



Developmental dynamics between psychological distress and psychological inflexibility in college students: A two-wave cross-lagged panel study

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Abstract: The present study investigated the longitudinal and reciprocal associations between psychological distress and psychological inflexibility among college students. A total of 391 participants (77.2% male; age = 20.31, $SD = 0.90$) were recruited through cluster sampling, completed the DASS-21 (21-item Depression Anxiety Stress Scale) and AAQ-II (Acceptance and Action Questionnaire–II) at two time points (T1: March 2024; T2: October 2024). After establishing longitudinal measurement invariance, a cross-lagged panel model was estimated while controlling for gender and age. Results from cross-lagged panel modeling (CLPM) revealed significant concurrent correlations between psychological distress and psychological inflexibility at both time points, as well as reciprocal predictive effects: T1 psychological distress significantly predicted higher T2 psychological inflexibility ($\beta = 0.155, p = 0.006$), and T1 psychological inflexibility significantly predicted higher T2 psychological distress ($\beta = 0.186, p < 0.001$). Gender was also significantly associated with baseline distress. These findings highlight the developmental interplay between psychological distress and psychological inflexibility consistent with the core assumptions of Acceptance and Commitment Therapy (ACT). These findings provide empirical support for prevention and intervention strategies grounded in ACT-based approaches, such as acceptance, mindfulness, and values-oriented action, to promote mental health in young adulthood.

Keywords: Psychological distress; psychological inflexibility; cross-lagged panel model; college students; developmental processes

Introduction

Among the many psychological regulatory factors, psychological flexibility has been widely recognized as a core protective variable against psychological distress. Rooted in Acceptance and Commitment Therapy (ACT), psychological flexibility refers to an individual's ability to flexibly adjust psychological resources in dynamic contexts to pursue valued goals (Kashdan & Steger, 2006). By contrast, psychological inflexibility is characterized by maladaptive responses such as experiential avoidance and cognitive fusion. Previous studies have demonstrated that psychological inflexibility is strongly associated with depression, anxiety, loneliness, and perceived stress (Dixit et al., 2023; Kato, 2020; Gloster et al., 2017). Despite accumulating evidence linking psychological inflexibility to various forms of psychological distress, it remains unclear how psychological distress and psychological inflexibility influence each other over time. In particular, few studies have examined their reciprocal longitudinal associations while simultaneously establishing longitudinal measurement invariance. Addressing this gap is essential for clarifying the temporal ordering and developmental dynamics between these two closely related constructs.

Psychological distress and inflexibility

Psychological inflexibility has been linked to depression, anxiety, chronic pain, and addictive behaviors (Hayes et al., 2006; Bond et al., 2011). At the intervention level, randomized controlled trials conducted by Fledderus et al. (2010) and Grégoire et al. (2024) found that enhancing

psychological flexibility significantly reduced depression and anxiety while improving well-being. Longitudinal evidence further suggests that psychological inflexibility not only co-occurs with distress but also predicts its future development (Østergaard et al., 2020).

Nevertheless, important gaps remain. First, most existing studies are cross-sectional, limiting the ability to capture the dynamic and reciprocal relationship between psychological distress and psychological inflexibility. Second, intervention studies often rely on small or unrepresentative samples, lacking naturalistic longitudinal observations. Third, few studies have systematically examined their cross-time interplay under the premise of measurement invariance.

Theoretical basis

Acceptance and Commitment Therapy (ACT) conceptualizes psychological flexibility as a core process underlying mental health and adaptive functioning. According to ACT, psychological inflexibility—manifested through experiential avoidance, cognitive fusion, and rigid behavioral patterns—limits individuals' capacity to respond effectively to internal experiences and environmental demands. From a process-based perspective, heightened psychological distress may progressively deplete regulatory resources, thereby reinforcing inflexible coping strategies. Conversely, persistent psychological inflexibility can increase vulnerability to negative emotional states by amplifying avoidance and reducing engagement in valued activities. This reciprocal process suggests a dynamic



feedback loop between distress and inflexibility over time. However, empirical tests of this bidirectional mechanism remain limited, particularly in longitudinal designs that ensure measurement equivalence across time points.

The China context

In recent years, the prevalence of psychological distress among Chinese college students has been on the rise, driven by increasing academic pressure, intense employment competition, and rapid societal changes (Shi et al., 2024). Symptoms of depression, anxiety, and stress have become increasingly common. Psychological distress not only undermines students' learning motivation and academic performance but also impairs their interpersonal adjustment and future career development (Tang et al., 2018). Thus, identifying the key mechanisms underlying psychological distress has become a pressing task for mental health research in higher education.

Ren et al. (2019) found that psychological inflexibility among college students was significantly correlated with multiple psychological symptoms. Kashdan and Rottenberg (2010) confirmed its predictive role in depression and anxiety. Landi et al. (2022) showed that, during the COVID-19 pandemic, psychological inflexibility functioned as a moderated mediator between perceived stress and depression. Mechanistic studies further revealed that experiential avoidance mediated the association between loneliness and both depression and social anxiety (Lei et al., 2019), while mindfulness played a crucial role in the link between cognitive fusion and emotional reactivity (Larsson et al., 2022; Long & Ma, 2021). In terms of intervention, Christodoulou et al. (2021) reported that an ACT-based group program effectively reduced psychological distress by enhancing flexibility, and Beygi et al. (2023) demonstrated that these effects were maintained over time.

The present study

To address these gaps, the present study employed a two-wave longitudinal design and constructed a cross-lagged panel model after testing for measurement invariance. Specifically, the present study addressed the following research questions:

(1) Do psychological distress and psychological inflexibility exhibit reciprocal cross-lagged associations over time among college students?

(2) Do these longitudinal associations remain significant after controlling for age and gender at baseline? By examining the bidirectional relationship between psychological distress and psychological inflexibility among college students, this study aims to provide theoretical insights and empirical evidence to inform mental health promotion in higher education.

Method

Participants and setting

A cluster sampling strategy was used to recruit undergraduate students from two universities in Chongqing, China. At Time 1 (T1; March 2024), 700 questionnaires were distributed, and 672 valid responses were collected through an online survey platform. Consistent with the

gender composition of the sampled academic programs—which were predominantly male in enrollment—more male students participated at baseline (472 males and 200 females). Similar gender imbalances have been reported in cluster-sampled university cohorts, especially in science-, engineering-, and technology-related majors (Verdugo-Castro et al., 2023).

To ensure data quality, several screening procedures were implemented. Because all T1 items were set as mandatory, no item-level missingness occurred at baseline. Participants who did not complete the T2 survey were excluded, as paired responses across waves are required for longitudinal analyses. Additionally, responses with extremely short completion times, duplicate submissions, and incorrect answers to an instructed-response attention-check item were removed. These procedures follow established recommendations for online data quality control (Peer et al., 2022; Meade & Craig, 2012; Ward & Meade, 2023).

After all exclusions, the final analytic sample consisted of 391 students (302 males and 89 females; 77.2% male). Although the proportion of male participants increased slightly from T1 to T2, follow-up analyses indicated no significant differences in attrition between male and female students, suggesting that the gender imbalance primarily reflects the original composition of the sampled clusters rather than selective dropout. Participants ranged in age from 18 to 25 years ($M = 20.31$, $SD = 0.90$).

Measures

Psychological distress

Psychological distress was assessed using the Chinese version of the 21-item Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995; Gong et al., 2010). The scale consists of three subscales—depression, anxiety, and stress—each containing seven items rated on a 4-point Likert scale (0 = “Did not apply to me at all,” 3 = “Applied to me very much or most of the time”). Participants reported their emotional experiences over the past week. Higher subscale scores indicate greater severity of the corresponding type of psychological distress. In the present study, the DASS-21 demonstrated excellent internal consistency, with Cronbach's α coefficients of 0.96 at T1 and 0.98 at T2. Recent psychometric evaluations further support the applicability of the DASS-21 in Chinese populations (Chen et al., 2023).

Psychological inflexibility

Psychological inflexibility was measured using the Chinese version of the Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011; Cao et al., 2013). The scale consists of seven items rated on a 7-point Likert scale (1 = “Never true,” 7 = “Always true”), with higher scores indicating greater psychological inflexibility. The AAQ-II has demonstrated good reliability and validity among Chinese college student populations. In the present study, Cronbach's α coefficients were 0.95 at T1 and 0.97 at T2, indicating excellent internal consistency.

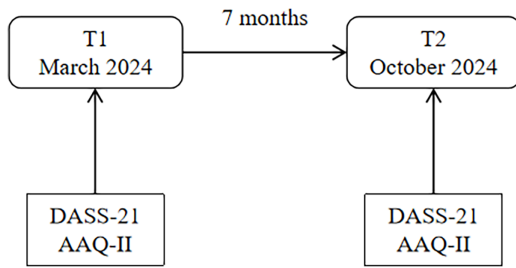


Figure 1. Study design and measurement timeline

Procedure

This study was reviewed and approved by the Institutional Ethics Committee of Sichuan International Studies University, China (Ethics Approval ID: LL202500009). All participants were informed about the purpose of the study and provided written informed consent prior to participation. The overall study design and measurement timeline are illustrated in Figure 1.

Psychological distress (DASS-21) and psychological inflexibility (AAQ-II) were assessed at Time 1 (March 2024) and Time 2 (October 2024), with a seven-month interval between waves.

Data analysis

Data analyses were conducted using Statistical Package for the Social Sciences (SPSS) 25.0 and Mplus 8.3. Before the main analyses, we examined the attrition pattern between T1 and T2. Among the 672 valid T1 participants, 391 completed the T2 assessment, resulting in an attrition rate of approximately 42%. To evaluate whether the missing data mechanism met the Missing Completely at Random (MCAR) assumption, Little's MCAR test was performed. The test yielded a significant result ($\chi^2 = 90.51$, $df = 5$, $p < 0.001$), indicating that the missingness was not strictly MCAR (Little, 1988). However, independent-samples *t*-tests comparing retained vs. attrited participants on baseline characteristics (age, gender, T1 psychological distress, and T1 psychological inflexibility) showed no meaningful differences, suggesting that the missingness was more consistent with a Missing at Random (MAR) mechanism (Schafer & Graham, 2002). Given that Full Information Maximum Likelihood (FIML) produces unbiased parameter estimates under MAR, all longitudinal models were estimated using FIML with robust standard errors, implemented via the Maximum Likelihood with Robust standard errors (MLR) estimator in Mplus.

Next, Confirmatory Factor Analyses (CFAs) were performed in Mplus to test the longitudinal measurement invariance of the DASS-21 and AAQ-II across T1 and T2. Configural, metric, and scalar invariance were examined sequentially, with model comparisons evaluated based on $\Delta CFI < 0.01$ (Ye et al., 2025). Descriptive statistics and correlations were then computed in SPSS.

Finally, a Cross-Lagged Panel Model (CLPM) was constructed to test the reciprocal longitudinal associations between psychological distress and psychological inflexibility. The model included both constructs at two time points and controlled for gender and age. Model fit was assessed using the chi-square statistic (χ^2), Root

Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR).

In line with widely cited guidelines, CFI and TLI values above 0.90 and SRMR values below 0.08 are generally viewed as indicating acceptable fit (Hu & Bentler, 1999). However, methodological reviews emphasize that global fit indices should not be interpreted using rigid universal cutoffs. Instead, model fit must be evaluated holistically and in light of model characteristics (Groskurth et al., 2024). Notably, RMSEA is known to be inflated in models with very few degrees of freedom, and recommended thresholds (e.g., 0.06 or 0.08) may become overly conservative or even misleading under such conditions (Kenny et al., 2015). Given these considerations, the high CFI and low SRMR observed in the present model provide stronger and more stable evidence for acceptable overall model fit.

Finally, given the sample size of 391, the study had adequate power (>0.80) to detect small-to-medium standardized cross-lagged effects ($\beta \approx 0.10$ – 0.15), based on power guidelines and previous simulation studies of cross-lagged panel models (Jobst et al., 2023; Faul et al., 2009).

Results

Test of measurement invariance

As shown in Table 1, the CFA results indicated that both the DASS-21 and AAQ-II met the criterion for scalar invariance across T1 and T2 ($\Delta CFI < 0.01$), suggesting that the two measures demonstrated structural stability over the seven-month interval. Although the relative fit indices (e.g., CFI, TLI, SRMR) were acceptable, some absolute fit indices—particularly the RMSEA values for the AAQ-II models—were modest. This pattern is not uncommon for models with very few degrees of freedom or complex item-level structures, as RMSEA tends to be inflated under such conditions and may appear to indicate poorer fit than is warranted. Therefore, the measurement models should be interpreted with caution. This limitation is further acknowledged in the Discussion section.

Descriptive statistics and correlations

As shown in Table 2, Pearson correlation analyses revealed significant positive associations between psychological distress and psychological inflexibility at both T1 and T2 ($p < 0.001$). Specifically, T1 psychological distress was significantly correlated with T2 psychological inflexibility, and T1 psychological inflexibility was likewise significantly correlated with T2 psychological distress. These findings provide preliminary support for conducting the subsequent cross-lagged panel analysis.

Longitudinal associations between psychological distress and psychological inflexibility

Given the high correlations among depression, anxiety, and stress, these subscales were combined into a composite indicator of psychological distress. After controlling for gender and age at baseline, the cross-lagged panel model demonstrated acceptable fit, $\chi^2(4) = 14.24$, $p = 0.006$, RMSEA = 0.081, 90% CI [0.038, 0.128], CFI = 0.966, SRMR = 0.030. Standardized cross-lagged effects and R^2 values are reported in Table 3.

Table 1. Tests of longitudinal measurement invariance for psychological distress and psychological inflexibility

Measurement model	χ^2 (<i>df</i>)	Δ CFI	CFI	TLI	RMSEA (90% CI)	SRMR
Psychological distress						
Configural invariance	2759.53 (817)		0.872	0.865	0.078 [0.075, 0.081]	0.043
Metric invariance	2771.36 (838)	0	0.872	0.869	0.077 [0.074, 0.080]	0.044
Scalar invariance	2801.38 (858)	0	0.872	0.871	0.076 [0.073, 0.079]	0.044
Psychological Inflexibility						
Configural invariance	378.14 (76)		0.952	0.943	0.101 [0.091, 0.111]	0.031
Metric invariance	380.78 (82)	0.001	0.953	0.947	0.097 [0.087, 0.106]	0.032
Scalar invariance	384.08 (88)	0	0.953	0.951	0.093 [0.083, 0.102]	0.033

Note. χ^2 = chi-square; *df* = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker–Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual; Δ CFI = change in CFI.

Table 2. Descriptive statistics and correlations among study variables (*N* = 391)

Variable	1	2	3	4	5	6	7	8
1. T1 Psychological inflexibility	–							
2. T1 Stress	0.508***	–						
3. T1 Anxiety	0.468***	0.883***	–					
4. T1 Depression	0.486***	0.879***	0.895***	–				
5. T2 Psychological inflexibility	0.366***	0.316***	0.299***	0.254***	–			
6. T2 Stress	0.385***	0.457***	0.441***	0.436***	0.477***	–		
7. T2 Anxiety	0.362***	0.455***	0.449***	0.415***	0.477***	0.928***	–	
8. T2 Depression	0.367***	0.437**	0.406***	0.457***	0.441***	0.920***	0.909***	–
<i>M</i>	18.00	6.00	5.57	5.15	16.50	5.50	5.27	4.86
<i>SD</i>	8.65	4.01	4.01	4.19	8.31	4.12	4.10	4.27

Note. T1 = first wave (March 2024), T2 = second wave (October 2024) and any significance asterisks (***) $p < 0.001$.

Table 3. Standardized cross-lagged effects and R² values

Outcome	Predictor	Estimate	95% CI	R ²
T2 Psychological inflexibility	T1 Psychological inflexibility	0.29	[0.171, 0.404]	0.15
T2 Psychological inflexibility	T1 Psychological Distress	0.16	[0.043, 0.267]	–
T2 Psychological Distress	T1 Psychological Distress	0.36	[0.247, 0.466]	0.23
T2 Psychological Distress	T1 Psychological inflexibility	0.19	[0.086, 0.287]	–

Note. R² values represent the variance explained in each T2 outcome; R² for T1 variables is not typically interpreted in cross-lagged models and therefore omitted from this table. Confidence intervals are based on Mplus STDYX standardized estimates.

The autoregressive paths were significant, supporting stability from T1 to T2 (T1 psychological inflexibility → T2 psychological inflexibility: $\beta = 0.29$, $SE = 0.06$, $p < 0.001$; T1 psychological distress → T2 psychological distress: $\beta = 0.36$, $SE = 0.06$, $p < 0.001$). Both cross-lagged effects were positive and significant, indicating reciprocal longitudinal prediction: T1 psychological distress → T2 psychological inflexibility ($\beta = 0.16$, $SE = 0.06$, $p = 0.006$); T1 psychological inflexibility → T2 psychological distress ($\beta = 0.19$, $SE = 0.05$, $p < 0.001$). Concurrent associations between the two constructs were also significant (T1: $r = 0.51$, $p < 0.001$; T2: $r = 0.33$, $p < 0.001$).

Regarding covariates, gender significantly predicted baseline psychological distress (gender → T1 psychological distress: $\beta = -0.21$, $SE = 0.04$, $p < 0.001$), but not baseline psychological inflexibility ($\beta = -0.06$, $p = 0.215$). Age showed no significant effects on either construct at baseline. As shown in Figure 2, both autoregressive and cross-lagged paths were statistically significant.

Discussion

Grounded in ACT, the present study employed a two-wave longitudinal design and cross-lagged panel modeling to examine the dynamic relationship between psychological

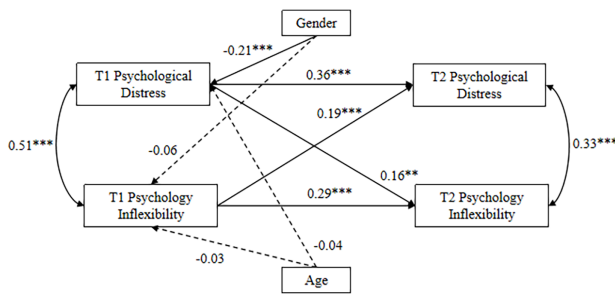


Figure 2. Cross-lagged panel model of psychological distress and psychological inflexibility (standardized path coefficients are reported). ** $p < 0.01$, *** $p < 0.001$.

inflexibility and psychological distress among Chinese college students. The results revealed a bidirectional association: psychological distress significantly predicted subsequent psychological inflexibility, and psychological inflexibility in turn predicted later psychological distress. These findings provide longitudinal evidence for the reciprocal interplay between the two constructs and address gaps in prior domestic research, which has rarely tested measurement invariance or temporal ordering.

The reciprocal associations observed in the present study align with ACT's process-based account of psychological rigidity, suggesting that emotional distress may gradually erode individuals' flexibility in responding to internal experiences, while reduced flexibility increases vulnerability to negative emotions. This pattern is consistent with previous work showing that inflexibility contributes to depression, anxiety, and emotional dysregulation, while distress can exacerbate cognitive fusion and experiential avoidance (Lei et al., 2019; Arch et al., 2023; Arslan et al., 2021). Our findings thus add longitudinal support to models proposing that inflexibility is both a contributor to and a consequence of psychological distress.

However, the interpretation of these findings must also consider ongoing debates about the construct validity of the AAQ-II. Recent research has questioned whether the AAQ-II measures a distinct process of psychological inflexibility or whether it partially reflects general negative affectivity. Hernández-López et al. (2021), for instance, reported strong concurrent but relatively weak prospective associations between AAQ-II scores and emotional distress, arguing that the measure may tap general emotional vulnerability rather than a fully independent regulatory process. This perspective provides an additional theoretical explanation for the strong cross-sectional correlations and the modest absolute fit indices observed in the present study, particularly for the AAQ-II. It also suggests that the bidirectional longitudinal associations found here may, in part, reflect shared variance between inflexibility and broader negative affect. Even so, the presence of significant cross-lagged effects in both directions indicates that psychological inflexibility retains incremental predictive value beyond this shared variance.

From a practical perspective, the findings highlight the need for a dual focus in psychological interventions. On the one hand, interventions should aim to reduce inflexibility through methods such as acceptance, mindfulness, and values clarification, enabling students to cope

with negative emotions more adaptively. On the other hand, it is equally important to recognize the resource-depleting effects of psychological distress, which may erode flexibility over time. Future campus mental health services may benefit from integrated approaches that combine screening, group training, and individual counseling to build a comprehensive intervention framework that simultaneously alleviates distress and reduces inflexibility (Christodoulou et al., 2021; Lei et al., 2019).

Limitations and future directions

Despite its contributions, this study has several limitations. First, the sample was drawn from a limited region, which constrains the generalizability of the findings. Second, the study relied primarily on self-report questionnaires; incorporating peer reports, behavioral measures, or physiological indicators in future research would strengthen the validity of the conclusions. Third, although longitudinal scalar invariance was achieved for both measures, some absolute fit indices—particularly the RMSEA for the AAQ-II—were modest. Given the known sensitivity of RMSEA in low-df models, these measurement limitations should be considered when interpreting the cross-lagged results. Future studies may consider alternative measurement structures (e.g., item parcels, second-order or bifactor models) to further improve model fit. Fourth, the two-wave design limits the ability to draw strong causal inferences, as the cross-lagged estimates capture longitudinal associations rather than within-person processes. Fifth, although several cross-lagged effects reached statistical significance, their magnitudes were small and should be interpreted cautiously. Sixth, although rigorous screening procedures were applied, the study experienced a relatively high attrition rate between T1 and T2, and the predominantly male sample may further limit the generalizability of the findings to more gender-balanced college populations. Finally, the follow-up duration was limited to seven months; longer-term designs are needed to assess more stable developmental processes.

Conclusion

In sum, this study provides preliminary longitudinal evidence for the bidirectional relationship between psychological inflexibility and psychological distress. By enriching the dynamic perspective of psychological flexibility theory, the findings also offer practical implications for the design of mental health interventions in higher education settings.

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writing—substantial revision of methodology and discussion sections, Min Hu; funding acquisition, Yanting Li. All authors reviewed and approved the final version of the manuscript.

Availability of Data and Materials: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval: This study was reviewed and approved by the Institutional Ethics Committee of Sichuan International Studies University, China (Ethics Approval ID: LL202500009). All participants were informed about the purpose of the study and provided written informed consent prior to participation.

Conflicts of Interest: The authors declare no conflict of interest.

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