Early Adolescent Multidimensional Emotion Regulation and Psychological Adaptation: A Multilevel Latent Profile Analysis

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Abstract

In daily life, individuals often employ multiple strategies simultaneously to regulate negative emotional experiences; however, few studies have explored the strategy combination patterns and adaptability of multiple emotion regulation in early adolescents. This study selected 352 students in grades five to seven from Henan and Shanghai ($M_{age} = 12.05$ years, $SD = 0.88$). Utilizing a 10-day diary tracking method and a questionnaire survey conducted at a six-month interval, the study investigated the strategy combination patterns of multiple emotion regulation in daily negative social situations among early adolescents and their relationship with psychological adaptation.

Multilevel latent profile analysis and structural equation modeling revealed that five types of multiple regulation strategy combinations were identified at the within-person level, with differences in overall usage intensity and preference across combinations. Daily depression and anxiety were associated with more frequent use of low-level, medium-level, and high-level multiple regulation strategy combinations, and less frequent use of adaptive-strategy-dominated combinations. At the between-person level, four types were identified; the mixed multiple regulation preference group exhibited lower loneliness and higher self-esteem, while the low-level and medium-level multiple regulation preference groups showed higher social anxiety. This study breaks through the limitations of traditional static perspectives in examining adolescent multiple emotion regulation, deepens the understanding of the dynamic process of emotion regulation in early adolescents, and provides insights for the prevention and intervention of psychological adaptation problems.

Full Text

Preamble

Multiple Emotion Regulation and Psychological Adaptation in Early Adolescence: A Multilevel Latent Profile Analysis

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Abstract

In daily life, individuals frequently employ multiple strategies simultaneously to regulate negative emotional experiences. However, few studies have explored the specific patterns of strategy combinations and their associated adaptability among early adolescents. This study selected 405 students in grades five through seven from Henan and Shanghai ($M_{age} = 12.05, SD = 0.88$). Utilizing a 7-day diary tracking method followed by a six-month longitudinal questionnaire survey, we investigated the combination patterns of emotion regulation strategies used by early adolescents in daily negative social situations and their relationship with psychological adaptation.

Multilevel Latent Profile Analysis (MLPA) and Structural Equation Modeling (SEM) revealed distinct patterns at both the within-person and between-person levels. At the within-person level, four specific emotion regulation strategy combinations were identified, showing significant differences in usage intensity and preference. Most adolescents primarily utilized adaptive strategies. At the between-person level, three distinct profiles were identified: the "Mixed Multiple Regulation Preference" group, the "Moderate Multiple Regulation Preference" group, and the "Low Multiple Regulation Preference" group.

The results indicated that adolescents in the Mixed Multiple Regulation Preference group reported lower levels of loneliness. Conversely, those in the Low and Moderate Multiple Regulation Preference groups exhibited higher levels of social anxiety. This research breaks through traditional static perspectives by examining the dynamic processes of multiple emotion regulation in adolescents. These findings deepen our understanding of the dynamic nature of adolescent emotion regulation and provide practical insights for interventions targeting psychological adaptation issues.

关键词

Early Adolescence: A Multilevel Latent Profile Analysis

Abstract

Early adolescence represents a critical developmental window characterized by significant biological, cognitive, and social transitions. Understanding the heterogeneity of developmental patterns during this period requires sophisticated analytical approaches that account for both individual differences and the nested nature of social environments (e.g., students within schools). This study employs Multilevel Latent Profile Analysis (MLPA) to identify distinct subgroups of early adolescents based on a comprehensive set of developmental indicators. By integrating individual-level psychological factors with group-level contextual variables, we aim to provide a more nuanced understanding of the diverse developmental trajectories present in early adolescence.

Introduction

Early adolescence is often described as a period of "storm and stress," yet empirical evidence suggests a wide range of adjustment patterns. Traditional variable-centered approaches often overlook the complex ways in which various developmental domains—such as academic engagement, emotional regulation, and social competence—interact within individuals. Person-centered approaches, specifically Latent Profile Analysis (LPA), allow researchers to identify unobserved subgroups (latent profiles) that share similar patterns across multiple indicators.

However, adolescents do not develop in a vacuum; they are nested within classrooms, schools, and neighborhoods. Standard LPA often ignores this hierarchical structure, potentially leading to biased parameter estimates and a failure to capture how organizational contexts influence the distribution of individual profiles. Multilevel Latent Profile Analysis (MLPA) addresses these limitations by simultaneously modeling individual-level latent profiles and group-level latent classes.

Methodology

Participants and Procedure The sample consists of early adolescents recruited from multiple middle schools. Data collection involved self-report surveys assessing psychological well-being, peer relationships, and academic motivation.

Statistical Analysis We utilized MLPA to analyze the data, following a stepwise procedure. First, we determined the optimal number of latent profiles at the individual level (Level 1). Second, we examined the nested structure to identify group-level latent classes (Level 2) that describe different compositions of individual profiles within schools.

The mathematical framework for the multilevel model is defined as follows: Let y_{pij} be the observed score for individual i in group j on indicator p. The probability of an individual belonging to a specific latent profile k is given by:

$$P(C_{ij} = k|\eta_j) = \frac{\exp(\gamma_{0k} + \gamma_{1k}\eta_j)}{\sum_{l=1}^{K} \exp(\gamma_{0l} + \gamma_{1l}\eta_j)}$$

1 引言

Properly managing negative emotional experiences during social interactions is crucial for the psychological development and well-being of adolescents. This issue has garnered significant attention due to its pivotal role in adolescent psychological adaptation (Compas et al., 2017; Schäfer et al., 2017). Previous research has primarily focused on single emotion regulation strategies—such as expressive suppression and cognitive reappraisal—to examine their specific relationships with psychological adjustment (Tamir et al., 2024). While these studies help clarify the role and adaptive differences of specific strategies within the emotion regulation process, they may fail to capture the complexity of emotion regulation in daily life. In practice, individuals do not use single strategies in isolation; rather, they frequently employ multiple strategies simultaneously (Baldwin et al., 2025; Ford et al., 2019). Ford et al. (2019) termed this phenomenon of using multiple strategies to handle emotional events as "emotion polyregulation." Facilitated by the development of social cognitive and metacognitive abilities (Choudhury et al., 2006), the capacity of adolescents to utilize diverse and refined strategies gradually increases. This work is supported by the National Science and Technology Major Project on Brain Science and Brain-Like Intelligence Technology (2021ZD0200500).

Adolescents report experiencing more than one emotion during emotional episodes (Cracco et al., 2017; Nook et al., 2018) and utilizing a variety of strategies (Lennarz et al., 2019). However, it remains unclear what specific patterns of strategy combinations employ during negative social interactions in their daily lives, and how these patterns relate to their overall adaptation.

Researchers have increasingly utilized person-centered approaches, such as Latent Profile Analysis (LPA) and Latent Class Analysis (LCA), to investigate the types of emotion regulation strategy combinations and their adaptive functions (Guassi Moreira et al., 2024; Lougheed & Hollenstein, 2012; Aleva et al., 2023). These assessments, often based on cross-sectional self-reports, provide a nuanced understanding of how different regulatory profiles manifest across individuals.

方法

Reflecting trait-like emotional regulation tendencies at the inter-individual level, researchers have begun to capture the complex and dynamic patterns of multiple

emotion regulation strategy repertoires as they occur in real life (Grommisch et al., 2020; Rottweiler et al., 2023). By employing the Experience Sampling Method (ESM) to observe how individuals vary their regulation strategies across different contexts over time, it is possible to identify specific profiles of emotion regulation strategy repertoires from an inter-individual perspective (McMahon & Naragon-Gainey, 2019).

The flexible use of emotion regulation strategies serves as both a goal and a primary mechanism for the development of mental health; therefore, investigating these strategy repertoires and their adaptive functions is of significant theoretical and practical importance (Riediger & Klipker, 2014). The present study utilizes a daily diary tracking method over several days, followed by a six-month longitudinal questionnaire survey, to explore the patterns of multiple emotion regulation strategy repertoires among early adolescents in the context of daily negative social situations, as well as the relationship between these patterns and psychological adaptation.

1.1 多元情绪调节及其适应性

Emotion regulation is the process by which individuals influence the occurrence, experience, and expression of emotions to achieve regulatory goals [**?**]. Previous research has primarily focused on single goals, strategies, or techniques of emotion regulation, examining the independent effects of different strategies at psychological and behavioral levels [**?**]. Adaptive strategies—such as cognitive reappraisal, problem-solving, and acceptance—have been shown to reduce psychological adjustment issues like anxiety and depression in adolescents, whereas maladaptive strategies—such as expressive suppression, rumination, and concealment—tend to increase these problems [**?**, **?**]. Growing evidence suggests that when facing emotional stress, people tend to use multiple strategies flexibly rather than relying on a single one [**?**, **?**]. In response to emotional experimental stimuli, nearly two-thirds of participants simultaneously employ multiple regulation strategies [**?**]; even when using one primary strategy, individuals often utilize additional strategies concurrently [**?**]. In real-life settings, individuals not only use combinations of qualitatively different strategies within specific scenarios [**?**], but also exhibit highly heterogeneous strategy combinations even when facing the same type of stressor [**?**, **?**].

Exploring the efficacy of single strategies in isolation may, to some extent, simplify the actual process of emotion regulation and overlook its complexity in daily life [**?**, **?**]. Building upon the process model of emotion regulation proposed by [**?**], [**?**] incorporated multiple regulatory goals and strategies into the emotion regulation framework, introducing the concept of poly-regulation. Similar to single-strategy regulation, poly-regulation begins with situational perception activating one or more regulatory goals—the identification stage. This is followed by the strategy selection and implementation stages, where multiple goals influence strategy choice in different directions. A small number of studies have explored individuals' daily poly-regulation and its adaptive characteristics.

For instance, [**?**] used experience sampling methods to record the use of daily emotion regulation strategies and identified several patterns of poly-regulation strategy combinations.

These patterns of strategy combinations differ in their intensity of use—ranging from none to moderate and high levels—across categories such as social sharing, situational modification, suppression, and ignoring.

Using similar methods to examine stress coping during the pandemic, [**?**] identified various coping strategy combination patterns. Aside from patterns characterized by non-use or a single dominant strategy, individuals often employed multiple strategies simultaneously. Compared to those who used no strategies, participants using combinations of strategies such as social support, relaxation, and distraction reported more pleasant emotional states. [**?**] focused on emotional experiences and the use of regulation strategies—such as hope and anxiety—before major university exams. They examined whether the use of poly-regulation strategy combinations depended on the achievement context, finding that anxious individuals were more likely to use multiple strategies, though this association was weaker in academic settings.

Research has also found that strategy combinations involving reflection and acceptance are generally associated with lower levels of negative affect and fewer psychological adjustment problems. Conversely, combinations involving expressive suppression, avoidance, and distraction are linked to higher negative affect and psychopathological symptoms [**?**, **?**]. These studies confirm that individuals exhibit various patterns of emotion regulation strategy combinations in daily contexts, with significant differences existing in the specific strategies employed.

Poly-strategy combinations dominated by low, medium, or high levels of use are common, while combinations dominated by maladaptive strategies typically vary according to sample characteristics. Adaptability depends not only on the compatibility between strategies but also on the level of analysis: at the intra-individual level, poly-regulation usually involves the joint use of strategies within a single context, whereas at the inter-individual level, it refers to the cross-situational use of one or more strategy combinations.

The synergy between strategies and context plays a crucial role in the effective exercise of emotion regulation flexibility [**?**, **?**]. Strategy efficacy is maximized when individuals flexibly deploy and adjust strategies according to changing situational demands [**?**]. Emotion regulation flexibility is reflected not only in the switching between strategies but also in the flexible use of poly-regulation strategy combinations [**?**]. According to rigidity theory [**?**], if an individual' s strategy use is rigid and singular when facing negative emotions or events—such as an extreme preference for a specific category—it indicates a lack of regulatory flexibility. Conversely, the moderate use of various strategies indicates higher regulatory flexibility.

It should be noted that stronger poly-regulation implies that an individual possesses a more robust "toolbox," manifesting in diverse strategy combinations

[?, ?]. However, poly-regulation is not synonymous with emotion regulation flexibility. The profile structure of poly-regulation at the intra-individual level primarily reflects the morphological characteristics of multiple strategies used in parallel, while its adaptability at the inter-individual level also depends on the degree of fit with the context [?]. Studies combining intra-individual and inter-individual perspectives to explore daily poly-regulation strategy combinations and their adaptive features [?, ?, ?] have found differences in the number and adaptive functions of strategy combinations across individuals.

Individuals exhibit preferences for using either a single strategy combination or multiple strategy combinations. Compared to a preference for a single poly-regulation combination, the flexible use of multiple combinations is associated with better adjustment [?, ?].

1.2 青少年多元情绪调节与心理适应

Psychological adjustment refers to the active response individuals make to achieve a state of balance between themselves and their environment when adapting to external changes. This process involves adjusting psychological activities and behavioral patterns to better align with environmental shifts and developmental demands [?, ?]. As they enter adolescence, individuals face increasingly complex internal and external environments. Significant changes in physiological functions, cognitive abilities, social environments, and family and peer relationships may exacerbate feelings of depression, anxiety, and loneliness [?, ?]. However, these transitions also provide opportunities for the development of emotional regulation capabilities [?, ?]. During this period, the intensity of positive emotions in adolescents gradually weakens while negative emotions increase [?, ?, ?], and emotional instability remains higher than in adults [?, ?]. With physiological and cognitive maturation, the diversity and flexibility of emotional regulation strategies increase [?, ?]; negative emotions, in particular, exert a continuous influence on the emotional regulation and psychological adjustment of adolescents.

Currently, there is a growing body of research examining the combinatorial patterns of adolescent emotion regulation strategies and their adaptive functions [?, ?]. Depending on the specific focus of these studies, the types and number of identified profiles vary slightly.

By examining combinations of adaptive and maladaptive strategies, researchers have generally identified several distinct patterns [?, ?, ?]. These include: "Low-Regulators," characterized by low usage of all strategies; "High-Regulators," characterized by high usage of all strategies; "Adaptive Regulators," who prefer adaptive strategies; and "Maladaptive Regulators," who prefer non-adaptive strategies [?, ?, ?, ?]. Compared to other combinations in both adult and adolescent populations, the "Adaptive Regulator" profile—defined by specific strategy preferences and usage intensity—is associated with the lowest risks of anxiety, depression, stress, and non-suicidal self-injury [?, ?, ?]. Conversely,

"Maladaptive Regulators" exhibit the highest levels of depression, anxiety, and borderline personality disorder symptoms, alongside the lowest life satisfaction [?, ?, ?]. "Low-Regulators" and "High-Regulators" typically show moderate levels of adjustment [?, ?, ?], though some evidence suggests that high usage of multiple strategies may be detrimental to psychological adjustment [?, ?, ?].

These studies have primarily utilized self-report questionnaires to examine the general tendencies of adolescent multi-strategy combinations at the trait level [?, ?]. To date, no research has integrated both intra-individual and inter-individual information to investigate the combinatorial patterns of multiple emotion regulation strategies in daily contexts and their subsequent relationship with psychological adjustment.

1.3 问题提出与研究假设

Multivariate emotion regulation holds significant theoretical and practical importance. An increasing number of studies have examined multivariate emotion regulation from a dynamic perspective, focusing on strategy combination patterns and their adaptability; however, several uncertainties remain to be clarified. First, regarding the combinations of multivariate emotion regulation strategies used by adolescents in daily negative social situations, research suggests that regulation strategies do not follow a uniform developmental pattern [?]. While strategy combinations exhibit heterogeneity, fixed preferences for specific regulation strategies may not yet be fully established at this developmental stage, suggesting that the degree of heterogeneity might be lower than that observed in adults [?]. Previous experience-sampling studies have often focused on specific scenarios, such as academic examinations in university settings [?, ?, ?], and their findings may not be generalizable to the real-life experiences of adolescents. Wang (2023) found differences in the strategy combinations individuals use when facing daily negative life events compared to specific contexts, noting that a greater number of strategy combinations were employed during the pandemic. Finally, there is a need to focus on the types of strategy combinations at the intra-individual level and the preferences for these combinations at the inter-individual level.

Previous research has often conducted only a single round of assessment for adaptive variables, which fails to provide robust evidence for the longitudinal relationship between strategy combinations and psychological adaptation [?]. The present study intends to record the use of emotion regulation strategies during negative social interactions over consecutive days, supplemented by psychological adaptation questionnaires administered at a six-month interval. This approach aims to investigate the patterns of daily emotion regulation strategy combinations in early adolescents and their relationship with psychological adaptation. Drawing on previous methodologies [?, ?], we will employ Multilevel Latent Profile Analysis (MLPA) to evaluate these multivariate patterns [?]. Specifically, MLPA first identifies the optimal profile structure at the intra-individual level through cluster analysis based on daily strategy usage. Build-

ing on these intra-individual results, the analysis then identifies the optimal cross-situational strategy combination preferences at the inter-individual level. Following prior research, we selected loneliness, depression, and social anxiety as inter-individual indicators of psychological adaptation [**?**, **?**]. Loneliness reflects the discrepancy between an individual' s actual and ideal social states and exhibits high stability; thus, it serves as an intra-individual indicator of psychological adaptation [**?**, **?**].

The present study proposes the following hypotheses: (1) Multiple strategy combinations exist at the intra-individual level among early adolescents. Combinations involving adaptive strategies, such as cognitive reappraisal and problem-solving, will be associated with lower levels of depression and anxiety, whereas combinations of maladaptive strategies, such as expressive suppression and rumination, will be associated with higher levels. High-intensity strategy combinations will also show distinct patterns of depression and anxiety. (2) Multiple cross-situational strategy combination preferences exist at the inter-individual level, ranging from single-strategy to multi-strategy preferences. Preferences for adaptive strategies will correlate with fewer psychological adaptation problems, while preferences for maladaptive strategies will correlate with more problems. Psychological adaptation for those preferring high-intensity strategy combinations will fall in the middle range. Compared to the tendency to use a single strategy combination, the relationship between current multivariate emotion regulation strategy combinations and immediate regulation effects remains unclear [**?**].

分析

At the intra-individual level, the overall success of emotion regulation is a critical factor. According to the social cognitive theory of social class, individuals in economically underdeveloped regions are more likely to develop context-dependent social cognitive styles. In contrast, those with greater external resources tend to develop social cognitive styles centered on a sense of personal control and environmental mastery (Cheng et al., 2014; Keltner et al., 2022). To address the strategic tendencies of adolescents and increase the representativeness of the sample, this study intends to select participants from regions with varying levels of economic development.

Previous research has identified significant differences in adolescent regulation strategies and psychological adaptation based on gender, age, and geographic region (e.g., , 2020; Tamir et al., 2024). Consequently, when examining the relationship between cross-situational strategy repertoires and psychological adaptation, it is necessary to control for the effects of gender, age, and region.

In accordance with theories of emotion regulation flexibility (Aldao et al., 2015; Haag et al., 2024), this study utilizes emotional expression flexibility and emotion regulation difficulties as criteria for evaluating the flexibility of strategy combinations at the inter-individual level. This approach allows for the inves-

tigation of the association between multi-component emotion regulation and overall emotion regulation flexibility.

2.1 被试与施测程序

There is currently no consensus regarding the minimum sample size required for multilevel latent class analysis. However, continuous observations suggest that a sample size of 500 participants is sufficient to meet the criteria for model identification and unbiased parameter estimation (2018).

A Monte Carlo simulation analysis was conducted to calculate the minimum required sample size [**?**]. The results indicated that with a minimum tracking period of 10 days, an effect size of $f^2 = 0.12$ [**?**], an intra-class correlation coefficient (ICC) of 0.50, and a statistical significance level of $\alpha = 0.05$, a sample of at least 150 participants is required to achieve sufficient statistical power. In this study, 215 students from grades five to seven were recruited from a public middle school in Henan and a nine-year consistent school in Shanghai, satisfying the sample size requirements. Prior to administration, the experimenter introduced the instructions and testing procedures, while declaring the principles of data confidentiality, informed consent, and the freedom to withdraw.

Both students and parents signed informed consent forms. Graduate students majoring in developmental psychology served as experimenters for the data collection. The measurement consisted of two parts: a questionnaire survey and a diary tracking component. The questionnaire included self-reported psychological adjustment indicators such as loneliness, depression, social anxiety, and self-esteem, which were completed the day before the diary tracking began. The diary component recorded the use of emotion regulation strategies and the degree of emotion regulation success following negative emotions arising from interactions with others (e.g., classmates, friends, teachers), as well as daily levels of anxiety and depression. Students were required to record these entries daily for the following 10 school days. To improve assessment accuracy, participants were first asked to briefly describe the event during the diary assessment and were informed that they did not need to consider the intensity or duration of the negative emotions. Diaries were distributed during the final break or after-school care period from Monday to Friday and were collected immediately upon completion. Any entries that were backfilled or submitted the following day were treated as invalid. Class teachers assisted in maintaining discipline during the sessions to ensure the smooth progress of the testing. This study was reviewed and approved by the University Ethics Committee.

After excluding participants who completed fewer than 4 days of entries or those whose emotion regulation strategy responses showed patterned/regularity bias, a final sample of 201 valid participants was collected. The average age was 11.85 years ($SD = 0.88$; range: 10–14). The sample consisted of 108 boys (53.7%) and 93 girls (46.3%); 29 fifth graders (14.5%), 79 sixth graders (39.5%), and 93 seventh graders (46.0%); 86 only children (42.9%) and 115 children with

siblings (57.1%). A total of 1,768 daily diary data points were collected, with participants completing an average of 8.80 days ($SD = 1.39$; range: 4–10). All 201 participants completed the questionnaire survey. Little' s MCAR test indicated that the data missingness pattern was missing completely at random ($\chi^2 = 12.83, df = 8, p = 0.118$) [**?**]. There were no significant differences between missing and non-missing samples across individual-level variables such as loneliness ($\chi^2(3) = 3.12, p = 0.373$), gender ($\chi^2(1) = 1.50, p = 0.221$), or sibling status ($\chi^2(1) = 1.98, p = 0.159$). However, differences existed across grades ($\chi^2(2) = 40.04, p < 0.001$).

The number of missing participants in the fifth grade ($n = 14$) was higher than in the sixth grade ($n = 4$) and seventh grade ($n = 6$).

Following informed consent from school leadership, class teachers, parents, and students, psychological assessments were conducted. A total of 215 students completed the questionnaire. Little' s MCAR test indicated that the data missingness pattern was missing completely at random ($\chi^2 = 60.73, df = 48, p = 0.103$). There were no significant differences between missing and non-missing samples across individual-level variables such as loneliness ($\chi^2(3) = 7.11, p = 0.069$), grade ($\chi^2(2) = 5.95, p = 0.051$), or sibling status ($\chi^2(1) = 0.00, p = 0.998$). However, a significant difference was found in gender ($\chi^2(1) = 8.99, p = 0.003$), where the number of missing male participants ($n = 13$) was higher than that of female participants ($n = 1$).

2.2.1 日记取样评估内容

Use and Success of Emotion Regulation Strategies

The diary sampling content included the participant' s name, student ID, grade, and class. Participants provided a brief record of negative events involving others (e.g., classmates, friends, teachers). They then evaluated the extent to which they used various emotion regulation strategies on a scale ranging from 1 (not used at all) to 7 (used all the time). The emotion regulation strategies included: distraction (doing or thinking about other things to divert attention); rumination (constantly or uncontrollably thinking about the event or being immersed in one' s emotions); cognitive reappraisal (thinking about or interpreting the current event from different perspectives); acceptance (accepting the event or one' s feelings); expressive suppression (inhibiting the expression of one' s emotions); emotional expression (expressing emotions through facial expressions, such as frowning or crying); social sharing (sharing emotions with others); problem-solving (trying to find ways to solve the current problem or formulating a solution); relaxation (trying to slow down heart rate and breathing); and masking (hiding true emotions, such as pretending to be happy).

The selection of these emotion regulation strategies was based on the widely accepted process model of emotion regulation (Gross, 1998, 2015). Strategies such as problem-solving, distraction, and rumination involve the redirection of atten-

tion toward or away from stimuli. Cognitive reappraisal, expressive suppression, masking, emotional expression, and social sharing tend to directly alter the emotional experience or its outward manifestation. Furthermore, emotion regulation involves not only distraction and social sharing; the regulation of physiological arousal is equally important. Relaxation is a strategy used to control autonomous emotional arousal (De France & Hollenstein, 2017; Liao et al., 2023). According to the functions and goals of emotion regulation strategies (Koole, 2009), acceptance serves as an important engagement strategy. Along with problem-solving, social sharing, and cognitive reappraisal, it is distinguished from disengagement strategies such as expressive suppression, rumination, distraction, and masking (Tng & Yang, 2024). Therefore, acceptance was included as one of the strategies in this experience sampling study of adolescent emotion regulation (De France & Hollenstein, 2022; Liao et al., 2023; McKone et al., 2024). Consistent with previous research (Grommisch et al., 2020), each strategy was assessed using a single item to reduce participant fatigue and improve compliance. Finally, participants provided an overall assessment of the success of the aforementioned strategies on a scale from 1 (not successful at all) to 7 (very successful) (De France & Hollenstein, 2022).

Daily depressive symptoms were assessed using the depression subscale of the short-form Depression Anxiety and Stress Scale (DASS-21), originally developed by Lovibond and Lovibond (1995) and adapted into Chinese (Gong et al., 2010). The original subscale consists of seven items, from which three were selected for this study: "I couldn't seem to experience any positive feeling at all,""I felt downhearted and blue," and "I felt I was pretty much worthless." Items were scored on a four-point scale (0 = did not apply to me at all, 3 = applied to me very much or most of the time). Higher scores indicate more severe daily depression. In the current study, the reliability coefficients were $\alpha = 0.85$ and $\omega = 0.86$. Daily anxiety was assessed using the Chinese version of the Generalized Anxiety Disorder Scale (GAD-7) to measure participants' daily anxious mood (Gong et al., 2010). Three items were selected from the original scale: "Feeling nervous, anxious, or on edge," "Being so restless that it is hard to sit still," and "Becoming easily annoyed or irritable." These were also scored on a four-point scale (0 = not at all, 3 = nearly every day). Higher scores indicate more severe daily anxiety. In this study, the reliability coefficients were $\alpha = 0.88$ and $\omega = 0.89$.

2.2.2 调查问卷

Methodology

Loneliness

Loneliness was assessed using the Illinois Loneliness Questionnaire developed by Asher (1984). The questionnaire includes items such as "I feel lonely." Participants responded using a Likert scale. After reverse-scoring the appropriate items, the mean score of all items was calculated, with higher scores indicating stronger feelings of loneliness. This questionnaire has demonstrated good relia-

bility and validity in assessing loneliness among Chinese children and adolescents (2015). In the present study, the Cronbach' s α coefficient was [VALUE].

Depression

Depression was assessed using the Children' s Depression Inventory (CDI), originally developed by Kovacs (1985) and revised by (2005). The scale includes items such as "My situation is terrible and will not get better," covering symptoms such as sleep disturbances, suicidal ideation, and self-deprecation. Items are rated on a 1–3 scale. After reverse-scoring, the mean score was calculated, where higher values indicate more severe depressive symptoms. This scale has shown good reliability and validity within the Chinese cultural context (Han et al., 2023). In this study, the Cronbach' s α coefficients were [VALUE].

Social Anxiety

Social anxiety was evaluated using the revised Social Anxiety Scale for Children (SASC-R; Liu et al., 2015). The scale includes items such as "I feel nervous when I talk to children I don' t know" and encompasses three dimensions: fear of negative evaluation, social avoidance and distress in new situations, and general social avoidance and distress. Participants were asked to report their feelings when interacting with others. Higher mean scores indicate higher levels of social anxiety. In the present study, the Cronbach' s α coefficients were [VALUE].

Self-Esteem

Self-esteem was assessed using the Global Self-Worth subscale of the Self-Perception Profile for Children (SPPC), translated and revised by (2005). The scale includes items such as "I feel that I am a good person overall." Participants responded using a Likert scale ranging from "completely inconsistent" to "completely consistent." The total mean score was calculated, with higher scores indicating higher levels of individual self-esteem. In this study, the Cronbach' s α coefficients were [VALUE].

Emotional Expressive Flexibility

Emotional expressive flexibility was measured using the Child and Adolescent Flexible Expressiveness (CAFE) scale developed by (2020). The scale consists of two dimensions: emotion enhancement and emotion suppression. Individuals were asked to evaluate their ability to produce a specific response in hypothetical scenarios, such as: "If I don' t really like a gift someone gives me, I can still pretend to be happy and grateful to avoid hurting their feelings."Responses were recorded on a scale from "completely inconsistent"to "completely consistent."This scale has demonstrated good reliability and validity among Chinese children and adolescents (Wang et al., 2023). In the present study, the Cronbach' s α was [VALUE].

Emotion Regulation Difficulties

Emotion regulation difficulties were assessed using the Brief Version of the Difficulties in Emotion Regulation Scale (DERS-16; Bjureberg et al., 2016). The scale includes items such as "I become out of control" and covers five dimensions: lack of emotional clarity, difficulties engaging in goal-directed behavior, impulse control difficulties, limited access to effective emotion regulation strategies, and non-acceptance of emotional responses. The total mean score was calculated, with higher values representing more severe difficulties in emotion regulation. This scale has shown good reliability and validity in adolescent populations (2019). In the present study, the Cronbach' s α was [VALUE].

2.3 分析思路

To explore the patterns of daily emotion regulation strategy combinations in early adolescents, data processing was conducted while simultaneously analyzing the intra-individual heterogeneity of these strategies. The analysis first identified latent classes of daily emotion regulation strategy use at the intra-individual level, based on the application of various strategies by early adolescents in negative social situations. Subsequently, using these intra-individual latent classes as a foundation, the study analyzed whether heterogeneity exists in the daily transitions of these strategy classes at the inter-individual level.

First, latent classes of daily emotion regulation strategy use were determined at the intra-individual level. Since the types and number of latent profiles were not known a priori, and precise profile characteristics and quantities cannot be obtained directly through a single model, this study followed previous research by using Mixture Latent Profile Analysis (MLPA) to incrementally increase the number of profiles. The optimal latent profile model was determined by cross-comparing model fit indices, class proportions, and theoretical interpretability (Mäkikangas et al., 2018; Nylund et al., 2007). The model fit indices used in this study include Log-Likelihood (LL), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Sample-Adjusted BIC (aBIC), the Lo-Mendell-Rubin adjusted likelihood ratio test (LMR-LRT), the Bootstrap Likelihood Ratio Test (BLRT), and Entropy. Lower values for AIC, BIC, and aBIC indicate better model fit. For LMR-LRT and BLRT, a p-value of less than 0.05 indicates that the k-class model is superior to the $k-1$ class model.

Entropy represents classification accuracy; higher values indicate better model classification, generally requiring a value greater than 0.80. The minimum class proportion was set at 5%, as classes smaller than this suggest limited classification significance (Wang et al., 2023). In addition to statistical indices, parsimony, theoretical rationality, and interpretability were key considerations when determining the intra-individual emotion regulation strategy patterns (Rindskopf, 2003). After obtaining the optimal latent profile model at the intra-individual level, the number of profiles was similarly increased incrementally at the inter-individual level. Following established practices for determining opti-

mal model fit, lower values for AIC, BIC, and aBIC indicate better classification (Mäkikangas et al., 2018). Consistent with the intra-individual level, excessively small class proportions were considered to lack classification significance.

To examine the relationship between multi-dimensional emotion regulation strategy combinations and short-term psychological adjustment at the intra-individual level, the latent classes were treated as dependent variables, while depression, anxiety, and emotion regulation success served as independent variables. A multinomial logistic regression model was used to compare the performance of intra-individual classes across levels of emotion regulation success, daily anxiety, and daily depression. Structural Equation Modeling (SEM) was employed to compare inter-individual differences in psychological adjustment. Strategy combinations were converted into dummy variables, with one category serving as the reference group. After controlling for demographic variables, the relative differences of other categories in psychological adjustment were investigated.

Regarding the interpretation of path effect sizes, this study followed the criteria proposed by Wen et al. (2024), where standardized path coefficients of 0.12, 0.24, and 0.41 correspond to small, medium, and large effect sizes, respectively.

All analyses in this study utilized Full Information Maximum Likelihood (FIML) to handle missing data, and parameter estimation was completed using Robust Maximum Likelihood (MLR).

Following previous research (e.g., Arbel et al., 2023), the parameters were set such that the means for each category were allowed to vary freely.

To ensure better model identification, the minimum number of initial stage starts was set to 500, and the final stage starts were set to 100.

Variances were set to be equal across classes, and covariances were set to zero. Both the latent profile models and structural equation models were analyzed using Mplus 8.3 (Muthén & Muthén, 2017). Data preparation and descriptive statistical analyses were performed using SPSS 24.0.

3.1.1 描述性统计分析

Preliminary analysis indicated regional differences in the usage of certain emotion regulation strategies. Specifically, the usage levels of cognitive reappraisal ($M = 3.25, SD = 2.06$) and distraction ($M = 3.14, SD = 2.11$) in the Shanghai sample were significantly higher than those in the Henan sample [cognitive reappraisal: $M = 2.97, SD = 1.74, t(3267) = 3.96, p < 0.001$; distraction: $M = 2.83, SD = 1.77, t(3273) = 4.43, p < 0.001$; and expressive suppression: $M = 2.79, SD = 1.90, t(3274) = 5.08, p < 0.001$]. Conversely, the usage of the acceptance strategy ($M = 2.81, SD = 2.02$) was significantly lower in Shanghai than in Henan [$M = 3.15, SD = 2.01, t(3263) = 4.84, p < 0.001$]. Regarding the latent profile structure, except for the "High Adaptive Multi-strategy Regulation"group, which had a slightly higher proportion in Shanghai (8.0%) compared

to Henan (3.7%) [$\chi^2(3) = 29.42, p < 0.001$], no significant regional differences were found in other profile structures. Furthermore, regional differences in the profile structure of multi-strategy emotion regulation at the between-person level were also non-significant. Consequently, the data from both regions were merged for subsequent analysis.

Descriptive statistics for daily emotion regulation strategy use, depression, and anxiety are presented in . The results show that the intraclass correlation coefficients (ICCs) for emotion regulation strategies ranged from 0.51 to 0.60, while the ICCs for emotion regulation success, daily depression, and daily anxiety were all below 0.59. This indicates that more than 40% of the variance in all variables can be explained by within-person fluctuations. The overall usage of emotion regulation strategies was at a low-to-moderate level. Problem-solving, social sharing, and acceptance were the three most frequently used strategies, while rumination was used the least. Each strategy followed a basically normal distribution, whereas daily depression and daily anxiety showed slight skewness. Correlation analysis revealed significant positive correlations between the usage levels of different emotion regulation strategies ($r = 0.30$ to $0.78, p < 0.001$), with an average correlation coefficient of 0.52. This suggests that the maximum accuracy for predicting the usage of one strategy based on another is approximately 37% ($R^2 = 0.608$). Furthermore, all strategies were significantly correlated with emotion regulation success ($r = 0.06$ to $0.24, p < 0.01$), daily depression ($r = 0.09$ to $0.32, p < 0.001$), and daily anxiety ($r = 0.10$ to $0.33, p < 0.001$).

Emotion regulation success was significantly and negatively correlated with daily depression ($r = -0.10, p < 0.001$) and daily anxiety ($r = -0.12, p < 0.001$).

When the model was specified with non-zero covariances within profiles and equal covariances across different profiles, the model fit indices and the identified latent profile types were largely consistent with the more parsimonious model setting (where covariances were fixed to zero). When the variances for each profile were set to be freely estimated, all models failed to converge.

6 情绪表达

Emotion regulation success; daily depression. N represents sample size; SD represents standard deviation; ICC represents the intraclass correlation coefficient. $**p < 0.01$, $***p < 0.001$.

Model containing only the within-person level: $p < 0.001$. Fixed number of within-person profiles; fixed number of between-person profiles.

Emotion regulation success: $p < 0.001$. Pairwise comparisons for emotion regulation success: C5 vs. C3; C5 vs. C4. Latent classes for emotion regulation success are defined as follows: C1 = [Group Name Missing/Incomplete], C2 = Low-level Multimodal Regulation Group, C3 = Moderate-level Multimodal Regulation Group, C4 = High-adaptive Strategy Multimodal Regulation Group, and C5 = High-level Multimodal Regulation Group. The table presents only

one set of results for the pairwise category references; since referencing groups against each other only results in differences in the sign (positive/negative) of the coefficients, the full reciprocal results are omitted for brevity.

3.1.2 个体内层面

Multilevel Latent Profile Analysis (MLPA) of emotion regulation was conducted by establishing a series of nested models with an increasing number of profiles. At the within-person level, the latent profile models for emotion regulation were determined. As the number of profiles increased, the AIC decreased and the BLRT values remained consistently significant.

The Entropy values were also examined; as the number of profiles reached 4, the ΔAIC no longer decreases sharply, while the Entropy fit index continues to decline.

5 和模型

The overall fit index for Entropy is superior to other models; however, a minimum class proportion of less than 5% suggests a risk of over-classification. Although theoretically sound, the small proportion indicates potential model divergence [**?**, **?**]. Therefore, the stability and interpretability of the model serve as the primary criteria for determination.

Differences were observed only in the degree of emotion regulation strategy use; no specific preference for emotion regulation strategies was found among early adolescents. This finding is consistent with previous research.

结论

The latent profile analysis (LPA) results demonstrate high interpretability, with average posterior probabilities ranging from 0.89 to 0.97 (Brandão, 2025), indicating that the model effectively distinguishes between different patterns. The five identified profiles are as follows: Profile 1 (C1; 31.7%, $N = 1043$), characterized by minimal use of all strategies, labeled as the "Inactive Group" ; Profile 2 (C2; 27.1%, $N = 891$), characterized by low-to-moderate use across all strategies, labeled as the "Low-Level Polyregulation Group" ; Profile 3 (C3; 26.7%, $N = 949$), characterized by moderate use across all strategies, labeled as the "Moderate-Level Polyregulation Group" ; Profile 4 (C4; 6.3%, $N = 206$), characterized by high use of cognitive reappraisal, acceptance, social sharing, and problem-solving, alongside low use of distraction, rumination, and suppression, labeled as the "Adaptive Polyregulation Group" ; and Profile 5 (C5; 8.3%, $N = 274$), characterized by high use across all strategies, labeled as the "High-Level Polyregulation Group."

The distribution of the sample across the profiles is as follows: C1 (31.7%), C2 (27.1%), C3 (26.7%), C4 (6.3%), and C5 (8.3%). The line graph illustrating the

mean levels of emotion regulation strategy use for each profile further clarifies these patterns: C1 represents the Inactive Group, C2 the Low-Level Polyregulation Group, C3 the Moderate-Level Polyregulation Group, C4 the Adaptive Polyregulation Group, and C5 the High-Level Polyregulation Group.

To examine the intra-individual differences in emotion regulation success, daily depression, and daily anxiety across these strategy combinations, a series of multiclass logistic regression models were constructed. In these models, emotion regulation success, daily depression, and daily anxiety served as independent variables (centered at the group mean), while the profile category served as the dependent variable. [TABLE:N] presents the results of these analyses using the Inactive Group, Low-Level Polyregulation Group, Moderate-Level Polyregulation Group, and Adaptive Polyregulation Group as reference groups, respectively. A positive coefficient indicates that higher levels of the independent variable increase the probability of belonging to a specific pattern relative to the reference group, with larger absolute values indicating a stronger effect. Conversely, a negative coefficient indicates a lower probability of membership.

The Odds Ratio (OR) similarly reflects the impact of the independent variables on the probability of profile membership, where higher values indicate a greater likelihood of belonging to a group. The results indicate that the coefficients for emotion regulation success were not significant, suggesting no significant differences in regulation success between any pair of the five strategy combinations. However, compared to the Inactive Group, individuals with higher levels of daily depression and anxiety were more likely to belong to the Low-Level, Moderate-Level, or High-Level Polyregulation Groups. Furthermore, compared to the Low-Level and Moderate-Level Polyregulation Groups, individuals with higher daily depression scores were significantly less likely to be classified into the Adaptive Polyregulation Group.

3.2.1 个体间

Multilevel Latent Profile Analysis (MLPA) of emotion regulation was employed to identify profile types of emotion regulation usage patterns at the inter-individual level, building upon intra-individual observations. These inter-individual profile types reflect the flexible shifts in an individual' s emotion regulation patterns over time. If an individual utilizes a diverse range of strategies, it indicates a high degree of flexibility; conversely, if an individual tends to rely on a single strategy across varying stressful contexts, it suggests a lack of regulatory flexibility.

As the number of profiles increased, the AIC decreased and Entropy continued to rise. Although model indices continued to improve when the number of profiles reached a certain point, the proportion of the smallest profile fell below the acceptable threshold, suggesting a potential risk of over-classification errors compared to other models.

The profile model demonstrated robust performance. Group robustness analysis

indicated that when the number of inter-individual profiles was fixed, increasing the number of intra-individual profiles led to a risk of over-classification, as the smallest subgroup proportion fell below the required threshold. Consequently, the current model was determined to be optimal. Furthermore, analysis of variance (ANOVA) results revealed significant group differences in emotional expression flexibility ($F(3, 324) = 10.88, p < 0.001, \eta^2 = 0.092$). Bonferroni post-hoc tests showed that the emotional expression flexibility of the "mixed preference group" was significantly higher than that of both the "moderate-level polyregulation preference group" and the "inactive preference group." No significant group differences were found regarding emotion regulation difficulties.

The distribution of emotion regulation strategy combination patterns at the inter-individual level is shown in [FIGURE:12]. Profile 1 (P1), labeled as the "inactive preference group" (predominantly no ER profile), accounted for 33.8% of the sample; within this group' s intra-individual strategy combinations, 79.8% were characterized by inactive regulation and 12.5% by low-level polyregulation. Profile 2 (P2), the "low-level polyregulation preference group," comprised 30.4% of the sample, with 74.9% of its intra-individual combinations consisting of low-level polyregulation and 12.6% consisting of moderate-level polyregulation. Profile 3 (P3), the "moderate-level polyregulation preference group," represented 23.0% ($N = 81$) of the sample; at the intra-individual level, 83.9% of its strategy combinations were moderate-level polyregulation and 9.4% were low-level polyregulation. Finally, Profile 4 (P4), the "mixed polyregulation preference group"(diversity of polyregulation profiles), accounted for 12.8% ($N = 45$) of the sample; its intra-individual strategy combinations were distributed among high-level polyregulation (55.0%), high-adaptive strategy polyregulation (28.7%), and moderate-level polyregulation (10.4%).

1 T1

2.11$±0.662.15±0.732.10±0.741.97±$0.76

2 T1

1.46$±0.311.49±0.351.46±0.341.53±$0.46

3 T1

2.32$±0.822.58±0.782.64±0.812.54±$1.07

4 T1

3.31$±0.823.29±0.853.36±0.803.61±$0.94

5 T2

2.08$±0.742.13±0.682.15±0.721.90±$0.63

6 T2

1.48$±0.371.49±0.391.50±0.371.56±$0.50

7 T2

2.23$±0.912.59±0.922.63±0.852.53±$0.99

8 T2

3.40$±0.963.41±0.923.44±0.753.87±$1.05

9 T1ERF

6.28$±1.606.23±1.266.73±1.557.62±$1.45

10 T1ERD

2.16$±0.792.25±0.782.33±0.822.36±$1.05 53/54 40/41 68/51 28/17

12 地域

46/61, 40/41, 51/68, 14/31; 11.95 ± 0.90, 12.17 ± 0.84, 12.22 ± 0.88, 11.76 ± 8.86. The reference group for gender is male (values before and after the slash represent males and females, respectively). The reference group for region is Shanghai (values before and after the slash represent Shanghai and other regions, respectively). Values following the plus-minus sign indicate the mean and standard deviation. ERF = Emotional Expressive Flexibility; ERD = Difficulties in Emotion Regulation. P1 = Inactive Preference Group; P2 = Low-level Multimodal Regulation Preference Group; P3 = Moderate-level Multimodal Regulation Preference Group; P4 = Mixed Multimodal Regulation Preference Group. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

P2 vs. P1 [0.080, 0.115], [0.087, 0.080], [0.067, 0.129], [0.021, 0.201]; P3 vs. P1 [0.073, 0.137], [0.068, 0.099], [0.075, 0.123], [0.022, 0.199]; P4 vs. P1 [0.157, 0.018], [0.028, 0.125], [0.015, 0.221], [0.012, 0.166]; P1 vs. P2 [0.118, 0.082], [0.083, 0.090], [0.133, 0.069], [0.207, 0.021]; P3 vs. P2 [0.075, 0.107], [0.058, 0.095], [0.093, 0.084], [0.079, 0.097]; P4 vs. P2 [0.004], [0.021, 0.124], [0.003, 0.194], [0.092, 0.084]; P1 vs. P3 [0.154, 0.082], [0.111, 0.076], [0.138, 0.084], [0.223, 0.025]; P2 vs. P3 [0.117, 0.081], [0.104, 0.063], [0.092, 0.102], [0.106, 0.086]; P4 vs. P3 [0.184, 0.006], [0.038, 0.111], [0.006, 0.203], [0.078]; P1 vs. P4 [0.025, 0.222], [0.178, 0.040], [0.312, 0.023], [0.234, 0.017]; P2 vs. P4 [0.007, 0.220], [0.170, 0.030], [0.267, 0.004], [0.116, 0.127]; P3 vs. P4 [0.009, 0.231], [0.140, 0.048], [0.256, 0.007], [0.099,

3.2.2 个体间层面多元调节策略组合的心理适应差异

The means, standard deviations, and correlation analysis results for the variables across the different inter-individual patterns of cross-situational multi-strategy regulation are presented in [TABLE:N]. Analysis of variance (ANOVA) results indicated significant inter-group differences in age across the multi-strategy regulation patterns ($F(3, 348) = 3.94, p = 0.009, \eta_p^2 = 0.033$). Bonferroni post-hoc tests revealed that participants in the mixed multi-strategy preference group were younger than those in the low-level and moderate-level multi-strategy preference groups ($p = 0.268$ and $p = 0.357$ respectively, though the overall model was significant). Preliminary analyses showed no significant differences in multi-strategy regulation patterns based on gender or geographic region. Given the correlations between gender, age, region, and psychological adaptation, these variables were included as control variables in the subsequent structural equation modeling (SEM).

Since changing the reference group does not alter the magnitude or significance of the standardized regression coefficients for other variables, the results presented here use the inactive preference group as the reference. [TABLE:N] displays the relative effects of inter-individual multi-strategy regulation patterns on psychological adaptation when each group serves as the reference. The structural equation model indicated that, after controlling for gender, age, and region, the mixed multi-strategy preference group reported significantly lower levels of loneliness compared to the low-level and moderate-level multi-strategy preference groups. Furthermore, the mixed multi-strategy preference group exhibited higher self-esteem compared to the inactive preference group. Conversely, the low-level and moderate-level multi-strategy preference groups reported higher social anxiety than the inactive preference group.

All significant paths mentioned above exhibited medium to large effect sizes. In the model using the inactive preference group as the reference ($P1$ = inactive preference group, $P2$ = low-level multi-strategy preference group, $P3$ = moderate-level multi-strategy preference group, $P4$ = mixed multi-strategy preference group), the results are presented concisely in [FIGURE:N]. For clarity, correlations between variables, the paths for control variables (gender, age, and region), and regression coefficients for non-significant paths are not displayed in the figure. Significance levels are denoted as follows: $*p < 0.05, * * *p < 0.001$.

讨论

This study is the first to employ a 14-day diary sampling method and a six-month follow-up with students in grades five through seven. Utilizing multilevel latent profile analysis (MLPA) and structural equation modeling (SEM), we explored the patterns of multiple emotion regulation strategy repertoires among early adolescents in social contexts and their relationship with psychological adaptation. At the within-person level, five strategy repertoires were identified: the Inactive group, the Low-level Multimodal Regulation group, the High-

adaptability Multimodal Regulation group, the Moderate-level Multimodal Regulation group, and the High-level Multimodal Regulation group. Results indicated that higher levels of daily depression and daily anxiety were associated with the High-level Multimodal Regulation group, while the High-adaptability Multimodal Regulation group showed lower levels of these symptoms. At the between-person level, four profile types were identified: the Inactive Preference group, the Low-level Multimodal Regulation Preference group, the Moderate-level Multimodal Regulation Preference group, and the Mixed Multimodal Regulation Preference group.

The Mixed Multimodal Regulation Preference group exhibited higher levels of social anxiety. This study breaks through traditional static perspectives by examining the dynamic processes of multiple emotion regulation in early adolescents, providing insights into psychological adaptation issues and potential interventions.

This study found that when facing negative emotions triggered by social interactions, early adolescents used adaptive strategies (such as problem-solving, social sharing, and acceptance) more frequently, while non-adaptive strategies (such as masking and rumination) were used less often. The probability of strategy reuse was 10%, which is significantly higher than the 1% observed in adults [**?**, **?**], suggesting that while early adolescents possess specific strategy repertoire preferences, their heterogeneity may not be as pronounced as that of adults. Previous research indicates that as the prefrontal cortex matures, the diversity and flexibility of emotion regulation strategies in early adolescents increase [**?**, **?**, **?**, **?**], leading to the gradual formation of specific usage preferences. However, compared to adults, the combination of intense social changes and immature cognitive development may limit the use and control of strategies in early adolescents [**?**, **?**]. Successful emotion regulation is a complex dynamic process involving multiple pathways—including situation selection, situation modification, attentional deployment, cognitive change, and response modulation—and the coordination of identification, selection, and implementation [**?**, **?**]. Incomplete development of regulation abilities may result in lower heterogeneity of strategy repertoires in early adolescents compared to adults [**?**, **?**]. Our results show that all regulation strategies were positively correlated with emotion regulation success, daily depression, and daily anxiety. This suggests that high-intensity strategy use in early adolescents facilitates successful regulation but also implies that such efforts require greater cognitive resources [**?**, **?**], which is associated with psychological adaptation issues [**?**, **?**]. The analysis further revealed that at the within-person level, the specific strategy preferences of early adolescents are consistent with findings from previous studies on adult populations.

结论

Grommisch et al. (2020) identified a "High-Level Poly-Regulation" group characterized by the intensive combined use of multiple strategies, where each strategy

within the repertoire is employed with comparable frequency. In contrast, the "High-Adaptive Poly-Regulation" group tends to favor adaptive strategies such as cognitive reappraisal, acceptance, social sharing, and problem-solving, while less frequently utilizing strategies like distraction, rumination, or expressive suppression.

At the inter-individual level, research by Grommisch et al. (2020) indicates that early adolescents typically employ one or more strategies with consistent frequency. Some individuals exhibit a "Moderate Poly-Regulation Preference," characterized by a tendency to favor a specific set of strategies across different contexts. Others belong to a "Mixed Poly-Regulation Preference" group, or a "High-Adaptive Poly-Regulation" group, which demonstrates greater flexibility in switching strategies based on situational demands. These findings support the poly-regulation perspective, suggesting that the simultaneous use of multiple strategies is not an anomaly but rather a standard regulatory pattern in emotion management [**?**, **?**, **?**].

At the intra-individual level, nearly one-third (31.7%) of the observed strategy combinations are classified into an "Inactive Group," where regulatory activity is minimal [**?**, **?**, **?**].

结果

This may be related to insufficient emotional regulation capabilities. When facing negative social interactions, early adolescents often lack adequate experience, making it difficult for them to implement effective coping strategies immediately [**?**, **?**]. Although the frequency of social conflict gradually increases during this period, the intensity and duration of these conflicts do not necessarily rise; intense, persistent conflicts remain relatively rare [**?**, **?**]. This context influences their active regulation motivations and goals.

Research has found that early adolescents often use combinations of non-adaptive strategies—such as expressive suppression and rumination—alongside adaptive strategies. This phenomenon may be related to the specific contexts being studied. Previous research has primarily focused on internal states such as worry and anxiety [**?**, **?**, **?**]. While using non-adaptive strategies like expressive suppression cannot fundamentally diminish internal conflict, they often persist as specific strategy preferences [**?**, **?**]. In contrast, within social interaction contexts oriented toward interpersonal communication, using suppression or rumination to process negative emotions can be as effective as sharing or problem-solving. These strategies play a positive role in preventing the escalation of interpersonal conflict, reflecting on social behavior, and promoting the enhancement of social competence [**?**]. Although the regulatory effects of adaptive strategies are generally superior to those of non-adaptive ones, the latter are also positively correlated with the degree of emotional regulation success. A recent review also noted that, compared to adolescents, certain populations show a stronger preference for non-adaptive strategies.

Combinations of these strategies are frequently observed in adults, college students, and clinical populations, such as patients with epilepsy [**?**, **?**]. These findings highlight the complex relationship between intra-individual multi-strategy regulatory combinations and psychological adaptation.

分析

Daily anxiety and depression are associated with preferences for using low, medium, or high levels of diverse emotion regulation strategy combinations. High-adaptive strategy use is linked to the emotional dynamics of anxiety and depressive states, particularly regarding abnormal patterns in emotional dynamics.

Emotion dynamics reflect the complexity of the emotional system, where increased negative emotional reactivity following negative events is a key indicator (Hartmann, 2024). In response to negative social interactions, individuals may employ a higher level and a greater number of strategies (Rottweiler et al., 2023). Specifically, when negative affect is high, the degree of strategy use may increase (Aldao & Nolen-Hoeksema, 2013). However, multivariate emotion regulation does not always yield linear benefits (Ford et al., 2019). When strategies support one another, they tend to form synergistic effects; conversely, incompatible strategies may lead to internal conflict within a multivariate regulation set (Grommisch et al., 2020). For instance, combinations focusing on cognitive reappraisal, acceptance, and social sharing emphasize situational focus, whereas high-level multivariate groups involving cognitive reappraisal, rumination, expressive suppression, and masking may trigger conflict due to incompatibility (Grommisch et al., 2020). These findings suggest that the quantity and specific combination of strategies in multivariate emotion regulation are fundamentally different. While some research suggests that a greater number of strategies leads to better regulation (Baldwin et al., 2025; Ford et al., 2019), the effectiveness depends on the regulation goals (Ford et al., 2019). Hartmann (2024) found that strategy combinations involving situational modification and interpersonal regulation help achieve positive outcomes by reducing the required intensity of regulation. In contexts requiring up-regulation (enhancing emotional intensity) or maintenance, combinations of emotional acceptance and interpersonal regulation prove more effective.

When facing negative social interaction scenarios, adolescents primarily engage in down-regulation rather than up-regulation (2014). Consequently, multivariate regulation dominated by high-adaptability strategies—such as cognitive reappraisal, acceptance, social sharing, and problem-solving—is prevalent. This study found that while strategy combinations dominated by adaptive strategies are effective, there may be a procedural dissociation between the immediate effectiveness of emotion regulation and long-term adaptability.

According to the broader framework of emotion regulation success proposed by Springstein and English (2023), emotion regulation success is a core component

in understanding emotional maladjustment or dysregulation. Success is defined by the realization of an individual' s emotion regulation goals or the satisfaction of regulatory motives. However, even if an individual achieves their immediate regulation goals, the process may be maladaptive if the goals themselves are detrimental to long-term functioning.

To manage negative emotional experiences and maintain a positive self-image, individuals may employ multivariate emotion regulation involving expressive suppression, masking, reappraisal, acceptance, or distraction. Different strategy combinations can all facilitate the achievement of regulatory goals, but their effectiveness is contingent upon the context, such as a classroom environment that encourages sincerity and cooperation (Ford et al., 2019). For early adolescents, although various strategy combinations may yield immediate regulatory effects, those who prefer combinations dominated by adaptive strategies likely exhibit better overall psychological adjustment.

A greater number of strategies does not necessarily result in higher immediate regulatory effectiveness. While strategies like cognitive reappraisal and problem-solving are important (Ford et al., 2019), the sequence of strategy use is also critical. When facing significant stress, it may be more useful to first employ a short-term strategy that provides rapid emotional relief before switching to a more effective long-term strategy (Sheppes et al., 2014). Results from inter-individual level analyses further support this nuanced view.

Early adolescents who utilize a diverse combination of strategies report lower levels of loneliness and higher self-esteem. This result is consistent with research on multivariate emotion regulation in adults (Grommisch et al., 2020). Robustness analysis of scores revealed that, compared to the other three groups, the mixed multivariate regulation preference group exhibited higher emotional expression flexibility. Greater flexibility in emotional expression implies a richer repertoire of strategies (Chen et al., 2024). The flexible use of multivariate emotion regulation strategy combinations across different contexts in early adolescence may be related to an individual' s flexible strategy-switching ability.

This finding not only validates the psychological adaptation of cross-contextual multivariate emotion regulation in early adolescents but also enriches the explanation of the dynamic functionality of emotion regulation flexibility. This study found that, compared to the inactive preference group, combinations of low-level multivariate regulation strategies may be associated with higher levels of social anxiety. Socially anxious individuals often exhibit excessive fear of negative evaluation in social situations and increased reactivity to varying degrees of negative emotional experiences (Dryman & Heimberg, 2018). These characteristics may lead socially anxious individuals to rely on masking and avoidance, resulting in less emotional regulation flexibility during daily events of varying emotional intensity (Yang, 2024). While this study examined the flexible use of multiple strategy combinations versus a preference for a single combination, it did not identify a specific non-adaptive strategy combination in early adolescents. However, existing research suggests that depressive symp-

toms may be linked to a preference for non-adaptive combinations (Grommisch et al., 2020), characterized by abnormally unstable emotional dynamics (2024) and a preference for expressive suppression and rumination (Rottenberg, 2017). Regarding specific strategy combinations, Aldao (2015) noted that flexibility in emotion regulation does not inherently promote adaptation; flexibility is only adaptive when it aligns with an individual' s long-term goals.

结果

The combination of regulatory strategies changes flexibly during psychological adaptation. When facing negative emotions triggered by daily social interactions, specific multivariate regulatory strategy combinations emerge. These patterns gradually manifest as unique preferences for strategy combinations as interaction contexts change. The innovation of this study lies in revealing that multivariate emotion regulation in early adolescents does not have a uniform effect across all adaptation indicators; rather, it presents a differentiated functional pattern dependent on context, time scale, and specific demands. Using multiple strategies does not inherently provide an immediate regulatory advantage. Instead, its developmental significance is more likely reflected in the quality of the strategy combinations and their degree of matching with situational demands. This breaks through the traditional static perspective on multivariate emotion regulation strategy usage patterns. Emotion regulation flexibility is not merely the coordinated change of a single strategy with the environment; from a dynamic perspective, the matching of strategy combinations to contexts is also a critical issue in the field of emotion regulation flexibility.

These findings provide insights for the cultivation and intervention of emotion regulation abilities, supporting the implementation of the Healthy China and Education Powerhouse strategies. Regulatory flexibility is a source of strength for individuals to resist trauma [**?**, **?**]. This study found that adolescents in the mixed multivariate regulation preference group demonstrated excellent ability to adapt and switch multivariate regulation strategies across time and contexts. Their core characteristic is not the rigid use of a specific strategy combination, but rather the ability to flexibly invoke different strategy combinations according to environmental demands. This discovery suggests that future emotion regulation training should focus on guiding adolescents to prioritize and integrate more functional strategy combinations in specific social interaction contexts. For instance, contextualized strategy combination training programs could be designed for common scenarios such as campus interpersonal conflicts or academic pressure, guiding adolescents to master context-appropriate emotion regulation skills.

Regarding mental health monitoring, the prevalence of multivariate emotion regulation in adolescents and its correlation with psychological adaptation problems suggest that single emotion regulation strategies or strategy frequency may be insufficient to fully reflect adolescent mental health status. Incorporating types of emotion regulation strategy combinations and the degree of strategy-context

Figure 1

Figure 1: Figure 1

fit into monitoring indicator systems will optimize psychological crisis prevention.

Distinguishing between immediate emotional responses and long-term adaptation can enhance the effectiveness and longevity of psychological adaptation interventions and reduce the recurrence of psychological crises. Mental health is an integral component of national health, and emotion regulation ability is a core competency for adolescents. Future mental health work should aim to improve the multivariate emotion regulation abilities of children and adolescents from a holistic, systematic, and dynamic perspective, strengthening psychological quality to serve the Healthy China and Education Powerhouse strategies. This study has several limitations. First, although this study observed the use of multivariate emotion regulation strategies across different contexts over time, it did not explore the interaction between strategy combinations and situational characteristic factors. [**?**] argued that multivariate emotion regulation has no fixed form; its adaptive function depends on whether multivariate regulation is sensitive to the context and the degree of conflict or synergy between multiple strategies. Consistent with the integrated framework model of emotion regulation flexibility recently proposed by \cite

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Figures

Source: ChinaXiv —Machine translation. Verify with original.