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Latent Profile Analysis: Mattering Concepts, Problematic Internet Use, and Adaptability in Chinese University Students

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ABSTRACT: Background: This study addresses the pressing need to understand the nuanced relationship between 'mattering'—the perception of being significant to others—and problematic internet use (PIU) among university students. Unlike previous research that has primarily employed variable-centered approaches, this study first adopts a person-centered approach using Latent Profile Analysis (LPA) to identify distinct mattering profiles. Subsequently, through variable-centered analyses, these profiles are examined in relation to different types of PIU—specifically problematic social media use (PSMU) and problematic gaming (PG)—as well as adaptability. **Methods:** Data were collected from 3587 university students across 19 universities in China. Participants completed three mattering-related scales (General Mattering Scale, Anti-Mattering Scale, and Fear of Not Mattering Inventory), along with the Bergen Social Media Addiction Scale, the Internet Gaming Disorder Scale-Short Form, and the Nine-item Adaptability Scale. **Results:** A four-class model identified by LPA was optimally selected: Class 1 (high general mattering, low anti-mattering, low fear of not mattering), Class 2 (moderate levels), Class 3 (moderate general mattering, high anti-mattering, high fear of not mattering), and Class 4 (low general mattering, low fear of not mattering, moderate anti-mattering). Significant differences were found among these classes in both PIU types (PSMU: $F = 139.66$, $p < 0.001$; PG: $F = 162.96$, $p < 0.001$). The pattern of mean differences consistently showed: Class 3 > Class 2 > Class 4 > Class 1. Class 3 participants demonstrated the highest likelihood of meeting the addiction criteria, Class 2 showed moderate probability, while Classes 1 and 4 exhibited lower probabilities ($\chi^2 = 113.38$ to 408.87, all $p < 0.001$). Additionally, Class 3 reported the lowest adaptability ($F = 131.67$, $p < 0.001$). **Conclusion:** This study reveals that the unique influence of three ways of assessing feelings of mattering and the fear of not mattering on university students' PIU at the personal level, concluding that these factors are integral to understanding PIU among this demographic.

KEYWORDS: Mattering; problematic social media use; problematic gaming; adaptability; latent profile analysis

1 Introduction

The pervasive engagement in social media and Internet gaming among university students is notably evident, particularly in China [1]. While such digital interactions might offer a therapeutic escape from academic stressors, excessive indulgence can potentially culminate in Problematic Internet Use (PIU). PIU

is characterized by an overwhelming and intractable urge to engage in Internet activities [2]. It manifests through excessive or compulsive use, preoccupation with online activities, and loss of control over Internet usage [2]. These behaviors can lead to various adverse consequences, including neglected social activities, strained relationships, deteriorating health, and compromised academic responsibilities [2]. As an umbrella term, PIU encompasses a broad spectrum of maladaptive online behaviors, most notably Problematic Social Media Use (PSMU) and Problematic Gaming (PG), which are commonly identified among university students [3].

PSMU involves preoccupation and compulsive engagement with social media, leading to withdrawal symptoms when access is restricted [3]. PG, also known as Internet Gaming Disorder, is marked by impaired gaming control, gaming prioritization, and continued gaming despite adverse effects [4]. While both share features like loss of control, PSMU is driven by social connection needs [3], whereas PG typically stems from achievement pursuit and escapism [4].

Different from prior PSMU and PG studies among university students, this research examines these behaviors through the lens of 'mattering'—the perception of being significant to others [5]. Mattering, first defined by Rosenberg and McCullough [6], includes three components: awareness, importance, and reliance. Flett and colleagues expanded this concept, highlighting mattering as an existential need for individuals to feel their existence is meaningful to others, essential for identity and psychological well-being [7,8].

1.1 Theoretical mechanisms linking mattering and PIU

Given the fundamental role of mattering in psychological well-being and social functioning, understanding how mattering deficits might contribute to problematic Internet behaviors becomes crucial. This relationship can be understood through two complementary theoretical frameworks: the Cognitive-Behavioral Model (CBM) of PIU [9] and the Compensatory Internet Use Theory (CIUT) [10].

The CBM framework [9] suggests that maladaptive cognitions and behaviors interact to maintain PIU, where low perceived mattering can act as a distal cause. Individuals feeling unimportant offline may develop distorted thoughts like 'I only matter online,' leading to excessive Internet use for validation. This process becomes self-reinforcing when online feedback temporarily satisfies their need to matter. Kardefelt-Winther's CIUT [10] and Self-Determination Theory [11] further explain how individuals compensate for unmet psychological needs through Internet use. When experiencing mattering deficits offline, people seek alternative recognition online [12]. This manifests differently in PSMU and PG: social media provides immediate validation through likes and comments [13], while gaming offers achievement-based recognition [4]. However, this compensatory strategy can become problematic when it becomes the primary means of fulfilling mattering needs [12].

The integration of these theoretical frameworks suggests a clear pathway: deficits in perceived mattering can lead to maladaptive cognitions (as described in CBM) about one's significance in online *vs.* offline contexts, which then motivates compensatory Internet use (as proposed by CIUT) through social media or gaming. This compensatory behavior may initially provide temporary relief but can eventually develop into problematic use patterns when it becomes the primary means of fulfilling mattering needs [12].

1.2 Empirical research on mattering and PIU: from general mattering to new constructs

Despite the theoretical foundations established through CBM and CIUT frameworks, empirical research examining the connection between mattering and PIU remains in its initial phase, with varied and sometimes contradictory findings [14–16]. Current evidence presents a complex picture: a study of Korean university students found that perceived mattering was negatively associated with general PIU (i.e., problematic smartphone use) [15], while Watson et al. [16] demonstrated a similar negative correlation

between feelings of mattering and PSMU among US adolescents. Both studies reported modest effect sizes, with correlations around −0.20 [15,16]. Conversely, research with Turkish university students revealed that general mattering was positively associated with general PIU (characterized by excessive screen use and loss of control) and showed no significant relationship with a specific PIU (mobile social online gaming addiction), which combines elements of both PSMU and PG [14].

Moreover, Flett and colleagues have recently expanded the concept of general mattering by introducing two related but distinct constructs: anti-mattering [5] and fear of not mattering [17]. Anti-mattering refers to the perception of being insignificant or not mattering to others, characterized by feelings that one's existence goes unnoticed or is devalued by others [5]. Fear of not mattering represents an individual's anxiety or concern about potentially becoming insignificant or unimportant to others in the future [17]. Through rigorous empirical investigation, they have demonstrated that anti-mattering is not simply the opposite end of the general mattering spectrum, and that fear of not mattering operates as a distinct psychological mechanism [5,18]. Recent literature portrays these mattering constructs as having differential psychological impacts: while feeling significant (general mattering) can offer substantial benefits, the experience of anti-mattering and fear of not mattering can be particularly detrimental to psychological well-being [19,20]. The distinct nature of these constructs is evidenced in their relationships with various psychological outcomes. For instance, both anti-mattering and fear of not mattering demonstrate stronger associations with trait loneliness compared to general mattering [21]. Furthermore, in studies examining the impacts on social anxiety, loneliness, and depression, anti-mattering emerged as a more potent predictor than general mattering, whose influence was considerably weaker [5,20].

The differential impacts of various mattering constructs on psychological outcomes (e.g., stronger associations of anti-mattering with loneliness, social anxiety, and depression) suggest the importance of examining mattering as a multifaceted construct, with its different forms potentially having distinct implications for PIU. To date, only a few studies have investigated the relationships between these new mattering constructs and PIU. For instance, Casale et al. [22] found that among young Italian adults, anti-mattering was strongly positively related to PSMU (medium effect size), a finding that was replicated with early Romanian adolescents [23]. Notably, the relationship between anti-mattering and PSMU remained robust even after controlling for various psychological factors such as fear of intimacy and fear of negative evaluation [22], as well as motivational factors including social relationships, mood regulation, and conformity [23]. However, to our knowledge, no studies have yet examined the association between fear of not mattering and PIU, representing a significant gap in the current literature.

1.3 Diverse mattering profiles: a closer look

Beyond the limited empirical evidence linking distinct facets of mattering with PIU, another crucial aspect that remains unexplored is how different forms of mattering collectively configure to shape an individual's overall sense of significance and how these distinct profiles relate to PIU. Conceptually, even when faced with experiences or societal signals suggesting their insignificance (i.e., anti-mattering), individuals may simultaneously maintain a sense of mattering through key relationships in their lives.

To date, very few studies have adopted a person-centered approach in this field. Notably, Liao et al. [24] examined profiles of psychological needs thwarting (PNT), which shares conceptual similarities with mattering as both constructs reflect individuals' perceptions of their psychological needs being satisfied or undermined in social relationships. Their study found significant differences in psychological distress and PIU (problematic smartphone use) across distinct PNT profiles among Chinese school teachers. Similarly, Saritepeci and associates employed a person-centered approach to classify Turkish university students into four groups based on multi-screen addiction and gaming patterns, though general mattering

did not significantly predict membership in these groups [14]. However, no studies have yet employed a person-centered approach to examine how these three distinct forms of mattering—general mattering, anti-mattering, and fear of not mattering—collectively influence PIU.

In our study, we adopt a novel approach by simultaneously considering these three forms of mattering as profiles, acknowledging the diverse range of experiences that university students encounter daily. For instance, a student might feel valued in their academic relationships while simultaneously experiencing feelings of insignificance in other social contexts. This complex interplay aligns with the existential challenge humans face in reconciling their sense of personal importance with feelings of inconsequentiality [25].

Importantly, empirical evidence supports examining these constructs as profiles, as research has shown that general mattering, anti-mattering, and fear of not mattering demonstrate moderate to modest inter-correlations with each other [5,18,20,26]. These distinct relationship patterns suggest that these constructs are relatively independent rather than merely different ends of the same spectrum, making it possible and meaningful to identify distinct patterns of how these three forms of mattering combine within individuals.

1.4　The interconnection of mattering profiles, PIU, and adaptability

Exploring the relationship between students' mattering profiles and their PIU is essential. Equally important is understanding how these profiles impact individual adaptability, which can provide a more systematic understanding of why distinct latent subgroups differ in their PIU. Adaptability, as defined by Martin et al. [27], encompasses the cognitive, behavioral, and emotional adjustments individuals make when faced with unfamiliarity and uncertainty. This capacity represents an individual's comprehensive ability to navigate daily life challenges, with diminished adaptability often manifesting as deficits in self-regulation across cognitive, behavioral, and emotional domains [28]. Notably, scholars like Spada [29] conceptualize PIU as a manifestation of these deficits—a maladaptive response to life's challenges—establishing a compelling link between adaptability and PIU.

The relationship between PIU and adaptability appears bidirectional. PIU might negatively impact students' adaptability by limiting opportunities for real-world adaptive experiences. When students spend excessive time online, they may miss crucial opportunities to develop and enhance their adaptability through real-world interactions. This notion is supported by Sinkkonen et al. [30], who found that adolescents with higher online engagement showed reduced adaptability in career decision-making, attributed to decreased participation in activities that provide face-to-face feedback and foster self-awareness.

Conversely, as proposed by the CIUT [10], individuals struggling with real-life adaptability might seek refuge online, developing maladaptive cognitions such as "I find solace only on the Internet" [31]. This suggests that reduced adaptability might also intensify PIU, as supported by Lai et al. [32], who found that college students' interpersonal adaptability served as a protective factor against problematic smartphone use.

Given this intricate relationship between PIU and adaptability, examining how different mattering profiles relate to both variables can provide valuable insights. Since adaptability is partly influenced by positive self-definition [33], we anticipate that subgroups characterized by relatively high general mattering, low anti-mattering, and minimal fear of not mattering would demonstrate superior adaptability and, consequently, lower PIU.

1.5　Study objectives and research questions

To address these gaps in the literature, our study investigated how different forms of mattering relate to PIU and adaptability within the context of China's COVID-19 response. We utilize a person-centered approach to illustrate the diverse manifestations of mattering across different profiles in a university student

population in China. This investigation was conducted during a period (2022) when China maintained its zero-COVID policy, which involved strict lockdown measures for areas where positive cases were identified. Such policies significantly impacted university students' daily lives, potentially affecting both their sense of mattering and their Internet use patterns.

These profiles encompass three forms of mattering: general mattering, anti-mattering, and fear of not mattering. By considering these three forms of mattering simultaneously, we can better understand how they interact and influence an individual's overall sense of mattering, particularly during periods of social restriction. Subsequently, we also employ variable-centered analyses to examine the differences between these mattering profiles in terms of two PIUs (PSMU and PG) and adaptability. The focus on adaptability is especially relevant given the rapidly changing circumstances and uncertain environment created by the pandemic, where students needed to adjust to new learning modes and social interaction patterns.

Accordingly, our two central research questions are:

i) Can meaningful mattering profiles be identified among university students in mainland China during the zero-COVID period? If so, how many profiles?

ii) How do the two PIUs and adaptability vary across students with varying mattering profiles in this context?

By addressing these questions, our study aims to contribute to a more comprehensive understanding of the intricate relationship between mattering and PIU, as well as its impact on adaptability during periods of social restriction. The findings of this study may provide valuable insights for the development of targeted interventions and prevention strategies to mitigate the negative consequences of PIU among university students, particularly during times of social disruption.

2 Method

2.1 Participants and data collection

The study was conducted with the approval of the Institutional Review Board of the Jiangxi Psychological Consultant Association (IRB ref: JXSXL-2022-Jul13) and employed a convenience sampling method for data collection. Informed consent had been obtained in writing from all participants involved in the study. We extended invitations to faculty members from various universities across Mainland China, requesting their assistance in distributing the survey hyperlink to potential participants. The data collection process spanned from August to October 2022, coinciding with a period of strict campus lockdowns enforced by many Chinese universities as part of their pandemic prevention measures. To be eligible for participation, individuals were required to be at least 18 years of age, currently enrolled in a university located in mainland China, and willing to provide digital informed consent. The online survey platform required all questions to be answered before submission, resulting in no missing data in the final dataset. The final sample consisted of 3587 participants from 19 universities across 13 provinces in mainland China.

2.2 Instruments

The study examined students' PSMU and PG, adaptability, and three types of mattering using the following self-reported Likert-type scales. Background information such as school type, grade level, and sex were also collected. The reliability of the measurement tools in the present study for these constructs will be discussed further.

Bergen Social Media Addiction Scale (BSMAS) for PSMU: The BSMAS, adapted from the Bergen Facebook Addiction Scale [34], comprises six items encompassing the fundamental elements of addiction (e.g., "You have tried to cut down on the use of social media without success"). Items are assessed via a

five-point Likert scale. The Chinese version of BSMAS has been deemed acceptable for use with Chinese primary school students [35] and college students [36]. In this study, the reliability of the BSMAS was confirmed with a McDonald's omega value of 0.855.

Internet Gaming Disorder Scale-Short Form (IGDS-SF9) for PG: The IGDS-SF9, developed by Pontes et al. [4], corresponds to the nine criteria for gaming disorder in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Items (e.g., "Do you systematically fail when trying to control or cease your gaming activity?") are evaluated using a five-point Likert scale. The Chinese version of the scale demonstrated satisfactory factorial validity and high internal consistency [35,37]. In the current study, the internal reliability was high, with McDonald's ω equaling 0.940.

Nine-item Adaptability Scale, tailored for the COVID-19 pandemic context: This scale, originally developed by Martin et al. [27], was modified to measure adaptability during the pandemic. Participants rated items (e.g., "I am able to seek out new information, helpful people, or useful resources to effectively deal with this new situation") on a scale from 1 ('Strongly Disagree') to 7 ('Strongly Agree'). The scale's reliability remained outstanding, with a McDonald's ω of 0.972.

Three scales assessed different dimensions of mattering, each comprising five items rated on a four-point Likert scale. The General Mattering Scale (GMS; e.g., "How much do you feel others would miss you if you went away?") [38], Anti-Mattering Scale (AMS; e.g., "How often have you been treated in a way that makes you feel like you are insignificant?") [20], and Fear of Not Mattering Inventory (FNMI; e.g., "Are you afraid of becoming someone who doesn't seem to count to others?") [5] were used. The Chinese versions of these mattering instruments have recently been validated, demonstrating satisfactory factorial and concurrent validity [18]. In the present study, all three scales showed good to excellent reliability (GMS: McDonald's ω = 0.866; AMS: ω = 0.911; FNMI: ω = 0.823).

2.3 Data analysis

The prevalence of PIUs was examined using established cut-off values for the BSMAS [39] and IGDS-SF9 [40]. Pearson correlation coefficients were used to assess preliminary associations between the study's interest variables.

Latent Profile Analysis (LPA) was employed to identify mattering profiles among university students in Mainland China, using items from the GMS, AMS, and FNMI. The analysis was conducted using the snowRMM statistical module within Jamovi software version 2.4.11. The optimal number of profiles was determined using various fit indices, including Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Sample-size adjusted BIC (SABIC), Integrated classification likelihood (ICL), Entropy, and Bootstrap likelihood ratio test (BLRT) [41,42]. The "elbow-criterion" [43] was also used to select the profile solution.

To examine how PIUs and adaptability vary across the identified mattering profiles, chi-square tests were conducted for each item within the BSMAS and IGDS-SF9 scales. ANOVA was used to compare the mean values of participants' PIUs, and adaptability levels across the profiles. For *post-hoc* comparisons following significant ANOVA results, Bonferroni corrections were applied. A significance level of $p < 0.05$ was used for all statistical tests.

3 Results

From a total sample of 3587 participants, the majority were first-year students (54.3%, n = 1946) and from four-year colleges (78.4%, n = 2811), with an almost even sex distribution (female: 47.2%, n = 1692). Detailed demographic characteristics of the sample are presented in Table 1.

Table 1: Participant characteristics (*n* = 3587)

	n (%)
School type	
Four-year college	2811 (78.4)
Three-year college	776 (21.6)
Grade	
Undergraduate freshman	1946 (54.3)
Undergraduate sophomore	718 (20.0)
Undergraduate junior	650 (18.1)
Undergraduate senior	270 (7.5)
Postgraduate student	3 (0.1)
Sex	
Male	1895 (52.8)
Female	1692 (47.2)

In the present study, general mattering scores surpassed the midpoint score of 12.5, while both anti-mattering and fear of not mattering scores fell below the respective midpoint. According to the established cut-off values in the BSMAS and IGDS-SF9, 86 participants (2.39%) and 61 participants (1.70%) respectively may exhibit disorders related to Internet use, specifically in the domains of social media usage and online gaming.

Pearson correlation analyses, as delineated in Table 2, revealed that PSMU and PG exhibited moderate positive correlations with both anti-mattering and fear of not mattering, with correlation coefficients ranging from 0.32 to 0.35 (all $p < 0.001$). Notably, PG was negatively correlated with general mattering ($r = -0.13$, $p < 0.001$). Additionally, adaptability demonstrated a significant positive correlation with general mattering ($r = 0.28$, $p < 0.001$) and was negatively correlated with anti-mattering ($r = -0.29$, $p < 0.001$), fear of not mattering ($r = -0.24$, $p < 0.001$), PSMU ($r = -0.15$, $p < 0.001$), and PG ($r = -0.26$, $p < 0.001$).

Table 2: Pearson correlations among Internet activities, three kinds of mattering, problematic Internet use, and adaptability

|	1	2	3	4	5	6
1. General mattering	—					
2. Anti-mattering	−0.30***	—				
3. Fear of not mattering	−0.04*	0.52***	—			
4. Problematic social media use	−0.02	0.32***	0.35***	—		
5. Problematic gaming	−0.13***	0.32***	0.32***	0.46***	—	
6. Adaptability	0.28***	−0.29***	−0.24***	−0.15***	−0.26***	—

Note: ***$p < 0.001$, *$p < 0.05$.

A series of LPAs was conducted examining 2 to 7 profile solutions, and the fit information derived from these analyses is outlined in Table 3. As evident from the table, with the augmentation of profile categories, there is a consistent decline in the values of AIC, BIC, and SABIC, and an increase in ICL, without these indices reaching a discernible minimum or maximum value. Furthermore, the *p*-values of the BLRT are

statistically significant across all types of profiles, suggesting an inclination towards a greater number of profiles. In light of these findings, the use of these indices alone does not suffice to identify meaningful profiles. As such, we pivoted to a different strategy where the selection of the profile is based on the disparity in AIC, BIC, SABIC, and ICL values among successive profiles. This approach revealed that the 4-profile model exhibits the highest variation in ΔAIC, ΔBIC, ΔSABIC, and ΔICL values when juxtaposed with the previous profile. A review of Fig. 1 further reinforces the distinctiveness of the 4-profile model, as it portrays a more pronounced plot for the "elbow". Thus, it was concluded that the 4-profile solution optimizes the model's performance without undermining its parsimony. It is noteworthy that despite the entropy of most profiles being above 0.90, the 4-profile model demonstrates a peak value of 0.98.

Table 3: Summary of the model selection for the latent profiles based on three kinds of mattering

Class	LogLik	AIC	Δ AIC	BIC	ΔBIC	SABIC	Δ SABIC	ICL	Δ ICL	BLRT(p)	Entropy
1-Profile	−62451.16	124962.32		125147.87		125052.55		−125147.87			1.00
2-Profile	−56350.03	112792.07	−12170.25	113076.58	−12071.29	112930.41	−12122.13	−113480.30	11667.57	0.010	0.85
3-Profile	−54083.08	108290.16	−4501.91	108673.63	−4402.95	108476.63	−4453.79	−109183.95	4296.34	0.010	0.87
4-Profile	**−49930.17**	**100016.34**	**−8273.82**	**100498.77**	**−8174.86**	**100250.93**	**−8225.70**	**−100624.58**	**8559.37**	**0.010**	**0.98**
5-Profile	−48778.22	97744.44	−2271.90	98325.84	−2172.94	98027.15	−2223.77	−98657.69	1966.89	0.010	0.94
6-Profile	−47865.53	95951.07	−1793.37	96631.42	−1694.41	96281.90	−1745.25	−97017.36	1640.33	0.010	0.94
7-Profile	−46966.29	94184.57	−1766.50	94963.89	−1667.54	94563.52	−1718.38	−95302.17	1715.19	0.009	0.95

Note: The values in bold represent the most optimized solutions. LogLik refers to the model's log-likelihood, while AIC stands for Akaike Information Criterion, BIC for Bayesian Information Criterion, SABIC for sample-size adjusted BIC, ICL for Integrated Complete-data Likelihood, and BLRT for bootstrap likelihood ratio test. The best model, as indicated by bold values, is determined through a combination of statistical evaluation and ease of interpretation. The sample size for this analysis is 3587.
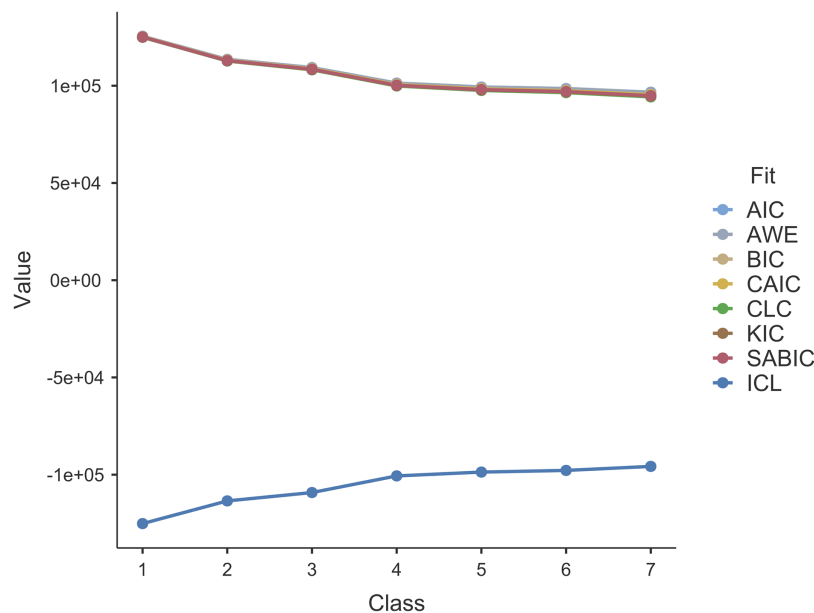
Figure 1: Elbow plot illustrating information criteria values for all latent profiles. Take note that a 4 profile solution was selected. Note: The value shown in the figure is log-likelihood.

As shown in Table 4 and Fig. 2, four distinct mattering profiles were identified. Class 1 (n = 862, 24.0%), labeled as "high general mattering, low anti-mattering, low fear of not mattering," is characterized by high general mattering along with low levels of anti-mattering and fear of not mattering, indicating a strong sense of perceived significance and minimal concern about potential insignificance. Class 2 (n = 1663, 46.4%), the "moderate levels" group, exhibits moderate levels across all dimensions, suggesting a balanced sense of perceived mattering and anti-mattering, with occasional concerns about not being perceived as significant. Class 3 (n = 544, 15.2%), termed "moderate general mattering, high anti-mattering, high fear of not mattering," displays moderate general mattering but high levels of anti-mattering and fear of not mattering, indicating a heightened sense of unimportance and significant concerns about perceived or potential lack of significance. Lastly, Class 4 (n = 518, 14.4%), labeled as "low general mattering, moderate anti-mattering, low fear of not mattering," is marked by low general mattering and fear of not mattering, contrasted with moderate anti-mattering, suggesting a reduced sense of perceived significance but fewer concerns about others' perceptions of their importance.

Table 4: The comparisons between four-profiles in terms of three kinds of mattering

	All participants (n = 3587)	Class 1 (n = 862, 24.0%)	Class 2 (n = 1663, 46.4%)	Class 3 (n = 544, 15.2%)	Class 4 (n = 518, 14.4%)	F-test (p-value)	Post-hoc
Variable: Mean (SD)							
General mattering (range: 5–20)	13.11 (3.03)	15.30 (2.15)	12.95 (2.65)	12.97 (2.86)	10.09 (2.74)	497.06 (<0.001)	1 > 2, 3 > 4
Anti-mattering (range: 5–20)	10.93 (3.57)	7.38 (2.21)	11.49 (2.77)	14.24 (2.75)	11.59 (3.69)	989.95 (<0.001)	3 > 2, 4 > 1
Fear of not mattering (range: 0–15)	4.14 (3.24)	1.01 (1.39)	4.98 (1.27)	9.47 (2.00)	1.06 (1.47)	3689.72 (<0.001)	3 > 2 > 1, 4
Problematic social media use (range: 6–30)	14.75 (4.45)	12.75 (4.16)	15.46 (4.06)	16.89 (4.31)	13.54 (4.68)	139.66 (<0.001)	3 > 2 > 4 > 1
Problematic gaming (range: 9–45)	16.68 (6.75)	13.29 (5.19)	17.54 (6.54)	20.15 (7.58)	15.92 (6.21)	162.96 (<0.001)	3 > 2 > 4 > 1
Pandemic-specific Adaptability (range: 9–63)	43.73 (12.32)	50.43 (11.92)	41.98 (11.14)	39.76 (10.43)	42.35 (14.13)	131.67 (<0.001)	1 > 2, 4 > 3

Note: The Games-Howell test was used to conduct *post-hoc* analysis for performing multiple comparisons.

It should be noted that the correlation patterns among the three types of mattering and two specific PIUs varied across the four classes (refer to Tables S1–S4). For instance, Class 4 exhibited a significant positive correlation between general mattering and PSMU, a pattern not seen in the other classes. Meanwhile, anti-mattering in Class 3 did not show a significant correlation with either PG or PSMU, whereas in the other three classes, it was significantly and positively correlated with both PIUs.

Table 4 indicates pronounced differences in the average scores across the four classes for PSMU and PG. Specifically, the *F*-values are 139.66 for PSMU and 162.96 for PG, both significant at $p < 0.001$. The ranking for two PIUs is as follows: Class 3 > Class 2 > Class 4 > Class 1. Fig. 2 further underscores the disparities in each PIU criterion, showcasing χ^2 values for addiction criteria ranging from 113.38 to 408.87, all significant at $p < 0.001$. A deeper dive into Table 5 reveals that Class 1 predominantly avoids meeting the addiction benchmarks for both PSMU and PG, with the sole exception being the 'salience' criterion for PSMU. Class 2 participants occasionally exhibit PSMU and PG symptoms, yet they often align with the PG criteria for "A means to mitigate negative feelings" and "Unsuccessful control".
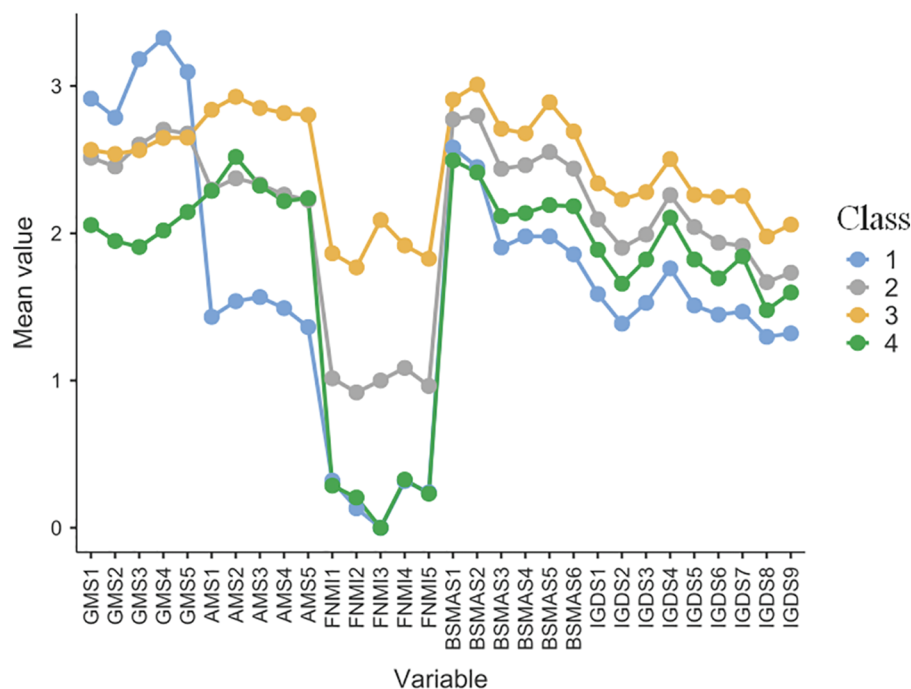
Figure 2: Line graph depicting profile comparisons for three mattering categories, problematic social media use, and problematic gaming.

Class 3 members frequently register high scores for most addiction indicators of both PIU types, except PSMU's "Salience". In contrast, Class 4 mainly opts for "very rarely" or "never" for most indicators, mirroring Class 1, but they notably deviate in their responses to PG's "A means to mitigate negative feelings" and "Persistent gaming despite known psychosocial issues", leaning more towards "often" for the latter.

In terms of adaptability, there's a significant difference between the classes ($F = 131.67$, $p < 0.001$). *Post-hoc* analysis indicates that Class 1 scores higher than Class 2, and Class 4 scores higher than Class 3.

4 Discussion

In this comprehensive investigation, a large-scale survey was conducted among Chinese university students to elucidate the associations between three types of mattering and students' propensities towards PSMU, PG, and adaptability. Using LPA, we identified four distinct profiles characterized by different combinations of general mattering, anti-mattering, and fear of not mattering.

The study's central findings, which show stronger associations between anti-mattering and fear of not mattering with PIU compared to general mattering, can be understood through both Davis's CBM [9] and the expanded CIUT by Flett et al. [12], based on Kardefelt-Winther's theory [10]. The CBM framework suggests that maladaptive cognitions about self and social worth lead to PIU, which is then maintained through reinforcement cycles. Specifically, when individuals with high anti-mattering and fear of not mattering receive positive feedback online (e.g., likes, comments, gaming achievements), this temporarily alleviates their negative self-perceptions, reinforcing the use of Internet as a coping mechanism [9]. This reinforcement process can gradually lead to more intensive and problematic use patterns. Complementing this, CIUT explains how mattering deficits motivate individuals to strategically seek alternative sources of validation online, where immediate feedback and quantifiable indicators of social recognition can compensate for unmet mattering needs in offline contexts [12].

Table 5: Adjusted residuals for distinct classes within BSMAS and IGDS-SF9

Scales	Criterion for addiction	Class 1 (n = 862, 24.0%)					Class 2 (n = 1663, 46.4%)					Class 3 (n = 544, 15.2%)					Class 4 (n = 518, 14.4%)				
		R1	R2	R3	R4	R5	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5	R1	R2	R3	R4	R5
BSMAS Item 1	Salience	4.37	1.13	−2.61	−1.55	−0.68	−6.62	1.51	3.09	1.03	−1.77	−2.88	−2.87	1.93	1.85	3.43	7.02	−0.58	−3.17	−1.48	−0.17
BSMAS Item 2	Tolerance	6.52	3.67	−4.41	−3.42	−2.35	−8.43	−0.14	5.09	1.83	−1.27	−4.67	−3.93	2.32	3.45	5.08	8.80	−0.25	−4.23	−1.96	−0.53
BSMAS Item 3	Mood modification	12.74	1.59	−9.13	−5.03	−3.52	−10.44	2.58	6.13	1.09	−0.85	−7.03	−3.83	5.90	5.07	5.31	6.49	−1.69	−3.63	−0.61	0.07
BSMAS Item 4	Relapse	11.19	2.05	−8.85	−3.89	−2.64	−9.73	1.48	6.77	0.62	−0.67	−6.11	−3.27	4.98	4.73	3.60	6.44	−1.24	−3.93	−0.97	0.49
BSMAS Item 5	Withdrawal symptoms	14.28	−0.14	−7.26	−5.97	−3.73	−10.63	2.19	6.76	0.91	−0.91	−8.22	−2.70	3.41	6.63	6.61	6.11	−0.18	−4.26	−0.79	−0.92
BSMAS Item 6	Conflict	15.76	−0.52	−10.51	−4.33	−2.88	−10.54	3.30	5.53	1.36	−0.29	−7.53	−2.95	6.31	4.02	4.51	3.48	−1.04	−1.51	−0.76	−0.70
IGDS-SF9 Item 1	Obsession	13.56	−3.25	−9.26	−3.69	−3.31	−8.39	3.98	4.77	1.84	−1.07	−7.44	−0.73	6.99	2.23	4.06	3.03	−0.95	−2.65	−0.38	1.41
IGDS-SF9 Item 2	Withdrawal symptoms	15.14	−5.34	−10.75	−3.99	−2.78	−9.11	6.05	4.87	−0.54	−1.01	−9.45	0.42	7.96	5.98	5.52	4.18	−2.52	−1.96	−0.49	−0.82
IGDS-SF9 Item 3	Tolerance	14.17	−5.23	−8.86	−3.68	−2.15	−8.05	5.14	4.14	0.21	−2.12	−8.46	0.38	6.83	4.68	3.64	2.82	−1.32	−2.06	−0.59	1.91
IGDS-SF9 Item 4	A means to mitigate negative feelings	13.49	−2.15	−8.27	−5.55	−1.72	−7.39	2.50	4.37	2.30	−1.88	−6.94	−0.94	4.91	3.70	4.32	1.18	0.03	−1.56	−0.30	0.35
IGDS-SF9 Item 5	Unsuccessful control	14.48	−3.99	−9.86	−4.95	−2.34	−9.03	4.46	4.89	2.03	−0.53	−6.97	−1.03	6.85	3.69	3.75	2.32	−0.41	−1.94	−0.63	−0.23
IGDS-SF9 Item 6	Diminishing interest in other hobbies	14.60	−5.84	−9.26	−4.12	−1.96	−8.95	6.01	4.55	0.37	−1.84	−8.49	−0.11	7.11	4.93	6.02	3.62	−1.30	−2.47	−0.56	−1.15
IGDS-SF9 Item 7	Persistent gaming despite known psychosocial issues.	14.45	−5.81	−9.05	−2.92	−3.29	−7.22	5.99	3.04	−1.06	−2.23	−8.34	−0.40	8.05	2.23	6.24	1.19	−1.03	−1.52	2.78	0.78
IGDS-SF9 Item 8	Deception about gaming duration towards others	11.91	−4.79	−9.40	−2.72	−1.73	−6.12	4.45	3.27	0.95	−1.96	−9.37	1.48	9.11	2.67	4.96	3.76	−2.00	−2.51	−0.76	−0.19
IGDS-SF9 Item 9	Gaming-related losses in important things	13.39	−5.58	−9.77	−3.57	−1.46	−6.41	5.28	2.69	0.41	−1.58	−9.65	1.38	9.06	4.42	2.67	2.67	−2.12	−1.18	−0.75	1.29

Note: In the table, for BSMAS, the scale from R1 to R5 ranges from 'very rarely' to 'very often'. For IGDS-SF9, the scale from R1 to R5 represents 'never' to 'very often'; Values highlighted with a gray background signify a notably higher or lower likelihood of selecting that response, as evidenced by adjusted residuals exceeding ±1.96.

Our person-centered analyses revealed distinct psychological mechanisms through which different mattering profiles might influence PIU vulnerability. Class 3's profile (moderate general mattering, high anti-mattering, high fear of not mattering) appears to operate through a "double vulnerability" mechanism: high anti-mattering generates immediate distress about current social insignificance, while high fear of not mattering creates future-oriented anxiety [5,12]. Previous research has shown that both anti-mattering and fear of not mattering are strongly associated with increased anxiety and loneliness [19–21]. This combination might create a particularly intense psychological distress that makes online validation especially appealing, explaining their highest PIU levels. The presence of social anxiety and loneliness might further intensify their need for online social connection, where the perceived risks of rejection are lower.

Class 4's profile (low general mattering, moderate anti-mattering, low fear of not mattering) reveals a distinct psychological pattern. Their combination of low general mattering but also low fear of not mattering suggests a unique state where individuals might experience loneliness but with less social anxiety about future relationships. This psychological state appears to specifically predispose them to gaming-related PIU, possibly because gaming environments offer structured achievement systems and clear metrics of success that provide an alternative pathway to feeling significant [44]. Their moderate anti-mattering coupled with low fear suggests they might be more responsive to achievement-based validation rather than social validation.

Conversely, Class 1's resilience mechanism becomes apparent through their profile combination (high general mattering, low anti-mattering, low fear of not mattering). Their robust sense of mattering likely serves as a psychological buffer against anxiety and loneliness, reducing the need for compensatory online behaviors. Moreover, their continued social media salience during the pandemic warrants careful interpretation, as previous studies have identified intensive social media use as an adaptive mechanism during periods of social restriction [45,46]. Importantly, recent theoretical critiques by Billieux et al. [47] have highlighted the distinction between core addiction criteria (e.g., conflict, withdrawal) and peripheral criteria (e.g., salience). Their framework suggests that salience might indicate high engagement rather than problematic use, a distinction that has received substantial empirical support (e.g., [48–52]). This framework provides a reasonable lens for interpreting Class 1's pattern of social media use during social restrictions, suggesting their elevated salience scores might reflect adaptive engagement rather than problematic use.

Class 2, representing the largest proportion of participants (46.4%), exhibited a distinctive pattern: a marked inclination toward specific PG criteria ("A means to mitigate negative feelings" and "Unsuccessful control") while showing resilience to PSMU (evidenced by the absence of high probabilities in BSMAS items). This pattern might be explained by what we term a "balanced vulnerability" mechanism, characterized by moderate levels across all mattering dimensions. Their moderate levels might create a state of psychological ambivalence about social significance, accompanied by moderate levels of both anxiety and loneliness, making gaming's structured achievement system particularly attractive as a compensatory mechanism [44], while being sufficiently buffered against the excessive social validation needs that typically drive PSMU. This distinct susceptibility pattern carries important implications for PIU prevention strategies. The findings suggest that individuals with moderate mattering profiles show different vulnerabilities to gaming *vs.* social media use. This differential pattern necessitates targeted intervention approaches that specifically address PG-related risks while acknowledging the potentially less problematic nature of social media engagement for this profile.

The varying adaptability levels across profiles suggest that mattering combinations influence not just PIU susceptibility but also broader psychological resilience during crises. For instance, the combination of high anti-mattering and fear of not mattering in Class 3 might create heightened anxiety that impairs adaptive responses, while Class 1's positive mattering profile might facilitate better coping strategies through reduced

anxiety and social support seeking behaviors. These pattern differences became particularly relevant during the COVID-19 pandemic, when social restrictions potentially amplified existing mattering vulnerabilities.

Comparing our study with similar person-centered research, Liao et al. [24] investigated PNT profiles and PIU among Chinese teachers. Their findings align with our results, showing that individuals with lower PNT (conceptually similar to lower anti-mattering) demonstrated less vulnerability to PIU. While the study by Saritepeci and associates with Turkish university students found no relationship between general mattering and their identified PIU profiles [14], our findings demonstrate the importance of considering multiple mattering constructs simultaneously, particularly the joint influence of anti-mattering and fear of not mattering on PIU vulnerability. This suggests that examining general mattering alone may not capture the full complexity of how mattering relates to PIU, highlighting the novel contribution of our profile approach incorporating all three mattering constructs.

These findings carry significant implications for intervention strategies. The identification of specific psychological mechanisms suggests that PIU interventions should be tailored to different mattering profiles rather than applying a one-size-fits-all approach. For instance, interventions for Class 3 might focus on addressing both current feelings of insignificance and future-oriented mattering anxieties, while Class 4 might benefit more from interventions that build general mattering through structured achievement opportunities. This understanding underscores the need for preventive interventions that consider both immediate PIU risks and longer-term adaptability development, particularly during periods of social disruption.

Despite the significant findings, this study has several limitations that need to be addressed. A primary methodological limitation is our use of convenience sampling, which introduces potential selection bias despite the large sample size and inclusion of students from multiple universities. This sampling strategy significantly limits our ability to generalize the findings to the broader Chinese university student population, as participants may not be representative of the overall demographic. Second, the cross-sectional design prevents us from assessing how PIU changes over time among students with different mattering profiles. Future research would benefit from longitudinal person-centered approaches to capture the dynamic nature of mattering profiles and their relationship with PIU over time. Third, the implementation of pandemic prevention measures during data collection could have influenced our results, including the LPA groupings, suggesting the importance of replicating these findings during non-pandemic periods. Future research should employ more rigorous sampling strategies to examine whether the four mattering profiles identified through LPA are consistently found in broader and more diverse student populations, both within China and internationally, to establish the generalizability of our findings.

5 Conclusion

In conclusion, our study underscores the importance of a person-centered approach to address the gap in existing literature, which mostly uses only variable-centered approaches. Additionally, our findings suggest that different mattering profiles influence individuals' susceptibility to PIU addiction criteria. As mattering is a highly malleable construct, enhancing it could be a proactive strategy to reduce the prevalence of PIU, providing a new direction for future preventive measures. Notably, the identification of four distinct subgroups through LPA presents an opportunity for more targeted interventions in PIU prevention.

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Ethics Approval: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the Jiangxi Psychological Consultant Association (IRB ref: JXSXL-2022-Jul13). Informed consent has been obtained in writing from all participants involved in the study.

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