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# Perceived Involution and Academic Burnout Among University Students: The Mediating Role of Anxiety and the Moderating Role

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## ABSTRACT

**Background:** The concept of "involution" has gained prominence in the context of China's education system, reflecting students' perceptions of intense and often fruitless academic competition. How-ever, little is known about how perceived involution affects students' psychological outcomes, par-ticularly academic burnout.

**Objective:** This study investigates the relationship between perceived involution and academic burnout among university students. Specifically, it examines whether anxiety mediates this rela-tionship and whether self-control moderates the effect of perceived involution on anxiety.

**Methods:** A cross-sectional survey was conducted among 673 university students in China. Stand-ardized scales were used to assess perceived involution, anxiety, self-control, and academic burnout. The data were analysed using SPSS 26.0 and the PROCESS macro (version 4.2), incorporating me-diation (Model 4) and moderation (Model 7) analyses with bootstrapping procedures.

**Results:** Perceived involution significantly and positively predicted academic burnout. Anxiety was found to partially mediate this relationship. Furthermore, self-control moderated the effect of per-ceived involution on anxiety, such that the positive association was weaker for individuals with higher levels of self-control.

**Conclusion:** These findings indicate that perceived involution contributes to academic burnout by exacerbating anxiety, while self-control acts as a protective factor against it. The study offers theo-retical insights into the emotional mechanisms of burnout and provides practical implications for stress intervention and mental health promotion in higher education.

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**Keywords:** Perceived Involution, Academic Burnout, Anxiety, Self-Control, Psychological Stress

## Introduction

In the context of rapid socioeconomic development in recent years, competition in the educational field has intensified significantly. The phenomenon of "involution" has emerged as a widely dis-cussed socio-cultural issue [1, 2]. Originally derived from an anthropological term, involution refers to excessive and ineffective competition within fixed resources or spaces. In the educational context, it is manifested in students investing increasing amounts of time and effort in pursuit of higher grades and more achievements, despite diminishing marginal returns and even adverse effects on mental health [3]. As the term "involution" gains traction among adolescent and college student populations, individuals' subjective perceptions of competitive pressure hereafter referred to as perceived invo-lution—have become an important topic in psychological research [4].

Meanwhile, academic burnout has become a prevalent negative psychological state among adoles-cents [5]. It is characterized by emotional exhaustion from learning, loss of motivation, and

a lack of sense of accomplishment. This issue has been widely recognized as a key factor influencing the quality of adolescent development [6]. Previous studies have indicated that external stressors, such as excessive academic workload and parental expectations, can trigger academic burnout [7]. Within an involuted educational climate, students who are continuously exposed to highly competitive envi-ronments may experience chronic psychological resource depletion, resulting in persistent fatigue and helplessness, and ultimately leading to academic burnout [7, 8]. Therefore, exploring the mechanism by which perceived involution contributes to academic burnout holds both theoretical and practical significance.

From the perspective of psychological mechanisms, emotion serves as a critical mediator linking external pressure with behavioral responses. Anxiety, a high-arousal, negatively valenced emotional state, commonly arises when individuals are faced with uncontrollable challenges [9]. In an involu-tional context, students may experience anxiety due to their inability to meet implicit or explicit performance standards, which in turn consumes cognitive and emotional resources and increases the likelihood of burnout [10]. Existing studies have also found that anxiety plays a mediating role be-tween environmental stressors and academic burnout [11]. However, no study has yet explored whether anxiety is likely to serve as an important intermediary in the relationship between perceived involution and academic burnout.

It is crucial to recognize that individuals subjected to comparable involutional environments do not uniformly report equivalent degrees of burnout. The inquiry into the potential critical role of psychological resources and self-regulatory capacity is thus warranted, as these factors may significantly influence how individuals cope with and are affected by such conditions. Self-control, defined as the ability to regulate emotions, inhibit impulses, and maintain goal-directed behaviors, is a key predictor of differential responses to stress [12]. According to the Conservation of Resources Theory, indi-viduals with high self-control are more capable of protecting and managing their limited psycho-logical resources [13]. When facing external stress, such individuals are more likely to engage in adaptive emotional regulation, thereby buffering the generation of negative affect. The emotion regulation process model proposed by Gross also emphasizes that effective emotion regulation strategies, such as cognitive reappraisal, can mitigate maladaptive emotional responses and reduce resource depletion [14]. Hence, self-control may moderate the influence of perceived involution on anxiety.

"Involution" was originally an anthropological concept that described a system or society maintaining operations through increasingly elaborate and repetitive competition in the absence of external de-velopment or expansion [15]. In recent years, the term has been redefined within the Chinese edu-cational context to refer to a high-input, low-output competitive state, colloquially termed "Neijuan" in Chinese, and is especially prevalent in academic competition among students [16]. Perceived in-volution refers to an individual's subjective experience of excessive competition within the education system, typically manifested as feelings of helplessness and anxiety in response to increasing aca-demic pressure, rising standards, and the intensified efforts of peers [17]. Empirical research has shown that students with higher levels of perceived involution are more likely to experience negative emotional states and psychological exhaustion, suggesting that perceived involution may be a key psychological antecedent of academic burnout [18].

Academic burnout refers to students' emotional exhaustion, cynicism, and reduced sense of aca-demic efficacy resulting from sustained academic pressure over time [19]. Originating from the occupational burnout literature, this construct has been widely applied in adolescent educational psychology research in recent years. Academic burnout has been found to negatively impact aca-demic performance and learning motivation and is strongly associated with depression, anxiety, and self-injurious behaviors [20]. Studies have identified both external stressors and internal resource deficiencies as key influencing factors. Among these, the pressure derived from an involuted edu-cational climate has been increasingly recognized as a sociopsychological cause of heightened aca-demic burnout in modern students [21].

According to the ABC (Activating events; Beliefs; Consequences) theory of emotion, emotional responses are not directly triggered by external events but are mediated by individuals' beliefs or subjective interpretations [22]. In the context of involution, students' subjective appraisals of the competitive environment may evoke worries about failure or falling behind, which in turn trigger anxiety. Anxiety is a high-arousal, negatively-valenced emotional state, typically characterized by excessive worry, self-doubt, and behavioral withdrawal [23, 24]. Previous studies have confirmed the mediating role of anxiety between various stressors and psychological outcomes. For example, Jiang et al. found that adolescents who perceived parental phubbing were more likely to experience social anxiety, which subsequently contributed to increased academic burnout [11, 25]. Similarly, Keshavarzi et al. reported that anxiety significantly mediated the relationship between academic performance and burnout in university students [26]. These findings suggest that anxiety may serve as a key psychological mechanism through which perceived involution influences academic burnout.

Self-control refers to an individual's ability to regulate impulses, delay gratification, and persist in goal-directed behavior. It is regarded as a crucial psychological resource for maintaining mental health and functioning under pressure [27]. According to the COR (Conservation of Resources) theory, individuals must continually mobilize and preserve cognitive, emotional, and social resources to cope with environmental stress [13, 28]. When resources are depleted or insufficient, individuals may experience emotional exhaustion and psychological withdrawal. However, individuals with high self-control are more capable of resisting the emotional erosion caused by external stressors through strategies such as cognitive reappraisal and task restructuring.

In addition, Gross's process model of emotion regulation emphasizes that different emotion regula-tion strategies have distinct effects on psychological outcomes. Antecedent-focused strategies are more effective in alleviating negative emotions, whereas response-focused strategies may increase emotional distress due to resource consumption [14]. As a regulatory resource, self-control may enhance the effectiveness of cognitive emotion regulation and inhibit impulsive responses, thereby buffering the adverse emotional impact of perceived involution. Empirical studies support this view; for instance, Chen et al. found that students with high self-control levels were less likely to experience emotional exhaustion and academic burnout when facing academic pressure [29].

In summary, this study aims to explore whether perceived involution affects academic burnout through anxiety and examine whether self-control plays a moderating role in this relationship.

We hypothesize that:
1) Perceived involution positively predicts academic burnout.
2) Anxiety mediates the relationship between perceived involution and academic burnout.
3) Self-control moderates the effect of perceived involution on anxiety specifically, the association between perceived involution and anxiety is weaker in individuals with higher levels of self-control. This study seeks to clarify the psychological adaptation mechanisms of students in high-pressure and competitive academic environments, and provide empirical support for intervention measures tar-geting academic burnout.

## Materials and Methods

### Methodology

### Participants and Data Collection

This study employed a random sampling method to recruit undergraduate students from multiple universities across China. A total of 751 questionnaires were collected. After excluding 78 invalid responses based on lie detection items and response quality checks (72 were excluded based on lie detection items, and 6 were excluded due to poor response quality), a final sample of 673 valid re-sponses was retained. Among the participants, 460 were female (68.3%) and 213 were male (31.7%), with ages ranging from 17 to 24 years.

The sample included students from a wide range of academic disciplines, such as humanities, en-gineering, science, and arts/sports, and covered diverse types of institutions including elite compre-hensive universities, regular undergraduate universities, and vocational colleges. Detailed demo-graphic information is presented in Table 1. All participants completed the survey anonymously online.

**Table 1: Demographic Information of the Sample**

| Variable | Category | N |
|---|---|---|
| Gender | Female | 460 |
| | Male | 213 |
| Only Child | Yes | 265 |
| | No | 408 |
| Major | Humanities | 447 |
| | Engineering | 117 |
| | Science | 95 |
| | Arts and Sports | 14 |
| Place of Origin | Urban | 365 |
| | Rural | 308 |
| Grade | Undergraduate | 640 |
| | Graduate and above | 33 |
| Type of School | Key Comprehensive Univ. | 531 |
| | General Comprehensive Univ. | 124 |
| | Vocational College | 18 |

### Measures

To ensure data quality, all instruments used in this study were adapted from established scales with proven reliability and validity, and were appropriately localized for the Chinese context. All Cronbach's alpha coefficients exceeded 0.65, indicating acceptable internal consistency.

Perceived Involution Scale: the In-Volume Perception Measurement Questionnaire developed by Wen Zhang et al. (2024) was used, with a total of 18 entries. The questionnaire involves four dimensions: resource scarcity, social norms, psychological pressure, and competitive behavior. A 7-point scale was used, with higher scores indicating a higher degree of perceived involution by the individual [15].

Academic Burnout Scale: The Academic Burnout Scale for Adolescents developed by Yan Wu and Xiaoyang Dai et al. in 2010 was used. This scale contains three dimensions of physical and mental exhaustion, academic detachment, and low achievement with 16 items. The scoring is based on a five-point scale, with "very low" scoring 1 point, "high" scoring 5 points, and individual items scored on a reverse scale. The higher the total cumulative score, the higher the level of academic burnout [21, 30, 31].

Anxiety Scale: The Anxiety Self-Rating Scale developed by Zung (1971) was used to assess students' anxiety levels. The scale contains 20 items. A four-point scale was used, with higher scores indicating higher levels of anxiety [30, 32].

Self-Control Scale: The Self-Control Scale for College Students developed by Tangney et al. (2004) and revised by Tan, Shuhua, and Guo, Yongyu (2008) was used. The revised scale consists of 19 items with a 5-point Likert scale. The scale is divided into five dimensions: impulse control, healthy habits, resisting temptation, focusing on work, and moderating entertainment. The higher the score, the better the self-control [33].

### Model Construction and Hypotheses

Based on the theoretical and empirical foundations, the present study proposes the following research model: perceived involution indirectly influences academic burnout through anxiety, and self-control moderates the path between perceived involution and anxiety. The specific research hypotheses are as follows:
**H1:** Perceived involution positively predicts academic burnout.
**H2:** Anxiety mediates the relationship between perceived involution and academic burnout.
**H3:** Self-control moderates the effect of perceived involution on anxiety, such that individuals with higher self-control experience a weaker link between perceived involution and anxiety.
The research model of this study is illustrated in the figure below.

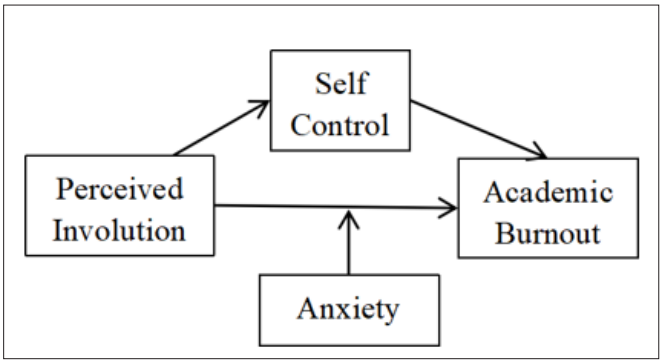


**Figure 1:** Perceived Involution Indirectly Influences Academic Burnout Through Anxiety, and Self-Control Moderates the Path between Perceived Involution and Anxiety

### Data Analysis Procedure

All data were processed and analyzed using SPSS 26.0 and the PROCESS macro (version 4.2). The analysis included the following steps:

1. **Descriptive Statistics and Correlation Analysis:** Means,

standard deviations, and Pearson correlation coefficients were calculated for all major variables to verify basic statistical as-sumptions.

2. **Group Differences:** One-way ANOVA and independent samples t-tests were conducted to explore differences in perceived involution, academic burnout, anxiety, and self-control across demographic variables such as gender, academic major, and university type.
3. **Reliability and Multicollinearity Checks:** The internal consistency of all scales was assessed via Cronbach's α. VIF (Variance Inflation Factor) and tolerance statistics were examined to ensure no significant multicollinearity among variables.
4. **Hypothesis Testing:** Multiple regression analyses were conducted to examine the predictive relationships among the key variables. To test the mediating role of anxiety, PROCESS Model 4 with 5,000 bootstrap samples was employed. Additionally, the moderating effect of self-control was assessed using PROCESS Model 7, which tested the interaction between perceived involution and self-control in predicting both anxiety and academic burnout.

## Results

### Correlation Analysis

Correlation analysis was conducted on the four key variables. The results showed strong correlations among all variables, as presented in the table below:

**Table 2: Correlation Coefficients among Variables**

| | Perceived Involution | Self-Control | Anxiety | Academic Burnout |
|---|---|---|---|---|
| Perceived Involution | — | — | — | — |
| Self-Control | 0.223** | — | — | — |
| Anxiety | 0.162** | 0.396** | — | — |
| Academic Burnout | 0.158** | 0.440** | 0.491** | — |

### Regression Analysis

Preliminary regression analysis was conducted to examine the predictive relationships among variables. The results showed that perceived involution significantly predicted academic burnout (β=0.158, p<0.001). After including anxiety as a predictor, it provided significant incremental explanatory power (ΔR^2=0.223, p<0.001). Further inclusion of self-control also significantly improved the model (ΔR^2=0.066, p<0.001).

### Reliability and Validity

VIF for all variables was less than 10, and tolerance values were greater than 0.1, indicating that multicollinearity was not a concern. Reliability analysis showed that the Cronbach's α coefficient for each scale was above 0.650, indicating acceptable internal consistency.

### Model Testing

### Mediation Effect

As shown in Table 4 perceived involution significantly predicted academic burnout (β = 0.245, p < 0.001). Perceived involution significantly predicted anxiety (β = 0.048, p < 0.050). Anxiety significantly predicted academic burnout (β = 0.168, p < 0.001). Even after controlling for anxiety, perceived involution still significantly predicted academic burnout (β = 0.238, p < 0.001), indicating a partial mediation effect of anxiety (Table 3). Since the 95% confidence interval for the indirect effect does not include 0, the mediation effect of anxiety is significant.

**Table 3: Mediation Analysis: Anxiety Between Perceived Involution and Academic Burnout**

| Dependent Variable | Academic Burnout | | Anxiety | | Academic Burnout | |
|---|---|---|---|---|---|---|
| Independent Varia-ble | Perceived Involution | | Perceived Involution | | Perceived Involution | |
| Mediator | | | | | Anxiety | |
| | Beta (β) | p | Beta (β) | p | Beta (β) | p |
| | 0.245 | P<0.001 | 0.048 | 0.036 | 0.168 | P<0.001 |
| Model Fit Indices | | | | | | |
| R2 | 0.060 | | 0.002 | | 0.088 | |
| Adj.R2 | 0.060 | | 0.002 | | 0.087 | |
| F | 115.403*** | | 4.380* | | 55.755*** | |

Note: *p<0.050, ***p<0.001;

**Table 4: Bootstrap Mediation Test**

| Dependent Variable | Effect Type | B | SE | LLCI | ULCI |
|---|---|---|---|---|---|
| Academic Burnout | Direct | 0.0400 | 0.0038 | 0.0326 | 0.0474 |
| | Indirect | 0.0013 | 0.0008 | 0.0003 | 0.0029 |
| | Total | 0.0413 | 0.0038 | 0.0337 | 0.0488 |

**Moderation Effect**

Self-control, as a continuous variable, was standardized and divided into three groups for clarity: Lower 27% = Low self-control group; Middle 46% = Medium group; Upper 27% = High self-control group.

The interaction term (Perceived Involution × Self-Control) was significant in predicting academic burnout (β = 0.188, t = 2.201, p = 0.028), indicating a significant moderating effect.

**Table 5: Hierarchical Regression Analysis: Moderating Role of Self-Control**

| Model | Independent Variable | R2 | B | Beta(β) | t | p |
|---|---|---|---|---|---|---|
| Model 1 | | | | | | |
| | Perceived Involution | 0.081 | 0.037 | 0.219 | 9.407*** | P<0.001 |
| | Self control | | -0.781 | 0.159 | 6.852*** | P<0.001 |
| Model 2 | | | | | | |
| | Perceived Involution | 0.084 | 0.013 | 0.079 | 1.170 | 0.243 |
| | Self control | | -0.284 | 0.058 | 1.124 | 0.261 |
| | Interaction | | 0.011 | 0.188 | 2.201* | 0.028 |

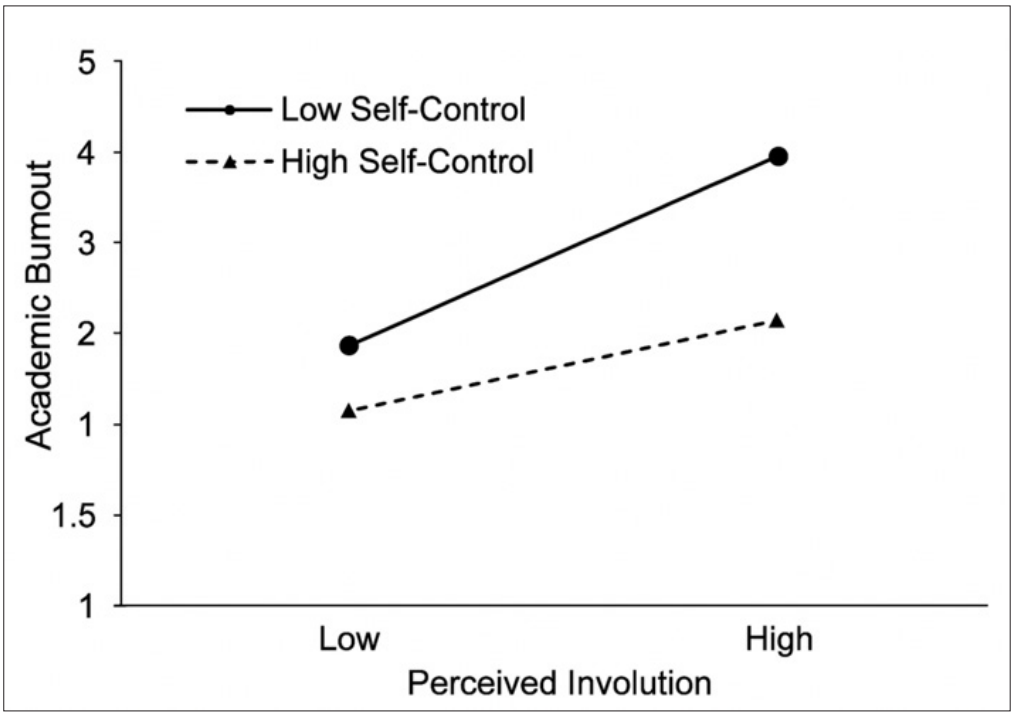


**Figure 2:** Simple Effects of Perceived Involution

Since the 95% CI [-0.0211, -0.0012] does not contain 0 and the interaction term is negative (B < 0), self-control significantly buffers the impact of perceived involution on academic burnout: the pre-dictive effect is stronger among individuals with lower self-control and weaker among those with higher self-control.

**Discussion**

**Main Findings**

This study investigated the psychological mechanisms of students in the context of perceived invo-lution and examined the influence path from perceived involution to academic burnout, with a par-ticular focus on the mediating role of anxiety and the moderating role of self-control. The key findings are as follows:

First, perceived involution significantly and positively predicted academic burnout, supporting Hy-pothesis 1 (H1). This finding is consistent with previous studies, indicating that in an environment of escalating competition, individuals' perceptions of resource scarcity and unattainable goals are likely to induce emotional exhaustion and a decline in motivation [34].

Second, anxiety partially mediated the relationship between perceived involution and academic burnout, confirming Hypothesis 2 (H2). This result supports Ellis's ABC theory of emotion and is consistent with recent empirical research [22]. Specifically, involution pressure, as an external acti-vating event (A), evokes anxiety (C), which is influenced by individuals' beliefs and cognitive evaluations (B), and further affects levels of burnout. In other words, the impact of perceived in-volution on burnout does not occur directly but is partially transmitted through the activation of negative emotional states.

Third, self-control significantly moderated the path from perceived involution to anxiety, supporting Hypothesis 3 (H3) and aligning with the perspectives of the COR theory and Gross's emotion regu-lation process model [13]. Specifically, individuals with low self-control are more likely to experi-ence anxiety and subsequent burnout under involution pressure, while those with high self-control are more capable of regulating emotions and stabilizing cognition, thus mitigating the adverse effects of involution.

**Theoretical Implications**

By exploring the path "perceived involution → anxiety → academic burnout" and incorporating self-control as a moderator, this study contributes a novel emotion–resource regulation model and expands the current theoretical framework linking stress, emotion, and behavior. The contributions are elaborated in three aspects:

Previous discussions of involution have largely been limited to sociological or educational discourse, with little attention paid to its psychological function as a subjective stressor. By operationalizing "perceived involution" as a measurable variable, this study identifies both its direct and indirect influences on emotional and mental states, enriching theoretical understandings of how sociocultural stressors are internalized as individual psychological burdens.

Specifically, perceived involution is not merely a response to structural inequality but also manifests as a constellation of emotional experiences including anxiety, shame, comparison, and self-doubt. By embedding a macro-level cultural phenomenon into a micro-level psychological model, this study contributes to the integration of sociocultural and psychological perspectives. Moreover, the scale used in this study offers a new approach for measuring students' sensitivity and responses to invo-lution across different populations, providing a foundation for further development of stress theory.

Anxiety was confirmed as a key mediator between perceived involution and academic burnout, empirically validating the chain logic of "belief → emotion → response" from the ABC theory of emotion. While prior studies often assumed a direct link between academic stress and burnout, this study reveals the essential role of emotional activation in mediating this relationship [35].

Additionally, the findings support a dual role for anxiety in adolescent development—as both a cognitive disruptor and a motivational regulator [36, 37]. Although anxiety can momentarily mobilize attention and energy, prolonged high levels can deplete psychological resources, reduce motivation, and trigger self-denial [38]. By establishing anxiety as a core psychological mechanism rather than a secondary consequence, this study provides a more causal and structured framework for incorpo-rating emotion into educational psychological models.

By introducing self-control as a moderating variable, this study bridges Gross's process model of emotion regulation with Hobfoll' s COR theory. It innovatively proposes that individuals with higher self-control are more likely to reduce the emotional impact of perceived involution through cognitive reappraisal and adaptive emotion regulation, thereby weakening the pathway to burnout.

This theoretical integration allows for a more dynamic and multidimensional explanation of student adaptation under pressure. Rather than treating emotion regulation and resource capacity as separate constructs, this model views them as interacting systems. It holds strong explanatory power and generalizability and could be applied to other high-pressure academic settings. Future research can further extend the model by incorporating specific emotion regulation strategies and various resource types to develop more comprehensive and testable models.

**Practical Implications**

Beyond its theoretical contributions, this study offers multi-level and actionable suggestions for educational interventions and student psychological support. In particular, under the post–"Double Reduction" policy context, university students face new forms of academic anxiety and perceived involution [39]. The practical significance of this study is reflected in the following three aspects:

The finding that perceived involution directly predicts academic burnout suggests that even when objective workloads remain unchanged, students' subjective perceptions of "having to work harder" or "being passively compared" still impose psychological stress. Educational institutions should be cautious about systemic mechanisms that reinforce hidden involution, such as excessive rankings, score-centric academic cultures, and widespread but low-value competitions.

Recommendations Include: establishing diversified evaluation standards to reduce anxiety caused by single-metric comparisons; strengthening non-competitive curricular elements; and promoting formative assessments and growth-oriented feedback in teaching to reduce performance pressure [40]. Ultimately, the goal is to reduce perceived involution and achieve preventive emotional and cognitive adjustments through systemic reform.

The mediating role of anxiety suggests that interventions targeting emotional states can alleviate burnout even when the external competition environment cannot be fully eliminated. Emotional regulation education should not be limited to crisis response but integrated into daily psychological training [41, 42].

Colleges are encouraged to include emotional recognition and regulation modules in freshman ori-entation or general education courses, covering topics such as identifying sources of anxiety, self-awareness training, cognitive reappraisal techniques, and relaxation breathing [43, 44]. Targeted interventions such as pre-exam counseling or stress management workshops can support high-risk groups [44]. Additionally, both psychological counselors and academic advisors should be trained in basic anxiety screening and intervention skills to ensure a system-wide emotional support network [45].

As demonstrated in this study, self-control plays a significant moderating role and functions as a broadly adaptive psychological resource. Its development should not only be a long-term personality goal but also a core element of school-based psychological education.

**Self-Control can be Cultivated Through Three Avenues**

1. Curriculum Level: Integrate goal setting, delay of gratification, and time management into personal development courses
2. Daily Life Level: Guide students to develop realistic daily plans and phase goals aligned with academic demands to enhance behavioral execution
3. Situational Training Level: Use experiential methods such as role-playing or stress simula-tion to help students strengthen willpower and impulse control in controlled settings [46, 47].

Such interventions can enhance students' self-regulation capacity and psychological resilience, equipping them to handle future academic challenges, societal transitions, and career-related anxiety.

**Limitations and Future Directions**

Although this study produced a set of systematic and empirically supported findings, several limita-tions must be acknowledged: The research design is cross-sectional, limiting causal inference. Future studies should adopt longitudinal or experimental designs to examine temporal or causal relationships. The sample is drawn primarily from universities in central China, limiting generalization across re-gions and educational levels. Future research could extend to secondary school students or vocational college students. This study focused mainly on the mediating role of negative emotions. Future work may incorporate positive emotional variables as mediators or moderators to build a more compre-hensive psychological mechanism model.

**Conclusions**

With the intensification of educational competition and the growing prevalence of the "involution" phenomenon, the psychological pressure faced by students has become increasingly complex and implicit [48, 49]. This study constructs an integrated model to examine how perceived involution impacts academic burnout through anxiety, with self-control as a moderator, among Chinese uni-versity students. Results revealed that perceived involution directly predicts academic burnout and indirectly exacerbates it via heightened anxiety, while self-control mitigates anxiety by fostering adaptive strategies, thereby buffering burnout progression. These findings expand sociocultural stress theory and emotion regulation frameworks, highlighting the need to address subjective stress per-ceptions and enhance self-regulatory capacities in educational interventions. Future research should explore longitudinal causal relationships and additional psychological resources to refine the "stress-emotion-resource-behavior" model. Therefore, optimizing the academic environment should focus not merely on reducing task load but also on addressing students' subjective perceptions of stress [50].

**Availability of Data and Materials**

The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Author Contributions**

**Concept:** Jinhua Xu, Kexin Chen, Ziyun Yang
**Design:** Kexin Chen, Ziyun Yang
**Supervision:** Kexin Chen, Ling Wang
**Materials:** Ziyun Yang, Jinhua Xu
**Data Collection and/or Processing:** Ziyun Yang, Jinhua Xu, Ling Wang, Kexin Chen
**Literature Search:** Ziyun Yang, Ling Wang, Jinhua Xu
**Writing:** Ziyun Yang, Ling Wang, Jinhua Xu, Kexin Chen

**Consent to Participate**

All participants in the study protocol signed an informed consent form.

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**Conflict of Interest**

The authors declare no conflict of interest.

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