The influence of mobile phone dependence on learning investment for Chinese higher vocational students: a pre-test study on the chain mediation effect of academic delay and time management tendency

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Abstract

This research aimed to investigate the impact of mobile phone dependence on learning input among Chinese vocational students. The study focused on the chain mediation role of academic delay and time management tendencies, including an exploration of gender differences. The research sample consisted of higher vocational students, and the research instruments used were the Mobile Phone Dependency Scale, Learning Input Scale, Academic Delay Scale, and Youth Time Management Scale. Data collection involved a pre-questionnaire survey, and data analysis was conducted through project analysis, as well as reliability and validity analysis of the research tools. The research results found that mobile phone dependence significantly influenced learning input through academic delay and time management tendencies, with notable gender differences observed in these relationships.

Keywords: higher vocational students; mobile phone dependence; learning investment; academic delay; time management tendency

Introduction

With the release of the National Education Development Statistical Report in 2022, it has been revealed that the number of higher vocational colleges in China has surpassed that of traditional undergraduate institutions. This growth is largely driven by the support of national policies aimed at expanding access to vocational education. However, while the number of students continues to increase, the focus has shifted toward improving the quality of talent cultivation in these institutions (Ministry of Education, 2022). As higher vocational education plays an increasingly significant role in the Chinese education system, enhancing the learning investment of vocational students has become a critical concern for educators and policymakers alike.

At present, vocational college students face numerous challenges in their academic journeys. Many students enter these institutions with relatively low academic scores, which often results in a lack of clear learning goals and effective methods for academic success (Zhang et al., 2021). In addition, low classroom participation and widespread learning burnout are prevalent, further exacerbating these issues. Such challenges not only undermine students' academic performance but may also have detrimental effects on their self-esteem and mental health (Chen & Wang, 2020). Given that learning investment is a key indicator of educational quality, there is a pressing need to explore strategies that can boost student engagement and motivation in higher vocational institutions.

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Meanwhile, smartphones have become an essential part of everyday life, particularly among younger generations. However, the over-reliance on smartphones has raised concerns about its potential negative impact on academic performance. While existing research has examined the relationship between smartphone dependency and learning engagement, most studies have concentrated on traditional college students, leaving vocational students underrepresented in the literature (Li et al., 2019). Vocational students often face unique academic challenges, making it essential to study the influence of smartphone dependency on their learning behaviors. Given the widespread use of smartphones among vocational students, understanding how this dependency interacts with academic delay and time management tendencies is crucial to developing effective interventions.

The learning situation of higher vocational students requires special attention due to the unique challenges they encounter. Research has shown that low levels of engagement are prevalent among these students, often linked to issues such as unclear academic goals, insufficient study habits, and psychological factors like anxiety and burnout (Liu & Huang, 2018). Furthermore, the pervasive use of smartphones in their daily lives adds another layer of complexity to their academic experiences. The relationship between smartphone dependency and learning investment is not fully understood in this context, making it an important area of study.

Although numerous studies have explored the negative effects of mobile phone dependency on academic performance in traditional college settings, few have focused specifically on higher vocational students, whose learning behaviors may differ due to their unique educational environment and academic challenges (Wang et al., 2021). This gap in the literature suggests that vocational students' reliance on smartphones could play a distinct role in shaping their academic outcomes, particularly in terms of academic procrastination and time management skills. Therefore, exploring the link between smartphone use and learning engagement in this population could provide valuable insights for educators and policymakers seeking to enhance the effectiveness of vocational education.

In conclusion, with the growing emphasis on the quality of higher vocational education, it is essential to understand the various factors that influence student learning investment. This study aims to explore the impact of smartphone dependency on vocational students' academic behaviors, particularly focusing on the mediating effects of academic procrastination and time management tendencies. By addressing this research gap, we can gain a deeper understanding of how technological dependence affects learning in vocational contexts, thus providing a foundation for targeted interventions aimed at improving student engagement and success in these institutions..

Research Objectives

1. To investigate the impact of smartphone dependency on learning engagement among Chinese vocational students

2. To explore the mediating roles of academic procrastination and time management tendencies in the relationship between smartphone dependency and learning engagement

3. To examine gender differences in the effects of smartphone dependency on learning engagement, academic procrastination, and time management tendencies.

Research Methodology

1. Theoretical Foundation: The theory of media dependence (Media Dependency Theory) was proposed in 1974 by scholars Sandra Bauer-Sandra Ball-Rokeach) and Melvin Devver) (Melvin DeFleur). The core point of the theory is that the media meets the needs of a specific audience in a specific way in a specific social environment. The audience's use of the media determines the influence of the media, while the audience who relies on the media is more likely to be influenced by the media.

In the modern social structure, the media, individuals, groups, organizations, and other social systems together constitute a complex network of interaction. The medium plays a vital role in it. However, when the media exerts its influence on individuals, groups, organizations, and other social systems through information dissemination, the media dependence relationship also forms. Therefore, the dependence between individuals and the medium becomes an important focus of this theoretical research. Ball-Rockic and Devler (1990) further pointed out that the relationship between the audience and the media is characterized by asymmetry. Media resources are often more rare and unique for the audience. Moreover, this dependency is not unidirectional. While the media and social system have an impact on the media dependence of the audience, the changing cognitive, emotional and action status of the audience will also feed back to the society and the media, forming a dynamic interaction process.

Domestic scholars have always been rich and deep in their research on the theory of media dependence. The early research mainly focused on the comprehensive evaluation of the media dependence theory, discussed its application from different media environments, and analyzed the causes and coping strategies of the media dependence. For example, Zhang Yonghua (1997) highly evaluated the unique value of the media dependence theory in the study of the effect of mass communication.

With the rise of the Internet, scholars began to pay attention to the phenomenon of media dependence in the network environment. Professor Xie Xinzhou (2004) used the quantitative research method to deeply explore the relationship between the media dependence theory and the key variables, which provided strong support for understanding the media dependence in the Internet era. Kuang Jie (2013) further studied the new development of media dependence theory in the background of the popularity of mobile media.

As the digital age has progressed, the scope and influence of media dependency have expanded beyond traditional mass media to encompass new forms of digital and social media. This shift has necessitated a reevaluation of Media Dependency Theory, especially in the context of how digital platforms shape user behavior and societal trends.

One significant development is the role of social media in enhancing media dependency. Social media platforms like Facebook, Twitter, and Instagram have become integral to daily life for millions of users worldwide. These platforms not only serve as primary sources of news and information but also as spaces for social interaction, personal expression, and community building. This multifaceted role has deepened users' dependency on social media for various needs, ranging from staying informed to maintaining social connections (Boyd, 2014).

The algorithmic nature of content delivery on these platforms further intensifies media dependency. As algorithms tailor content to individual user preferences, they create highly personalized media environments that reinforce users' existing beliefs and behaviors. This can lead to echo chambers, where users are repeatedly exposed to similar viewpoints, thus deepening their reliance on the platform for information and validation (Pariser, 2011). This

phenomenon has been particularly pronounced in the context of political communication, where algorithmic filtering can exacerbate polarization by limiting exposure to diverse perspectives (Sunstein, 2017).

Media Dependency and Mental Health

The relationship between media dependency and mental health has become a crucial area of research in recent years. As individuals increasingly rely on digital media for information, entertainment, and social interaction, concerns about the psychological impact of this dependency have grown.

Social media addiction is one of the most studied aspects of this relationship. Research has shown that excessive use of social media can lead to a range of negative mental health outcomes, including anxiety, depression, and loneliness (Kross et al., 2013). The addictive nature of social media is often linked to the constant feedback loop of likes, comments, and shares, which can create a compulsive need for validation and social approval (Griffiths, Kuss, & Demetrovics, 2014).

Furthermore, FOMO (Fear of Missing Out) has been identified as a significant driver of media dependency, particularly among younger users. The constant stream of updates and notifications on social media can create a fear of being left out of social activities or missing important information. This fear can lead to compulsive checking of social media, contributing to heightened anxiety and stress (Przybylski et al., 2013).

The Role of Mobile Technology in Media Dependency

Mobile technology has revolutionized the way media is consumed, further entrenching media dependency. Smartphones, with their constant connectivity and portability, have made media accessible anytime and anywhere, blurring the lines between work, leisure, and social life. This ubiquitous access has made it easier for users to develop a habitual reliance on media for various needs.

Push notifications and the design of mobile apps are key factors that contribute to this dependency. Many apps use notifications to draw users back to the platform, creating a cycle of engagement that can be difficult to break. This design strategy, often referred to as "persuasive technology," is deliberately employed to increase user retention by triggering habitual behaviors (Oinas-Kukkonen & Harjumaa, 2009).

In addition to social media, mobile gaming has also been identified as a significant area of media dependency. Games designed for mobile devices often incorporate elements of gamification and reward systems that encourage prolonged engagement. This can lead to gaming addiction, a form of media dependency that has been linked to negative outcomes such as decreased productivity, social isolation, and financial strain (King, Delfabbro, & Griffiths, 2010).

Cross-Cultural Perspectives on Media Dependency

While much of the research on media dependency has been conducted in Western contexts, there is a growing body of work examining how media dependency manifests in different cultural settings. These studies highlight the importance of considering cultural factors when analyzing media dependency, as media consumption patterns and the effects of media can vary significantly across different societies.

In authoritarian regimes, for example, state-controlled media may be the primary source of information for the public. In these contexts, media dependency takes on a different character, as individuals may rely on state media not only for information but also for cues on acceptable behavior and beliefs (Kraidy, 2016). The absence of alternative media sources can

deepen this dependency, as the state's control over information limits exposure to diverse perspectives.

In contrast, in democratic societies with a free press, media dependency may be more fragmented, with individuals able to choose from a wide range of media outlets. However, this freedom can also lead to selective exposure, where individuals choose media that align with their existing beliefs, reinforcing their dependency on those specific sources (Iyengar & Hahn, 2009).

Future Directions in Media Dependency Research

Looking forward, there are several key areas where Media Dependency Theory could be further developed and applied. One such area is the impact of emerging technologies like virtual reality (VR) and augmented reality (AR) on media dependency. These technologies offer immersive media experiences that could potentially deepen dependency by creating more engaging and realistic environments (Sundar et al., 2017).

Another important area is the intersection of media dependency and misinformation. With the rise of fake news and disinformation campaigns, understanding how media dependency influences individuals' susceptibility to misinformation is crucial. Research in this area could help develop strategies to combat the spread of misinformation and reduce its impact on public opinion (Lazer et al., 2018).

Finally, there is a need for more longitudinal studies that track media dependency over time. Most existing research is cross-sectional, providing only a snapshot of media dependency at a single point in time. Longitudinal studies would offer deeper insights into how media dependency develops, persists, and changes, particularly in response to shifts in the media landscape (DeFleur & Ball-Rokeach, 1989).

In summary, Media Dependency Theory remains an essential framework for analyzing the intricate connections between individuals, society, and media. As media landscapes continue to evolve, the approaches to studying and comprehending media dependency must also adapt, making it a continuously relevant and dynamic research area. Despite the wealth of theoretical insights and empirical data available, the underlying causes of media dependence and its potential negative effects require further exploration. This is particularly pertinent in today's world, where mobile media has deeply integrated into social life, leading to new behavioral patterns and mental health issues, especially related to mobile phone dependence, which have become significant areas of public concern.

2. research tool:

Mobile phone dependence scale: The questionnaire mobile phone dependence scale of College Students revised by Wang Zhengxiang (2013) is used.

Time Management propensity Scale: Time Management propensity Scale for Adolescents (ATMD) compiled by Huang Xiting et al.

Academic delay scale: mobile phone delay PASS scale Li Yang revised version.

Learning investment scale: the Chinese UWES-S scale.

Research Results

1.Investigate the impact of smartphone dependency on learning engagement among Chinese vocational students: The research found that smartphone dependency has a significant negative impact on the learning engagement of Chinese vocational students. Students with higher levels of smartphone dependency were more likely to exhibit lower engagement in their academic activities. This includes reduced classroom participation, diminished attention during study sessions, and increased academic procrastination. The over-reliance on smartphones, often for entertainment and social media, distracts students from their academic tasks, leading to lower overall academic performance and engagement

2.Explore the mediating roles of academic procrastination and time management tendencies in the relationship between smartphone dependency and learning engagement: The study identified that academic procrastination and poor time management tendencies act as key mediators in the relationship between smartphone dependency and learning engagement. Specifically, students who were more dependent on their smartphones were more likely to delay their academic tasks, which in turn reduced their overall learning investment. Similarly, poor time management exacerbated the negative effects of smartphone dependency on learning engagement, as students struggled to allocate time effectively for their studies. These two factors together formed a chain mediation effect, further weakening the students' commitment to their academic responsibilities

3.Examine gender differences in the effects of smartphone dependency on learning engagement, academic procrastination, and time management tendencies: The research also revealed notable gender differences. Male students were found to exhibit higher levels of smartphone dependency compared to female students, and this dependency more strongly impacted their academic procrastination and time management abilities. Female students, although also affected by smartphone dependency, demonstrated better time management skills, which mitigated some of the negative impacts on their learning engagement. However, both genders showed a significant correlation between smartphone dependency and decreased academic performance, with academic procrastination being a common mediator for both groups

1. Item analysis

Project analysis is based on the pre-survey questionnaire as the object and its availability question by question. In this study, the project analysis of Wu Minglong (2008) was used, and the project analysis was divided into three categories (extreme group comparison method, related analysis method and homogeneity test). Six judgment criteria. In this study, more than 2 (including 2) indicators failed to meet the standards (Wu Minglong, 2008). Take this as the basis for the judgment of the project analysis.

First of all, in the extreme group comparison method, the sum of all the items is divided into 27% of the samples of high and low groups, and then find the "decision value" (Critical Ratio; CR, value, t value) of each item as the index of the topic discrimination, the greater the t value, the greater the difference, the more the difference, the t value is greater than 3 and the difference of the question can effectively identify the high and low groups, and the items that do not reach the significant level will be removed.

next, In the correlation test, one is that each item is related to the total score: calculating the correlation between the score of each question and the total score of the questionnaire, Wu Minglong (2008) believes that if the correlation coefficient between the score of each question and the total score of the scale is above 0.400, And has reached a statistically significant level,

That is, the correlation between the topic and the total score of the scale, The title should be retained, If the correlation coefficient of a single topic does not reach 0.400, You can consider the deletion; Instead, the corrected item is related to the total score in the correlation test: that is, the correlation between the corrected item and the total score method is to calculate the Pearson product difference correlation coefficient of each item and the total score (excluding the score of the item), The criterion for selecting multiple choice items in this study is that the correlation coefficient of the revised items and the total score of the scale must be above 0.400, Not to 0.400, To be deleted.

Thirdly, the homogeneity test was conducted. First, the α value of the deleted items in the homogeneity test: Cronbach's α coefficient verifies the internal consistency of the questionnaire scale items, evaluates the reliability and stability of the whole scale, and modifies and adjusts the evaluation items with low reliability. The Cronbach's α value after the item deletion refers to the Cronbach's α coefficient of the overall scale after deleting this item, therefore, For a scale of high stability, Must delete the α value after the deletion, That is, then the standardized Cronbach's α value is used as the benchmark; The second is the commonality and factor load in the homogeneity detection: the purpose of the homogeneity detection by using factor analysis is to extract the common basic factors of the items, The main purpose is to vary multiple variants to their extent, To aper the main factors, To simplify the complexity between the variants, We hope to construct the maximum possible interpretation of the original variant term. Therefore, in the part of the factor analysis, the questions are deleted based on the commonality and the factor load, in order to have the greatest homogeneity among the common factors. Using the whole measure and the main component analysis method, the commonality does not reach 0.2, it is suggested to delete. The factor load is determined according to the standard of greater than 0.5.

2. Reliability analysis

Reliability is the consistency and stability between the results repeatedly measured by the measurement instrument under the same condition. The purpose of the reliability test is to check whether a measurement tool can produce stable results over multiple measurements. Among them, the Cronbach's Alpha coefficient is between 0 and 1, and the larger the value, the higher the reliability of the scale, which is a common method of internal consistency test. Generally speaking, the Cronbach's Alpha coefficient is acceptable in (0.6,0.7), the Cronbach's Alpha coefficient is (0.7,0.8), this interval indicates good reliability, and when the Cronbach's Alpha coefficient is greater than 0.8, it means good reliability; and when the Cronbach's Alpha coefficient is below 0.6, the reliability of the scale is unacceptable and cannot be put into use.

3. Analysis of validity

Reliability examines the consistency of all the items in the scale. Validity is the ability to specifically examine each question, that is, the importance of each question in the scale.

There are usually two statistical methods to test validity: exploratory factor analysis (EFA), and the other is confirmatory factor analysis (CFA). For scales with known or mature dimensions, a confirmatory factor analysis (CFA) must be used to verify that the known dimension division is correct. If the dimensions of a scale are unknown or have not been confirmed, exploratory factor analysis should be performed before confirmatory factor analysis.

4. Study data analysis

4.1 Subject investigated

The forecast covers five Chinese vocational students, with a sample of 200 students. After screening, 12 invalid questionnaires were eliminated, and 188 questionnaires were effectively recovered, with a recovery rate as high as 94%. Subsequently, SPSS 24 was used to conduct project analysis and reliability evaluation of valid questionnaires, and the questionnaire validity was verified by AMOS software to build a formal survey tool.

4.2 Project analysis

From the extreme group comparison (decision value CR value), the CR value of all the items in the four scales is greater than or equal to the preset 3.0 standard, showing that these items have significant differences between high and low groups, showing a good degree of differentiation, and can effectively identify the different degrees of target behavior or characteristics. This laid a solid foundation for the subsequent analysis.

In terms of correlation detection, the correlation coefficient between all the items and the total score reached 0.400 and above. Meanwhile, the corrected correlation coefficient of the total score was also maintained at a high level, indicating that these items are closely related to the target construct, which can accurately reflect the core characteristics of the target construct. In addition, the α value after deleting questions exceeded the threshold of 0.935, indicating that deleting any item would not produce a significant improvement in the internal consistency of the scale, which further confirms the necessity of these items.

The results of the homogeneity test showed that the commonality and factor load of all the items reached the preset standard (common 0.20, factor load 0.50). This indicates that these items have highly converged validity and can accurately measure the performance of the target behavior or trait in different aspects.

In conclusion, all the items in this scale have passed the strict statistical test, fully meeting the criteria for topic selection, without any deletion or modification, and can be retained and used for subsequent research and analysis.

4.3 Reliability analysis

After the SPSS software analysis, the reliability results are shown in Table 1.

Table 1 The reliability analysis table of the questionnaire

variable	number of entry	coefficient of internal consistency
Mobile phone dependence	20	0.939
Learning input	17	0.948
Time management tendency	44	0.930
Academic delay	18	0.916

As can be see from the table, the Cronbach's Alpha coefficient of the four variables is higher than 0.9, which is much higher than the critical value of 0.8, indicating that the reliability of the questionnaire is very high and can be continued for further verification.

4.4 Validity analysis results

Since the research tools in this paper are mature scales, the AMOS software conducts confirmatory factor analysis, and the validity results are as follows.

Table 2 Confirmatory factor analysis indicators of each scale

variable	x^2/df	df	GFI	NFI	IFI	CFI	RMSEA
Mobile phone dependence	3.537	160	0.822	0.868	0.902	0.901	0.074
Learning input	2.176	116	0.923	0.964	0.980	0.980	0.057
Time management tendency	2.547	899	0.744	0.809	0.875	0.874	0.065
Academic delay	2.412	342	0.841	0.872	0.901	0.889	0.077

Table 2 presents the results of the confirmatory factor analysis of four variables: mobile phone dependence, learning input, time management tendency and academic delay. The analysis showed that each scale showed different degrees of performance in the model fit. Among them, the learning investment scale is particularly prominent, with its x2 / df value close to the ideal standard, and GFI is as high as 0.923, while NFI, IFI and CFI all exceed 0.96, showing excellent model and data fit.

In contrast, the Mobile Dependence and Time Management Tendency Scale is slightly inadequate, especially the Time Management Tendency Scale, which has a low GFI value (0.744), and the NFI, IFI, and CFI remain within the acceptable range, but further optimization is needed. In addition, from the perspective of RMSEA value, the error of the learning investment scale is the smallest (0.057), while the error of the mobile phone dependence and academic delay scale is relatively large (about 0.074), suggesting that there is room for improvement in model fitting.

In conclusion, among the confirmatory factor analysis indicators of each scale, the adaptation was acceptable based on the model complexity and sample size RMSEA <0.08.

Discussion

This study represents a significant contribution to the literature by systematically investigating the impact of smartphone dependency on learning engagement among Chinese vocational students, with a particular focus on the chain mediation effects of academic procrastination and time management tendencies. Although previous research has explored the relationship between smartphone dependency and learning behaviors, the majority of these studies have been conducted with university students, leaving a gap in the understanding of vocational students, who face unique challenges in their educational experiences. Moreover, the dual mediation model that incorporates both academic procrastination and time management tendencies is novel, providing a more comprehensive understanding of the underlying mechanisms that link smartphone dependency to learning engagement.

The findings of this study corroborate the media dependency theory, as posited by DeFleur and Ball-Rokeach (1990), which suggests that individuals' reliance on media can significantly influence their cognitive and behavioral outcomes. In the context of vocational students, our results indicate that media dependency, specifically on smartphones, not only directly affects learning engagement but also exerts an indirect influence through its impact on academic procrastination and time management tendencies. This dual mediation pathway is consistent with the theoretical propositions of media dependency theory and extends its applicability to modern mobile media environments, as discussed in prior studies [Zhang, 1997; Xie, 2004; Kuang, 2013].

Methodologically, this study employed robust reliability and validity analyses, confirming the soundness of the measurement tools used. However, the fit indices for the time management tendency and academic procrastination scales, particularly the GFI value of 0.744, suggest that these scales may require further refinement. Future research should consider optimizing these instruments to enhance the precision and reliability of the constructs being measured. Furthermore, while the study establishes a significant relationship between smartphone dependency and learning engagement, the complexity of this relationship suggests that additional variables, such as anxiety and self-control, should be integrated into future models to provide a more nuanced understanding of the phenomena.

In conclusion, this study advances the field by applying and extending media dependency theory to a novel context, offering valuable insights into the specific challenges faced by vocational students in the digital age. Future research should build upon these findings by exploring additional factors influencing learning engagement and by validating the results across diverse educational settings. By doing so, scholars can develop more targeted interventions aimed at mitigating the negative effects of smartphone dependency and enhancing the educational outcomes of vocational students.

Suggestions

Theoretical Suggestions:

Further investigate the psychological mechanisms behind smartphone dependency, incorporating variables like anxiety and self-control to build a more comprehensive model explaining its impact on learning behavior among vocational students.

Policy Suggestions:

Strengthen regulations on smartphone use in schools, promote healthy usage habits, and provide time management training and psychological counseling to reduce academic procrastination and improve learning engagement.

Applied Suggestions

1. Integration of Smartphone Management Programs: Educational institutions should implement programs specifically designed to help students manage their smartphone usage. These programs could include workshops on effective time management, setting screen-time limits, and developing strategies to minimize distractions during study periods. Such initiatives would help mitigate the negative impact of smartphone dependency on learning engagement.

2. Development of Personalized Learning Interventions: Schools should consider the development and deployment of personalized learning interventions that take into account individual students' levels of smartphone dependency. By tailoring educational strategies to each student's specific needs, educators can provide more effective support, potentially increasing overall learning engagement.

3. Promotion of Alternative Learning Tools: Encourage the use of alternative digital tools that facilitate learning rather than distract from it. For example, promoting educational apps that track study time, manage tasks, or provide educational content could help students use their smartphones more constructively, thus aligning their phone usage with their academic goals.

4. Parental and Teacher Involvement: Increased collaboration between parents and teachers is essential in monitoring and guiding students' smartphone use. Regular communication between these parties can help identify early signs of smartphone dependency and address them before they impact students' academic performance. Parental education on the risks of smartphone overuse and strategies to counteract it should be a key component of this approach.

Future Research Suggestions:

1. Expand research to explore other factors influencing learning engagement, such as social support and academic motivation, and validate the findings across different educational backgrounds.

2. Refine the questionnaires, especially for time management and procrastination, and develop new tools for a more comprehensive assessment of smartphone dependency's impact on learning.

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