



Short-term profile transitions in college freshmen's mobile phone addiction: A two-wave person-centered study

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Abstract: This study aimed to identify distinct profiles of mobile phone addiction (MPA) among college freshmen and examine the short-term stability of and transitions between these profiles. Participants were 405 Chinese first-year undergraduates (46.67% female) who completed two assessments of MPA three months apart. Latent profile analysis was adopted to identify distinct patterns of MPA, and latent transition analysis was conducted to examine changes in profile membership. Multinomial logistic regression analyses assessed demographic, self-regulatory, and school-adjustment correlates of profile membership. At both assessments, participants were classified into three profiles characterized by low, moderate, and high levels of MPA. Greater impulsivity was associated with a higher likelihood of membership in profiles characterized by elevated MPA, whereas stronger control-system functioning and better school adjustment were associated with a lower likelihood of membership in the high-MPA profile. Demographic characteristics showed comparatively limited associations with profile membership. The transition analysis indicated substantial short-term stability, although some students moved between profiles. These findings provide preliminary person-centered evidence of heterogeneity and short-term change in MPA among first-year college students, further suggesting that student development and counseling services should take into account individual differences in MPA patterns, with special focus on self-regulation and school adjustment.

Keywords: mobile phone addiction; college freshmen; latent profile analysis; latent transition analysis

Introduction

Mobile phone addiction (MPA) is a form of behavioral addiction characterized by compulsive and excessive mobile phone use that undermines individuals' physical health, psychological well-being, and social functioning (Lapierre et al., 2019; Cheng et al., 2024). With the rapid penetration of smartphones into daily life, MPA has become highly prevalent, particularly among adolescents and young adults at approximately 28.3% (Xiong et al., 2021). MPA in college students appears to be driven by social anxiety, insecure attachment, and maladaptive coping styles (Lu et al., 2021; Ran et al., 2022; Zhang et al., 2022). Yet, there would be considerable heterogeneity in MPA yet to be investigated utilizing proven latent profile analysis approaches.

Latent heterogeneity in MPA

Recent person-centered studies generally identify three or four MPA profiles that differ mainly in symptom severity and in emotional or contextual correlates. Three-profile solutions have been reported among college students and adolescents (Wang et al., 2015; Kabadayi, 2024; Li et al., 2024; Zeng et al., 2023), whereas four-profile solutions have appeared in freshman and medical-student samples (Dong et al., 2025; Zhang & Shi, 2025). Sex-specific and ecological analyses further suggest that profile membership may vary with emotional difficulties and family, peer, or school contexts (Lv et al., 2023; Xiong et al., 2023). However, most of this evidence is cross-sectional.

It therefore remains unclear whether comparable profiles can be identified across the first semester of university and how students move among them over a short interval.

Three gaps are especially relevant. First, prior studies have seldom evaluated whether profile solutions are comparable across measurement occasions, even though cross-wave similarity is necessary before transition probabilities can be interpreted. Second, research has emphasized demographic differences more than theoretically relevant self-regulatory systems and adjustment to university life. Third, evidence on short-term profile transitions among freshmen remains limited.

Theoretical basis

The present study was primarily informed by the dual-systems perspective on self-control, which proposes that behavior reflects the interplay between relatively automatic impulsive processes and more deliberative control processes (Hofmann et al., 2009). Within this framework, the impulsive system is associated with spontaneous, reward-oriented responses, whereas the control system supports the regulation of impulses and the pursuit of longer-term goals. Applied to mobile phone use, students with stronger impulsive tendencies may be more likely to respond immediately to notifications, entertainment opportunities, or social rewards, thereby increasing their vulnerability to elevated MPA. In contrast, stronger control-system functioning may help students regulate habitual checking and excessive use despite the immediate rewards provided by



smartphones. From this perspective, individual differences in the balance between impulsive and control processes may contribute to heterogeneity in MPA severity and help explain why some students are more likely than others to belong to moderate- or high-MPA profiles.

The compensatory internet use model provides a complementary framework for understanding the role of school adjustment (Kardefelt-Winther, 2014). This model suggests that excessive technology use may emerge partly as a response to unmet psychological needs, stress, or difficulties in adapting to offline environments. For first-year university students, adjustment to new academic expectations, social relationships, and daily routines may create stressors that increase reliance on smartphones for distraction, social connection, or emotional regulation. Students with poorer school adjustment may therefore be more likely to use mobile phones as a compensatory coping strategy, whereas those who adapt more successfully to university life may have less need to rely on such patterns of use. Integrating the dual-systems and compensatory-use perspectives, the present study conceptualized MPA profiles as reflecting heterogeneity associated with both self-regulatory functioning and adaptation to the university environment. Accordingly, higher impulsivity was expected to be associated with greater odds of elevated MPA-profile membership, whereas stronger control-system functioning and better school adjustment were expected to be associated with lower odds of such membership.

The Chinese context

Similar prevalence rates have been reported among Chinese college and medical students, with estimates ranging from 29% to over 36%, underscoring the heightened vulnerability of university populations (Mei et al., 2023; Song et al., 2023). Recent meta-analytic evidence indicates that smartphone addiction remains prevalent among Chinese college students, with a pooled prevalence of approximately 28.5% across nearly 130,000 participants (Wang & Abdullah, 2026). Moreover, a cross-temporal meta-analysis suggested an overall upward trend in MPA among Chinese college students over the past decade (Lyu et al., 2024). For Chinese freshmen, the transition from highly structured secondary education to the more autonomous university environment involves substantial changes in academic demands, interpersonal relationships, and daily routines. Smartphones are deeply embedded in students' learning, communication, and leisure activities, making them useful tools for university adjustment while also creating opportunities for excessive or maladaptive use. Recent person-centered evidence has further demonstrated considerable heterogeneity in smartphone dependence among Chinese college freshmen, with meaningful proportions of students falling into moderate- and high-dependence groups (Chen et al., 2025). Similarly, Dong et al. (2025) identified multiple MPA profiles among Chinese university freshmen and found that students with more severe MPA tended to report less favorable emotional functioning. School adjustment may be particularly relevant in this context, as poorer adjustment to

university life has been associated with greater smartphone addiction among Chinese college students (Zhao et al., 2023). Taken together, these contextual characteristics make the first semester of university an important period for examining not only individual differences in MPA but also the short-term stability and transitions of MPA profiles.

The present study

The present study addresses these gaps by comparing alternative profile solutions at two waves, evaluating longitudinal measurement invariance and profile similarity, estimating three-month transition probabilities, and examining wave-specific associations of impulsive-system functioning, control-system functioning, and school adjustment with profile membership. This design extends prior cross-sectional work while avoiding claims about long-term developmental trajectories.

To address these gaps, the present two-wave study examined the short-term profile structure and transition dynamics of MPA during the first semester of university. We tested the following hypotheses:

Hypothesis 1. MPA comprises multiple latent profiles rather than a single homogeneous continuum.

Hypothesis 2. MPA is stable over time and with minor movement between profiles.

Hypothesis 3. Higher impulsivity is associated with greater odds of elevated-profile membership at each wave.

Hypothesis 4. Stronger control-system functioning and better school adjustment were expected to be associated with lower odds.

Method

Participants and setting

Participants were a convenience sample of 512 students from two Chinese universities, who completed an online survey measuring MPA and demographic information. Data for Time 1 and Time 2 were collected in September 2022 and December 2022, respectively. After data cleaning and screening at Time 1—which involved removing invalid responses such as those from participants without mobile phone experience or with completion times under three minutes—425 valid participants remained (48.4% female).

At Time 2, 405 students completed the follow-up assessment, with 20 participants lost to attrition due to reasons such as transferring majors or personal withdrawal, resulting in a dropout rate of 4.71%. After excluding invalid responses, the final matched sample consisted of 405 students who provided data at both time points (mean age = 18.42 years, SD = 0.76). Only participants with complete data across both waves were included in the analysis. Only participants with complete, matched data across both waves were included in the analytic sample. Recruitment was based on convenience sampling from two universities; therefore, no claim of population representativeness was made.

Measures

Mobile phone addiction tendency scale

Participants' propensity for MPA was assessed using the MPA Tendency Scale developed by Xiong et al. (2012).

This instrument comprises 16 items covering four domains: withdrawal (six items; e.g., “I feel uncomfortable if I go for a long time without using my mobile phone”), salience (four items; e.g., “Phone calls or text messages make it difficult for me to concentrate in class”), social gratification (three items; e.g., “I prefer communicating via mobile phone to interacting face-to-face”), and mood modification (three items; e.g., “When I am waiting for someone, I repeatedly call them to ask where they are”). Items are scored on a 5-point Likert scale, with higher scores reflecting greater risk of MPA. In the present sample, internal consistency for scores was high, with Cronbach's α values of 0.89 at Time 1 and 0.92 at Time 2.

Dual-system of self-control scale

Self-control was measured using the Dual-System of Self-Control Scale revised by Xie et al. (2014). The scale contains 21 items assessing two components: the control system (9 items; e.g., “When faced with a problem, I carefully consider what action to take”) and the impulsive system (12 items; e.g., “I speak without thinking”). Responses are scored on a 5-point Likert scale. Higher scores indicate stronger regulatory capacity in the control system and greater impulsivity in the impulsive system. The scale has demonstrated adequate psychometric properties among Chinese college students. In this study, Cronbach's α coefficients were 0.76 for the control system and 0.78 for the impulsive system at Time 1.

School adjustment scale

School adjustment was evaluated using the School Adjustment Scale developed by Ouyang (2012). This 36-item measure assesses five aspects of adjustment: interpersonal adjustment (seven items; e.g., “I get along well with my university roommates”), overall satisfaction (eight items; e.g., “I am satisfied with the quality of the courses at my university”), personal-emotional adjustment (eight items; e.g., “Recently, I have felt tense or anxious”), academic adjustment (five items; e.g., “I am able to keep up with my studies”), and institutional identification (eight items; e.g., “I am pleased that I attend this university”). Items are rated on a 5-point Likert scale, with higher total scores indicating better adjustment to university life. In the current study, scores from the School Adjustment Scale demonstrated excellent internal consistency (Cronbach's $\alpha = 0.92$ at Time 1).

Procedure

Ethical approval for this study was obtained from the Institutional Review Board of Shanghai Normal University (Approval No. SHNU-IRB-2022076) before data collection commenced. Participants consented to the study. Prior to participation, students were informed of the purpose and procedures of the study, the voluntary nature of participation, and their right to withdraw at any time without penalty. They completed the online survey.

Data analysis

Participants were matched across waves using student identification numbers, and descriptive analyses were conducted in SPSS 27.0. Longitudinal measurement

invariance of the MPA scale was evaluated sequentially through configural, metric, and scalar models; changes in comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) were considered alongside overall model fit. LPAs were then estimated separately at each wave in Mplus 8.3 for two- through four-profile solutions. Profile selection was based on multiple criteria rather than a single index: AIC, BIC, and aBIC; BLRT and adjusted Lo-Mendell-Rubin tests; entropy; minimum profile size; substantive distinctiveness; and cross-wave interpretability (Tein et al., 2013). Average posterior probabilities and replication of the best log-likelihood were also considered as classification and estimation checks. Wave-specific multinomial logistic regressions, with the low-MPA profile as the reference group, examined associations of gender, major, residence, impulsive system, control system, and school adjustment with profile membership. These regressions were not transition-specific models. Cross-wave profile similarity was evaluated using the staged procedure described by Morin et al. (2016), distinguishing configural, structural, dispersion, and distributional similarity. LTA was used to estimate three-month transition probabilities only after considering the degree of profile similarity across waves (Nylund-Gibson et al., 2023). Because the study included only two assessments over three months, it was designed to estimate short-term transitions rather than long-term developmental trajectories. The wave-specific regression models examined correlates of profile membership and were not interpreted as predictors of particular transition pathways.

Mixture models were estimated with robust maximum likelihood (MLR). For the retained three-profile LPAs at both waves, 200 initial-stage random starts and 50 final-stage optimizations were used, with 10 initial-stage iterations. The best log-likelihood was replicated in all 50 final-stage optimizations at Time 1 (LL = -1742.139) and Time 2 (LL = -1699.024). The LPA indicators contained no missing data. Within-profile covariances were fixed to zero, and indicator variances were constrained equal across profiles. The LTA was also estimated with MLR and used 20 initial-stage random starts, four final-stage optimizations, and 10 initial-stage iterations; the best log-likelihood was replicated in all four final-stage optimizations. Corresponding profile means were constrained equal across waves, whereas indicator variances were constrained equal across classes within each wave but were allowed to differ across waves. No missing data were present on the LTA indicators.

Measurement invariance analysis for MPA scale. As shown in Table 1, the configural model showed acceptable fit, supporting the same four-factor measurement structure across waves. Constraining factor loadings produced only trivial changes ($\Delta\text{CFI} = -0.001$; $\Delta\text{RMSEA} = -0.001$), and additional equality constraints on item intercepts likewise produced negligible changes ($\Delta\text{CFI} = -0.002$; $\Delta\text{RMSEA} = 0.000$). These results support scalar invariance of the MPA measure and permit comparison of scale scores across the two assessments. Importantly, scale-level measurement invariance does not by itself establish

Table 1. Longitudinal measurement invariance for MPA scale

MPA	Model fits						Model comparison			
	χ^2	df	CFI	TLI	RMSEA	SRMR	Pairs	Δ CFI	Δ TLI	Δ RMSEA
M1 (CI)	238.92	109	0.948	0.936	0.058	0.041	—	—	—	—
M2 (MI)	247.36	121	0.947	0.939	0.057	0.043	M2 vs. M1	−0.001	0.003	−0.001
M3 (SI)	261.88	133	0.945	0.937	0.057	0.045	M3 vs. M2	−0.002	−0.002	0.000

Note. M1–M3 represent the configural, metric, and scalar invariance models, respectively. CI = configural invariance; MI = metric invariance; SI = scalar invariance.

Table 2. Model-fit indices for MPA profiles

Profiles number	AIC	BIC	aBIC	Entropy	BLRT (<i>p</i>)	LMRT (<i>p</i>)	Profile prevalence
Time 1							
2	3669.60	3721.651	3680.400	0.787	<0.001	<0.001	0.553/0.447
3	3520.278	3592.348	3535.232	0.818	<0.001	0.032	0.452/0.433/0.115
4	3469.210	3561.299	3488.317	0.810	<0.001	0.192	0.366/0.388/0.218/0.027
Time 2							
2	3657.689	3709.740	3668.489	0.786	<0.001	<0.001	0.536/0.464
3	3434.047	3506.117	3449.001	0.830	<0.001	0.005	0.570/0.252/0.178
4	3300.873	3392.962	3319.980	0.856	<0.001	<0.001	0.383/0.354/0.200/0.063

Note. Boldface indicates the selected three-profile solution at each time point.

similarity of the latent profile solutions; profile similarity was evaluated separately below.

Results

Descriptive statistics

Descriptive statistics and bivariate correlations among the study variables were examined prior to the profile analyses. At Time 1, the mean scores for the impulsive system, control system, school adjustment, and MPA were 2.19 ($SD = 0.63$), 3.52 ($SD = 0.61$), 3.80 ($SD = 0.57$), and 2.36 ($SD = 0.71$), respectively. The mean level of MPA increased slightly to 2.50 ($SD = 0.75$) at Time 2. As expected, the impulsive system was positively correlated with MPA at both Time 1 ($r = 0.47$, $p < 0.001$) and Time 2 ($r = 0.34$, $p < 0.001$), whereas the control system was negatively correlated with MPA at Time 1 ($r = -0.23$, $p < 0.001$) and Time 2 ($r = -0.20$, $p < 0.001$). School adjustment was also negatively associated with MPA at both assessments ($r = -0.43$ and -0.34 , respectively, $ps < 0.001$). In addition, MPA showed substantial cross-wave stability ($r = 0.67$, $p < 0.001$).

Latent profile analysis for MPA

Table 2 compares two- to four-profile solutions at each wave. At Time 1, information criteria decreased as profiles were added, but the four-profile solution yielded a nonsignificant LMRT ($p = 0.192$) and a very small class (2.7%); the three-profile solution therefore offered a more parsimonious representation. At Time 2, however, the four-profile solution had lower information criteria, higher entropy, a significant LMRT, and a smallest class of 6.3%. Thus, the available Time 2 indices do not unequivocally favor the three-profile solution. Given the greater parsimony, substantive interpretability, and cross-wave comparability of the three-profile solution, the

three-profile model was retained for subsequent longitudinal analyses.

For the retained three-profile solutions, classification accuracy was satisfactory across both waves, with high average posterior probabilities indicating clear separation among the identified MPA profiles. In addition, the best log-likelihood values were replicated across final-stage optimizations at each wave, supporting the stability and reliability of model estimation. This result supported Hypothesis 1.

Figures 1 and 2 display the indicator means for the provisionally retained three-profile representation. The broad ordering of the profiles was similar at both waves, permitting common descriptive labels. The High-MPA profile showed the highest scores on all four indicators and represented 11.5% of participants at Time 1 and 17.8% at Time 2. The Moderate-MPA profile showed intermediate scores and represented 45.2% and 57.0%, respectively. The Low-MPA profile had the lowest indicator scores, and its prevalence declined from 43.3% to 25.2%. These profiles primarily reflected graded severity rather than qualitatively distinct symptom configurations.

Wave-specific correlates of MPA profile membership

The wave-specific multinomial logistic regressions (Table 3) indicated that demographic associations were generally limited but not entirely absent. Gender and residence were nonsignificant in most comparisons, although female gender and rural residence were associated with lower odds of membership in the Moderate-MPA profile at Time 2. Psychological and adjustment variables showed more consistent associations. Higher impulsivity was associated with greater odds of High- and Moderate-MPA profile membership at both waves, whereas stronger control-system functioning was associated with lower odds of elevated-profile

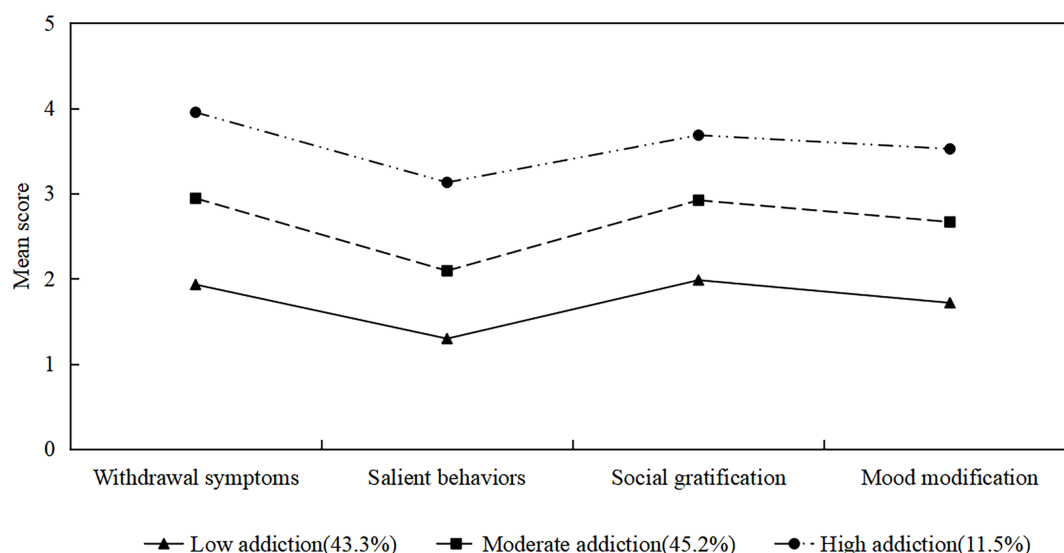


Figure 1. MPA profiles in freshmen at time 1

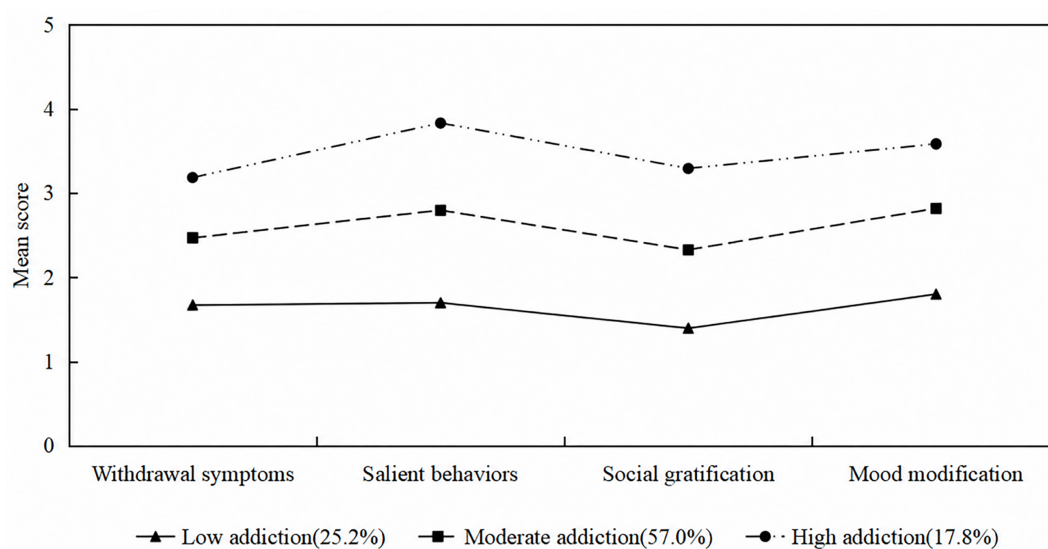


Figure 2. MPA profiles in freshmen at time 2

membership. Better school adjustment was also associated with lower odds of High- and Moderate-MPA profile membership at both assessments. These results identify concurrent, wave-specific correlates of profile membership; they do not establish that the variables caused profile changes or predicted particular transitions between Time 1 and Time 2. These findings supported Hypotheses 3 and 4.

Latent profile similarity analysis

Following Morin et al. (2016), profile similarity was evaluated through a sequential procedure (Table 4). The same three-profile solution was identified across the two waves, supporting configural similarity at the broad structural level. However, imposing full equality constraints on profile-specific means across waves resulted in poorer model fit, suggesting that the assumption of complete structural similarity was overly restrictive. Therefore, a partial structural similarity model was estimated by freeing the noninvariant profile mean identified in the high

MPA profile, while retaining equality constraints on all other profile means across waves. The partial structural similarity model demonstrated substantially improved fit compared with the full structural similarity model ($AIC = 6766.50$, $BIC = 6882.61$, $aBIC = 6790.59$), and was therefore retained as the baseline model for subsequent tests of dispersion and distributional similarity.

Short-term latent transition analysis of MPA

An LTA was conducted to examine transitions among the Low-, Moderate-, and High-MPA profiles over the three-month interval. Based on the partial structural similarity model, the final LTA model was estimated to evaluate changes in profile membership across waves. Specifically, the equality constraint on the U12 indicator mean of the High-MPA profile was released, whereas the remaining profile means were constrained to be equal across waves. The partial structural similarity model showed improved fit relative to the full structural similarity model and

Table 3. Wave-specific multinomial logistic regression results for MPA profile membership

Variable	Time point	High vs. Low MPA profile		Moderate vs. Low MPA profile	
		<i>B</i>	OR	<i>B</i>	OR
Gender	Time 1	−0.06	0.94	0.15	1.16
	Time 2	−0.47	0.62	−0.59*	0.55*
Major	Time 1	0.24	1.27	0.22	1.24
	Time 2	−0.08	0.92	0.20	1.22
Residence	Time 1	−0.12	0.89	−0.01	0.98
	Time 2	−0.24	0.78	−0.62	0.54**
Impulsive system	Time 1	2.48***	11.91*	1.49***	4.43***
	Time 2	1.74***	5.71*	1.17***	3.23**
Control system	Time 1	−0.75*	0.47*	−0.62**	0.53**
	Time 2	−1.00***	0.37***	−0.74**	0.48**
School adjustment	Time 1	−2.19***	0.11***	−1.21***	0.30***
	Time 2	−1.72***	0.18***	−0.95***	0.39***

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Gender: male = 1, female = 2; residence: urban = 1, rural = 2. OR = odds ratio; reference profile = Low MPA.

Table 4. MPA profile similarity across two waves

Model	# <i>fp</i>	LL	AIC	BIC	aBIC	Entropy
1. Configural similarity	52	−3360.44	6824.88	7033.087	6868.08	0.804
2. Structural similarity	40	−3390.38	6860.76	7020.92	6893.99	0.808
3. Partial structural similarity	29	−3354.25	6766.50	6882.61	6790.59	0.852
4. Dispersion similarity	28	−3401.51	6859.03	6971.14	6882.29	0.805
5. Distributional similarity	26	−3406.75	6865.51	6969.61	6887.11	0.802

Note. #*fp* = number of free parameters; LL = Loglikelihood.

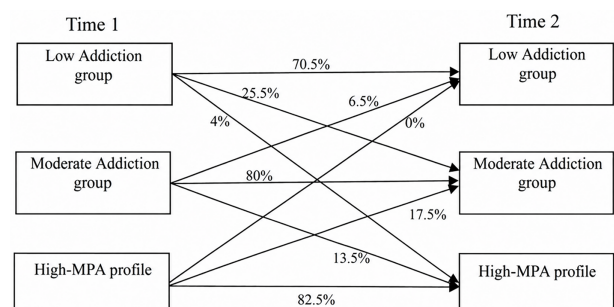
Table 5. Probabilities of profile transitions in students' MPA from T1 to T2

Profile group	Low addiction T2	Moderate addiction T2	High addiction T2
Low addiction T1	0.705	0.255	0.040
Moderate addiction T1	0.065	0.800	0.135
High addiction T1	0.000	0.175	0.825

Note. Bold values indicate the probabilities of remaining in the same profile from T1 to T2.

was therefore retained as the measurement model for subsequent transition analyses.

Table 5 and Figure 3 present the estimated transition probabilities between the two waves. Overall, profile membership demonstrated substantial short-term stability. Specifically, 70.5% of students in the Low-MPA profile, 80.0% of those in the Moderate-MPA profile, and 82.5% of those in the High-MPA profile remained in the same profile at Time 2. Among students initially classified in the Low-MPA profile, 25.5% transitioned to the Moderate-MPA profile and 4.0% transitioned to the High-MPA profile. Among those initially classified in the Moderate-MPA profile, 13.5% transitioned to the High-MPA profile and 6.5% transitioned to the Low-MPA profile. Among students initially classified in the High-MPA profile, 17.5% transitioned to the Moderate-MPA profile, whereas no direct transition to the Low-MPA profile was observed. This finding supported Hypothesis 2.

**Figure 3.** Short-term transition probabilities of MPA profiles from Time 1 to Time 2

Discussion

The present study identified Low-, Moderate-, and High-MPA profiles across two assessment waves and examined their short-term transitions during the first semester of university. The distribution of profile membership showed

some variation over time, with a relatively higher proportion of students classified into the Moderate- and High-MPA profiles and a lower proportion classified into the Low-MPA profile at Time 2. This pattern is broadly consistent with previous person-centered research identifying severity-graded MPA profiles among young adults (Wang et al., 2015; Kabadayi, 2024; Li et al., 2024). However, these changes should be interpreted cautiously, as profile distributions may be influenced by model specification and classification characteristics (Nylund-Gibson & Choi, 2018). Rather than indicating definitive developmental changes in MPA severity, the observed differences in profile prevalence reflect short-term variations in latent subgroup membership. Future research using longer longitudinal designs is needed to clarify the developmental dynamics of MPA profiles.

The wave-specific regression analyses further highlighted the importance of self-regulatory and adjustment-related factors in differentiating MPA profiles. Impulsivity was consistently associated with greater likelihood of membership in elevated-MPA profiles, whereas stronger control-system functioning and better school adjustment were associated with lower likelihood of elevated MPA membership. These findings align with dual-system models of self-control, suggesting that heightened impulsive tendencies may increase vulnerability to maladaptive mobile phone use, whereas effective self-regulation may serve as a protective factor (Hofmann et al., 2009).

In addition, the negative association between school adjustment and elevated MPA profiles supports the view that successful adaptation to the academic and social demands of university life may reduce excessive reliance on mobile phones as a compensatory coping strategy (Peng et al., 2022; Zhao et al., 2023). Although demographic factors showed relatively limited effects, the observed associations of gender and residence with selected Time 2 profile comparisons suggest that contextual characteristics may still contribute to individual differences in MPA patterns. Overall, these findings extend previous variable-centered research by demonstrating that psychological self-regulation and adjustment processes are closely linked to heterogeneity in MPA experiences.

The LTA results indicated considerable stability in MPA profile membership across the three-month transition period, while also revealing that some students changed profiles over time. The relative predominance of upward transitions suggests that the transition to university may represent a period of increased vulnerability for some students, potentially due to changes in academic demands, social environments, and daily routines. However, these short-term transition patterns should not be interpreted as evidence of fixed developmental trajectories, as changes in MPA may reflect temporary adaptation difficulties, persistent behavioral tendencies, or recovery processes. The findings therefore highlight the importance of early identification and timely support for students showing elevated MPA patterns. Future longitudinal studies with multiple assessment waves and diverse samples are needed to further clarify the mechanisms underlying profile stability and change.

Implications for theory and practice

The findings have important theoretical and practical implications for understanding and addressing MPA among college freshmen. The identification of distinct MPA profiles highlights the heterogeneity of problematic mobile phone use and suggests that students may differ substantially in their risk patterns and adjustment needs. From a theoretical perspective, the findings extend previous variable-centered approaches by demonstrating that MPA is better understood as a dynamic and multidimensional phenomenon involving different subgroups with distinct behavioral and psychological characteristics (see also Parent et al., 2022). The observed associations of impulsivity, control-system functioning, and school adjustment with profile membership further underscore the importance of considering both self-regulatory processes and adaptation to the university environment when explaining individual differences in MPA.

From a practical perspective, universities may benefit from incorporating early screening and targeted support into freshman transition programs. Rather than applying uniform interventions to all students, prevention efforts could focus on students showing elevated impulsivity, weaker self-regulation, or poorer school adjustment, who may require additional guidance in developing adaptive technology-use habits and improving academic and social adjustment. Programs that combine digital-use education with self-regulation training and adjustment support may provide a promising direction for intervention development. However, the effectiveness of such approaches should be further evaluated through longitudinal and experimental research.

Limitations and future study directions

Several limitations should be acknowledged. First, the use of convenience samples from two Chinese universities may limit the generalizability of the findings to other institutions, regions, and cultural contexts. Second, although the two-wave design allowed us to examine short-term changes in MPA profiles, future longitudinal studies with more measurement occasions are needed to clarify longer-term developmental patterns. Third, latent profile and transition analyses are probabilistic approaches, and the identified profiles should be further validated in independent samples. Finally, the study relied primarily on self-report measures and did not include some potentially relevant contextual factors, such as family, academic, and environmental influences. Future research incorporating multiwave designs, diverse samples, and objective behavioral indicators is encouraged to provide a more comprehensive understanding of MPA development and change.

Conclusion

This two-wave study provides preliminary person-centered evidence regarding short-term changes in mobile phone addiction profiles among college freshmen. A severity-graded profile structure was identified, and the findings revealed considerable stability and meaningful changes in profile membership over time. Individual characteristics

related to impulsivity, self-regulation, and school adjustment emerged as important correlates of MPA profiles, highlighting the need to consider both personal functioning and adjustment-related factors in understanding problematic mobile phone use. These findings contribute to a more nuanced understanding of MPA heterogeneity and temporal dynamics. Future research using larger and more diverse samples, extended longitudinal designs, and multimethod assessments is needed to further clarify the development and change of MPA patterns.

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Availability of Data and Materials: Data are available from the corresponding author on reasonable request.

Ethical Approval: This study received ethical approval from the Institutional Review Board of Shanghai Normal University (Approval No. SHNU-IRB-2022076, dated 23 September 2022). All procedures conducted in this research strictly adhered to the ethical principles outlined in the Declaration of Helsinki and its subsequent amendments. Before taking part in the anonymous online survey administered from September to December 2022, all participants provided informed consent in accordance with all relevant regulatory standards.

Conflicts of Interest: The authors declare no competing interests.

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