, when "anything they want to know is only a click away"? Based on Self-Determination Theory and Compensatory Internet Use Theory, this study investigated the relationship between mentor-student relationship and smartphone dependence among 1,432 Chinese social science and humanities (SSH) graduate students. A moderated mediation model was constructed to focus on the role of research self-efficacy and growth mindset. The results showed that a positive mentor-student relationship is found to have a significant negative predictive effect on smartphone dependence. Scientific self-efficacy is identified as a mediator in the relationship between the mentor-student relationship and smartphone dependence. Additionally, growth mindset is found to moderate the predictive effect of the mentor-student relationship on research self-efficacy. The results of this study revealed the mechanism of mentor-student relationship on graduate students' smartphone dependence, offering valuable insights for rethinking the role of mentors in the modern educational environment.

1. Introduction

The continuous advancement of mobile internet technology and the widespread adoption of mobile devices have significantly influenced and reshaped individual lifestyle patterns. Currently, approximately 1.395 million graduate students are enrolled in social science and humanities (SSH) programs in China, constituting 38.2% of the total graduate student population. SSH graduate

students play a crucial role in promoting knowledge and technological innovation. In China, the predominant model for training these graduate students is the mentorship, under which interactions between students and their mentors occur inevitably in terms of academics, research, and daily life. Z-Generation (Gen Z) SSH graduate students entered their programs during a period of rapid expansion in China's graduate education and a slowdown in international economic growth. A pressing need is experienced by these students to find their way out. However, uncertainty remains concerning their aspirations and what they aim to achieve in life[1].

Recently, the caption "Life is a wilderness, not an orbit" has spread widely on Chinese mobile social media. The term "orbit" is interpreted as denoting a life pattern that conforms to mainstream expectations across education, career development, and family life, while "wilderness" symbolizes non-linear career progression, diverse life experiences, and personalized self-actualization. This symbolism aligns with the contemporary aspiration for autonomy among young people. However, individuals who have grown up under excessive protection and supervision often lack the experience necessary for making independent life choices. Consequently, when confronted with real-life challenges and risks, they tend to exhibit anxiety and vulnerability[2]. Compared to previous generations, these individuals are more accustomed to engaging in social activities with peers through screens[3]. During the critical phase of transitioning from school to society, these individuals desire guidance and intervention from adults but feel at a loss when faced with interactions with their mentors[2].

The mentor-student relationship, referring to the relationship between a master's or doctoral student and their mentor, constitutes a core interpersonal relationship during the graduate student's academic stage. The attention and fulfillment of graduate students' intrinsic needs by mentors are found to significantly reduce career confusion, thereby aiding in the management of real-life challenges and risks. In contrast, inappropriate guidance behaviors and attitudes from mentors can lead to the deterioration of the mentor-student relationship, disrupting the normal interactions between graduate students and their mentors and inducing problematic smartphone use behavior[4].

Therefore, in the context of the real self-dilemmas faced by SSH graduate students, a thorough exploration of the impact mechanism of the mentor-student relationship on smartphone dependence is found to be of significant importance for promoting the mental health of graduate students and enhancing the quality of graduate education.

2. Theoretical Basis and Research Hypothesis

2.1. Mentor-Student Relationship and Smartphone Dependence

Establishing connections and interactions with others is an inevitable part of life. Autonomy, competence, and relatedness are identified as fundamental psychological needs[5]. The perception of these needs being met is found to enhance intrinsic motivation and reduce behavioral problems. Intrinsic motivation is characterized by an inherent tendency to seek novelty and challenges, expand and exercise one's capabilities, and engage in continuous exploration and learning[6]. The need for relatedness necessitates that individuals form positive and supportive relationships. It is observed that individuals lacking care and support from others in real-life situations are more prone to seek compensatory satisfaction through the internet[7,8].

Mentors are identified as the significant others with whom graduate students have the closest ties

in the university context. The quality of interactions between mentors and students is noted to potentially influence students' perceptions of support[9]. Mismatch, boundary violations, incompetence, and conflicts are known to lead to dysfunctional mentor-student relationship[10], which are often reported as "the most disappointing aspect of their graduate experience."[11] Furthermore, the rapid advancement of mobile internet technology is seen to provide SSH graduate students with convenient and practical tools for self-directed learning. Mobile social media is observed to support individual self-expression and define relationships with others[12], making the use of smartphones a natural choice for addressing life situations[13]. On the other hand, mentors are perceived as serving as academic coaches, career role models, and filters for information noise[14], thereby facilitating the development of graduate students. Thus, when the mentor-student relationship fulfills the psychological needs of SSH graduate students, individuals are less likely to compensate through internet use. Based on theory and related empirical research, we developed the following hypothesis: Hypothesis 1. A good mentor-student relationship can negatively predict the smartphone dependence of SSH graduate students.

2.2. Research Self-efficacy

Competence refers to an individual's feeling of being capable of completing a specific task, synonymous with self-efficacy[15]. Research self-efficacy may serve as a crucial bridge through which the mentor-student relationship influences individual behavioral adaptation. The norms and operational aspects of SSH research are often implicit, and the distinctions in research outcomes can be subtle[16]. During the academic research process, SSH graduate students may lack clear direction and motivation for their studies. In this context, the behavior and attitude of the mentor significantly influence the graduate student's perception of research activities and confidence in advancing research tasks[17].

In a positive mentor-student relationship, the mentor assigns moderately challenging tasks, supports individual learning based on personal interests and pace, and provides positive feedback[18]. In daily research guidance, mentors impart skills and experiences that contribute to the success of the students. Mastery experiences are one of the most potent ways to foster self-efficacy[19]. Empirical results also indicate that the perception of positive interaction with the mentor is associated with higher levels of research self-efficacy[20]. In addition, compensatory internet use typically occurs in negative life situations, although the perception of "negative" is subjective. Low self-efficacy and negative self-perception are key factors that may lead to problematic internet use[21]. Empirical studies show a significant negative correlation between research self-efficacy and smartphone dependence[22]. Specifically, when the need for competence is met, the intrinsic motivation of SSH graduate students is strengthened; they are more likely to engage in research activities due to interest and value alignment. Individuals with higher levels of research self-efficacy, even when facing "negative" research life situations, may not resort to compensatory internet use. Thus, this study proposes: Hypothesis 2**.** *The mentor-student relationship has an impact on smartphone dependence through the mediating role of research self-efficacy of SSH graduate students.*

2.3. Growth mindset

Compensatory Internet Use Theory explains smartphone dependence as an individual's response

to negative life situations, and the perception of these situations may originate from one's mindset, specifically the naive interpretation of the malleability of personal traits (intelligence, abilities, personality, etc.)[23]. The tendency of an individual's mindset affects how they perceive their interactions with mentors. Individuals who have a higher level of growth mindset tending to employ higher-order cognitive strategies and adapt better to stress[24], thereby mitigating the negative impact of negative life situations on their academic performance[25].

Therefore, this study selects mindset as a moderating variable, focusing on whether the influence of the mentor-student relationship remains robust at different levels of growth mindset. Growth mindset is the belief in the malleability of personal traits, including the belief in the possibility of exerting influence and control over life situations, representing the value of personal effort: when individuals believe that intelligence and abilities can be improved, effort is seen as a tool for achieving this, and setbacks are more likely to be viewed as informational experiences[26]. The self-efficacy information conveyed by teachers through modeling has the most significant impact on students[27], and the students' perspectives influence the internalization of the information transmitted through the mentor-student relationship[28]. This suggests that, when faced with negative feedback from a mentor, graduate students with a lower level of growth mindset are more likely to interpret this information as a "validation" of their abilities, which in turn affects their belief in their research capabilities. Based on the above discussion, this study proposes: Hypothesis 3. *The mediating role of research self-efficacy in the relationship between the mentor-student relationship and smartphone dependence is moderated by growth mindset.*

Existing research tends to view problematic smartphone use, such as smartphone dependence, primarily as a form of behavioral addiction in the absence of addictive substances. This perspective does not fully account for the neutrality of smartphone use and lacks a theoretical framework to explain its causes and the psychological factors involved. Therefore, this study aims to explore the relationship between mentor-student relationship and smartphone dependence among contemporary graduate students, and to uncover the underlying mechanisms, with a focus on the mediating role of research self-efficacy and the moderating role of growth mindset, from the perspectives of Self-Determination Theory and Compensatory Internet Use Theory.

3. Material and Methods

3.1. Research Participants

A cluster random sampling method is used to select SSH graduate students from five ordinary universities in Shanghai that have the authority to confer master's and doctoral degrees. A total of 1,500 questionnaires are distributed, with 1,432 valid responses collected, resulting in an effective response rate of 95.47%. Among the respondents, 714 are male (49.86%) and 718 are female (50.14%). The sample includes 879 master's students (61.38%) and 553 doctoral students (38.62%). Additionally, 914 are full-time students (63.83%) and 518 are part-time students (36.17%). Furthermore, 560 are professional degree students (39.11%) and 872 are academic degree students (60.89%).

3.2. Research Tools

Mentorship Measure: The quality of the relationship between graduate students and their

mentors is assessed using the 9-item Mentoring Functions Questionnaire (MFQ-9). This instrument encompasses three dimensions: role modeling, psychosocial support, and career guidance. A 5-point Likert scale is utilized, with higher scores indicating a more positive mentoring relationship. In the present study, the Cronbach's α for this measure is reported to be 0.887.

Mobile Phone Addiction Index: The Mobile Phone Addiction Index (MPAI) is used to evaluate the degree of dependence on smartphone usage among graduate students. This scale includes four dimensions: compulsivity, withdrawal, escapism, and inefficiency. A 5-point Likert scoring method is applied, with higher scores indicating a higher level of dependence on smartphones. The Cronbach's α coefficient for this scale in this study was 0.958.

Research Self-Efficacy Scale: The Research Self-Efficacy Scale is utilized to assess the research self-efficacy of graduate students[29]. This scale encompasses three dimensions: research methods and communication, supervision and organization, and interpersonal relationships, focusing on the participants' research capabilities. A 5-point Likert scale is employed, with higher scores indicating a stronger sense of research self-efficacy among graduate students. In the present study, the Cronbach's α for this scale is reported to be 0.914.

The Implicit Theories of Intelligence Scale is utilized to measure individuals' beliefs regarding the malleability of personal attributes[30]. This scale includes two dimensions: growth mindset and fixed mindset. A 5-point Likert scale is employed, with reverse scoring applied to the fixed mindset dimension. Higher scores indicate a stronger growth mindset among graduate students. In the present study, the Cronbach's α for this scale is reported to be 0.640.

Based on a preliminary review and analysis of literature, after collecting the questionnaires and obtaining the relevant data, the study primarily utilized SPSS for descriptive statistics and correlation analysis. Mediation effects, moderation effects, and moderated mediation effects were tested using the SPSS macro Process.

4. Results

4.1. Common Method Bias Test

In this study, Harman's single-factor test was conducted through principal component factor analysis. The results indicated that there were 12 factors with eigenvalues greater than 1. The first factor accounted for 27.01% of the variance. This suggests that the data in the present study do not exhibit a significant common method bias.

4.2. Variable Descriptive Statistics and Correlation Analysis

Table 1. Means, standard deviations, and correlations among variables in the research.

Variable	Mentor-student relationship	Smartphone dependence	Research self-efficacy	Growth mindset
Mentor-student relationship	-			
Smartphone dependence	-0.511**	-		
Research self-efficacy	0.438**	-0.559**	-	
Growth mindset	0.215**	-0.278**	0.233**	-
Means	3.948	2.371	3.918	3.613
Standard Deviations	0.792	0.945	0.890	0.601

Note. *N*=1432. *p<0.05, **p<0.01, ***p<0.001

The means, standard deviations, and correlation coefficients among the variables are presented in Table 1. Correlation analysis shows positive mentor-student relationship is negatively linked with smartphone dependence and positively with research self-efficacy and growth mindset. Smartphone dependence is negatively correlated with both research self-efficacy and growth mindset, which are positively correlated with each other. These correlations support the examination of moderated mediation effects.

4.3. Testing of the Moderated Mediation Model

In testing a moderated mediation model, three regression equations are estimated: Equation 1 examines how growth mindset moderates the relationship between mentor-student relationship and smartphone dependence. Equation 2 looks at the moderation of growth mindset on the link between mentor-student relationship and research self-efficacy. Equation 3 assesses growth mindset's moderating role on both the relationship between research self-efficacy and smartphone dependence, and any remaining direct effect of the mentor-student relationship on smartphone dependence after accounting for the mediator.

All variables are standardized, and gender, year of study, mode of study, and degree type are all dummy variables. Specifically, these variables are coded (Gender: Male = 0, Female = 1; Year of Study: Master's student = 0, Doctoral student = 1; Mode of Study: Full-time student = 0, Part-time student = 1; Degree Type: Professional degree student = 0, Academic degree student = 1). The analysis is conducted using the SPSS macro Process, employing a bias-corrected percentile bootstrap method with 5000 resamples to test the significance of the effects, and 95% confidence intervals are calculated.

Analysis shows a significant total effect of the mentor-student relationship on smartphone dependence, with growth mindset moderating this effect and the influence on research self-efficacy. Research self-efficacy significantly impacts smartphone dependence, indicating moderated mediation. Table 2 confirms the direct effect of the mentor-student relationship on smartphone dependence. Including research self-efficacy as a mediator and growth mindset as a moderator reveals that the mentor-student relationship positively predicts research self-efficacy, which in turn negatively predicts smartphone dependence. Both factors have significant negative effects on smartphone dependence, showing partial mediation by research self-efficacy. The interaction between the mentor-student relationship and growth mindset is significant in both equations, highlighting growth mindset's moderating role.

The results indicate that when SSH graduate students exhibit a lower level of growth mindset, a positive mentor-student relationship significantly and negatively predicts smartphone dependence (b_{simple} = -0.445, t = -13.712, P < 0.001). When the students' growth mindset is at a higher level, the negative predictive effect of a positive mentor-student relationship on smartphone dependence remains significant but is attenuated (b_{simple} = -0.257, t = -6.269, P < 0.001). This suggests that a growth mindset can mitigate the impact of the mentor-student relationship on smartphone dependence.

Table 2. Test of Moderated Mediation Effects of mentor-student relationship on smartphone dependence.

	Equation 1 (Y)			Equation 2 (M)			Equation 3 (Y)		
	β	SE	95%CI	β	SE	95%CI	β	SE	95%CI
Gender	0.084*	0.042	[0.002,0.166]	-0.001	0.041	[-0.082,0.081]	0.085*	0.038	[0.010,0.160]
Grade	-0.004	0.011	[-0.025,0.018]	-0.038***	0.011	[-0.059,-0.016]	-0.019	0.010	[-0.039,0.001]
Mode of Study	0.014	0.045	[-0.075,0.103]	-0.078	0.045	[-0.166,0.011]	-0.018	0.041	[-0.100,0.063]
Type of degree	-0.057	0.045	[-0.145,0.031]	0.047	0.045	[-0.040,0.134]	-0.037	0.041	[-0.117,0.043]
X	-0.524***	0.029	[-0.580,-0.468]	0.416***	0.028	[0.360,0.472]	-0.353***	0.028	[-0.408,-0.298]
W	-0.274***	0.036	[-0.344,-0.204]	0.201***	0.035	[0.132,0.271]	-0.187***	0.033	[-0.252,-0.122]
X×W	0.211***	0.044	[0.124,0.297]	-0.130**	0.044	[-0.216,-0.044]	0.139**	0.045	[0.050,0.228]
M							-0.410***	0.025	[-0.460,-0.360]
M×W							0.031	0.036	[-0.040,0.102]
R^2	0.305			0.228			0.423		
F	89.066***			59.953***			115.875***		

Note. In the table above, the variables are represented as follows: X = mentor-student relationship; Y = smartphone dependence; M = Research Self-Efficacy; W = Growth Mindset.

Furthermore, when SSH graduate students have a lower level of growth mindset, a positive mentor-student relationship significantly and positively predicts research self-efficacy (b_{simple} = 0.494, t = 15.062, P < 0.001). For those with a higher level of growth mindset, the positive predictive effect of a positive mentor-student relationship on research self-efficacy is still significant, though it is also attenuated (b_{simple} = 0.338, t = 7.717, P < 0.001). This indicates that a growth mindset can also moderate the influence of the mentor-student relationship on research self-efficacy.

5. Discussion

This study, based on Self-Determination Theory and the Compensatory Internet Use Theory, examines the impact of mentor-student relationship on smartphone dependence among SSH graduate students and the underlying mechanisms, providing valuable insights for promoting the internalization of motivation and healthy smartphone use among graduate students.

Correlation analysis shows that a positive mentor-student relationship reduces smartphone dependence in SSH graduate students. The smartphone dependency behaviors and psychological states of these students are influenced by unmet needs for relatedness, competence, and autonomy in their living contexts. The crisis of disciplinary identity, induced by economic pragmatism, hinders the internalization of research motivation[31]. When individuals perceive their research activities as driven by external performance pressures, which are inconsistent with intrinsic motivation, they are more likely to choose avoidance or feel helpless when faced with negative life situations.

When mentors effectively fulfill roles in role modeling, psychological support, and career guidance, they assist students in overcoming the difficulties encountered during the research process. This support helps graduate students recognize the significant value of humanities research and maintain a positive outlook on their career development, aligning their research activities with personal developmental goals. As a result, the reliance on smartphones for research and the tendency to use them to meet psychological needs are reduced.

The majority of current SSH graduate students are part of Gen Z that has grown up alongside

mobile internet, with a natural adaptability to completing daily activities and tasks through mobile internet. In reality, despite a desire for adult intervention and guidance, this generation of youth appears to lack experience in handling real interpersonal relationships and is hesitant to build and maintain deep, meaningful connections[3]. Engaging in instrumental and fragmented interactions through mobile social media and even with artificial intelligence applications to gain experiential knowledge and satisfy psychological needs has become a "safe" mode of interaction for them[2].

This study finds that, for SSH graduate students, research self-efficacy mediates the link between a positive mentor-student relationship and reduced smartphone dependence. In a supportive mentor-student relationship, mentors guide students in refining their professional skills and expanding their knowledge base, thereby enhancing their sense of competence. Individuals with higher research self-efficacy are more likely to use the internet in a "healthy" manner, meaning they use it within appropriate time frames for specific purposes without developing emotional or behavioral issues[32].

The need for autonomy requires individuals to identify with their own actions. When individuals perceive less external pressure, they are more likely to engage in autonomous behavior. Additionally, individuals are highly sensitive to changes in autonomy; they exhibit different behavioral patterns when acting voluntarily versus feeling coerced[33]. In an alienated mentor-student relationship, where mentors view students as tools for completing specific tasks, graduate students may feel exploited and used. The neglect of their individual developmental needs by mentors further hinders the internalization of their research motivation. This can lead to a weakening of their research beliefs, potentially causing them to abandon research opportunities and their pursuit of a research career. In such contexts, smartphone use serves to address psychological needs, such as coping with stress and enhancing self-awareness. It provides space for autonomous learning and offers references for individual career development paths[34]. At its core, the smartphone serves as a tool for individualism, helping young people mitigate the impacts of interpersonal uncertainty and facilitate their process of self-actualization.

This study finds that the indirect effect of the mentor-student relationship on smartphone dependence via research self-efficacy is moderated by a growth mindset, with feedback and communication highlighting the relationship's quality. The impact of students' active use of mentor feedback on self-efficacy is embedded in the positive utilization of feedback, rather than in the feedback itself[35]. Graduate students with a lower growth mindset tend to interpret the information provided by mentors as an assessment of their ability levels, rather than as guidance for effort. Consequently, the influence of mentor-student relationship on their research self-efficacy is more pronounced. Interestingly, the study also reveals that the direct effect of mentor-student relationship on smartphone dependence is moderated by growth mindset. The negative predictive effect of mentor-student relationship on smartphone dependence is weaker among individuals with a higher growth mindset. This may be because graduate students with a higher growth mindset place greater emphasis on the development of individual traits. For them, smartphones are seen as a direct tool for achieving personal development[36], rather than merely as a substitute when the mentor-student relationship is dysfunctional. Therefore, when SSH graduate students turn to their smartphones, are they seeking to escape the irreconcilable contradictions between their graduate life and intrinsic motivations, or are they searching for new avenues of self-actualization?

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