Differential Effects of Trajectories of Parental Educational Involvement on Primary School Students' Learning Engagement and Academic Achievement under the Background of the "Double Reduction" Policy

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Abstract

To examine the dynamic changes in the sub-dimensions of parental educational involvement before and after the implementation of the "Double Reduction" policy and their effects on primary school students' learning engagement and academic achievement, this study recruited 323 primary school students (mean age = 11.02 ± 0.83 years, 49% boys) as participants. Parental educational involvement was assessed three times: before the "Double Reduction" policy (T1), one and a half years after its implementation (T2), and two years after its implementation (T3). Learning engagement was measured at T1 and T3, and academic achievement was collected at T3, on the basis of which a latent growth model was constructed. The results showed that: (1) the trajectories of parental emotional involvement, parental intellectual involvement, and parental behavioral involvement all presented a linearly decreasing trend; (2) after controlling for demographic variables, with respect to learning engagement, the initial levels and rates of change of parental emotional involvement and parental behavioral involvement exerted cumulative effects on students' learning engagement; with respect to academic achievement, only the rate of change in parental emotional involvement significantly predicted academic achievement, whereas both the initial level and the rate of change of parental behavioral involvement exerted an amplifying effect on academic achievement; parental intellectual involvement had no significant effect on either learning engagement or academic achievement. This study not only contributes to a deeper understanding of the developmental trajectories of parental educational involvement under the background of the "Double Reduction" policy and its impact on learning engagement and academic achievement, but also provides empirical evidence for evaluating the

implementation effectiveness of the "Double Reduction" policy and for designing interventions targeting parental educational involvement after the policy's implementation.

Full Text

Trajectories of Parental Educational Involvement Before and After China's "Double Reduction" Policy and Their Differential Effects on Primary School Students' Learning Engagement and Academic Achievement

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Abstract

To examine the dynamic changes in multidimensional parental educational involvement before and after the "Double Reduction" policy and their effects on primary school students' learning engagement and academic achievement, this longitudinal study tracked 323 primary school students (mean age = 11.02 ± 0.83 years, 49% boys) across three time points: pre-policy (T1), 1.5 years post-implementation (T2), and 2 years post-implementation (T3). Parental involvement was measured at all three waves, learning engagement was assessed at T1 and T3, and academic achievement data were collected at T3. Latent growth modeling revealed: (1) All three dimensions of parental involvement—emotional, intellectual, and behavioral—showed linear decreasing trajectories; (2) After controlling for demographic factors, parental emotional and behavioral involvement demonstrated cumulative effects on students' learning engagement, where both initial levels and rates of change independently contributed to engagement. For academic achievement, only the rate of change in emotional involvement was significant, while behavioral involvement exhibited an amplification effect, wherein both initial levels and change rates jointly influenced achievement. Intellectual involvement showed no significant effects on either outcome. These findings advance understanding of how parental involvement dimensions evolve during policy transitions and provide empirical evidence for evaluating "Double Reduction" policy effects and designing targeted family interventions.

Keywords: parental involvement, learning engagement, academic achievement, "Double Reduction" policy, latent growth modeling

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In 2021, the Central Committee of the Communist Party of China and the State Council issued the "Opinions on Further Reducing the Homework and After-School Training Burdens for Students in Compulsory Education" (hereinafter referred to as the "Double Reduction" policy). Following its implementation, educational focus has shifted from solely emphasizing academic outcomes to also valuing learning processes. Learning engagement, as an indicator of the learning process, refers to students' active and fulfilling mental states during learning (Schaufeli et al., 2002), while academic achievement serves as a classic measure of learning outcomes (Stiggins et al., 1989). Extensive research demonstrates that learning engagement not only correlates strongly with academic performance (Chen et al., 2020) but also influences students' internalizing and externalizing problems (Olivier et al., 2020). Academic achievement predicts future academic performance (He et al., 2024) and subsequent antisocial behaviors (Lankester et al., 2024). Nevertheless, how the "Double Reduction" policy has affected Chinese primary students' learning engagement and achievement, and the underlying mechanisms, remain unknown. Identifying these influences is crucial for promoting holistic student development and evaluating policy effectiveness.

Parental educational involvement represents a critical factor in academic success (Graves & Brown, 2011). Numerous studies have documented its positive effects on learning engagement (Li et al., 2023) and academic achievement (Castro et al., 2015; Hsu et al., 2011). However, research has rarely examined dynamic changes across its subdimensions, leaving unclear how initial levels and change rates jointly affect primary students' engagement and achievement. Scholars emphasize that post- "Double Reduction," parents must strengthen emotional, intellectual, and behavioral involvement (Luo, 2023) to comprehensively support children' s learning. This longitudinal study investigates how trajectories of these three involvement dimensions before and after the policy affect engagement and achievement, providing evidence for how families with different initial involvement levels should adapt to enhance children' s outcomes.

1.1 Dynamic Changes in Parental Educational Involvement Before and After the "Double Reduction" Policy

Parental involvement refers to the degree and manner of parents' participation in children' s education, encompassing parents' educational philosophies, developmental expectations, and diverse behaviors at home and school that promote academic and psychological development. It comprises three dimensions: emotional involvement (expressing positive attitudes toward children' s learning and school experiences), intellectual involvement (providing resources that facilitate intellectual development, such as tutoring), and behavioral involvement (direct participation in children' s development, such as daily companionship and sched-

ule management) (Grolnick & Slowiaczek, 1994; Li et al., 2023).

Early cross-sectional research documented that parental involvement declines from primary through high school (Catsambis & Garland, 1997; Wei et al., 2019). Subsequent two-wave longitudinal studies confirmed this decreasing trend during primary school (Daniel, 2015; Garbacz et al., 2015). However, accurately capturing developmental trajectories requires at least three waves of longitudinal data (Pfost et al., 2014). Few studies have examined primary school parental involvement across three or more time points (Flack et al., 2023), though findings suggest involvement declines from preschool through second grade. Building on family systems theory, Epstein (2005) conceptualized parental involvement as a multidimensional, multilevel dynamic process, yet research has not sufficiently investigated subdimensional changes.

Although scholars have begun examining dynamic changes, systematic investigation of initial levels, change rates, and their interrelations remains lacking. Initial levels reflect pre-policy individual differences in parental involvement, while change rates describe increasing or decreasing trends following policy implementation (Liu et al., 2005). Their relationship reveals how individual differences evolve: a significant positive correlation indicates that disparities widen over time (Matthew effect), a negative correlation suggests disparities narrow (compensatory pattern), and non-significant correlation indicates stable differences (Cheng et al., 2023). Previous research suggests a Matthew effect where "the rich get richer" in parental involvement (Bakermans-Kranenburg et al., 2005). Under "Double Reduction," high-involvement families may maintain their levels through alternative educational resources (slower decline), while low-involvement families face a "replacement vacuum" (faster decline), potentially exacerbating inequalities (He & Guo, 2024). Meanwhile, post-policy research emphasizes the need for coordinated emotional, intellectual, and behavioral involvement (Luo, 2023). This study' s first aim is to delineate trajectories of three involvement subdimensions by examining initial levels, change rates, and their interrelations.

1.2 Longitudinal Relationships Between Parental Involvement and Primary Students' Engagement and Achievement

According to the developmental-contextual model, students' engagement and achievement result from dynamic interactions between individual and environmental factors (Wang et al., 2019). Regarding initial levels, emotional involvement can enhance learning identification and focus through encouragement (Kim & Kim, 2021), whereas intellectual involvement may negatively impact engagement through over-intervention (Pomerantz et al., 2007). Behavioral involvement' s effects on engagement remain mixed, with some studies showing positive effects (Fan & Williams, 2010) and others negative effects due to excessive control (Pomerantz et al., 2007). For achievement, emotional involvement demonstrates positive effects (Wang & Sheikh-Khalil, 2014), while intellectual involvement' s negative effects and behavioral involvement' s inconsistent results

have been documented (Castro et al., 2015; Ciping et al., 2015; Patall et al., 2008). In the post-policy context with reduced external constraints and limited self-regulation among primary students, moderate behavioral involvement may cultivate learning habits and enhance engagement and achievement (Fan & Williams, 2010).

Regarding change rates, dynamic changes across involvement dimensions may carry different meanings. Declining emotional and behavioral involvement (negative change rates) may reduce family learning resources and psychological support, hindering motivation and achievement (Jeynes, 2005; Wang & Eccles, 2012). Conversely, intellectual involvement' s decline may create space for autonomy development, potentially benefiting engagement and achievement (Grolnick & Ryan, 1989; Ryan & Deci, 2000).

Beyond independent effects of initial levels and change rates (Dearing et al., 2006; Hong et al., 2020), their dynamic interaction warrants investigation. Two competing models describe how initial levels and change rates jointly influence outcomes: the cumulative effects model (Figure 1a [Figure 1: see original paper]), where low initial levels and rapid decline additively impair outcomes without interaction (Dearing et al., 2006), and the interaction effects model. The latter includes the amplification model (Figure 1b [Figure 1: see original paper]), where low initial levels magnify the negative impact of rapid decline, and the sensitivity model (Figure 1c [Figure 1: see original paper]), where high initial levels create psychological dependency, making students more vulnerable when support declines (Zeng et al., 2022). Although direct evidence for interaction effects remains limited, research suggests parental involvement' s impact depends on initial conditions (Xu et al., 2020). This study will systematically test these three models' applicability to engagement and achievement in the "Double Reduction" context.

1.3 The Present Study

Primary school children exhibit high environmental sensitivity and plasticity. High-quality parental involvement significantly enhances their engagement (Li et al., 2023) and achievement (Englund et al., 2004), influencing later emotional, intellectual, and behavioral development (Maccoby & Martin, 1983). Most research on primary school parental involvement derives from Western contexts (Garbacz et al., 2015), leaving unclear the developmental trajectories and effects of initial levels and change rates on engagement and achievement in Chinese primary schools post-policy. This study conducted three waves of parental involvement assessments and collected engagement and achievement data to examine subdimensional trajectories. Given that the first post-policy year represents a turbulent adaptation period (Viennet & Pont, 2017), we measured at T1 (pre-policy), T2 (1.5 years post-implementation), and T3 (2 years post-implementation). Because engagement (core process indicator) and achievement (direct outcome indicator) may be differentially affected by the policy, we examined relationships between involvement trajectories and both T3 outcomes, test-

ing whether initial levels and change rates operate independently (cumulative effects) or synergistically (amplification or sensitivity models), while controlling for gender, age, and T1 engagement (Hill & Tyson, 2009; Xu et al., 2020).

Based on the literature, we propose:

H1: Parental involvement subdimensions will show significant decreasing trends before and after the "Double Reduction" policy. Given the policy' s potential to exacerbate educational inequality through a Matthew effect (He & Guo, 2024), we further hypothesize that initial levels will positively correlate with change rates, such that high-involvement families show slower decline.

H2: Emotional and behavioral involvement will positively predict engagement and achievement at both initial levels and change rates, whereas intellectual involvement will negatively predict outcomes. We will test cumulative and interaction models to clarify specific effect patterns. The hypothesized model appears in Figure 2 [Figure 2: see original paper].

2.1 Participants

We used cluster sampling to recruit primary school students from two public schools in Yantai, Shandong Province, for a two-year, three-wave longitudinal study. Wave 1 (June 2021, pre-policy, T1) included 504 valid participants (241 boys, mean age = 8.89 ± 0.94 years) from grades 3-5, excluding students with reading difficulties or intellectual disabilities. Wave 2 (January 2023, 1.5 years post-implementation, T2) included 425 valid participants (200 boys, mean age = 10.40 ± 0.98 years). Wave 3 (July 2023, 2 years post-implementation, T3) retained 323 valid participants (158 boys, mean age = 11.02 ± 0.83 years). Attrition occurred due to school transfers and absences, with 79 students lost between T1 and T2, and 102 between T2 and T3, yielding a 25.08% longitudinal attrition rate from T1 to T3. Attrition analyses revealed no significant differences between retained and lost participants in age (t = 1.60, p = 0.10), gender (χ^2 = 0.44, p = 0.51), T1 parental involvement (t = -3.79, p = 0.50), or T1 engagement (t = 0.06, p = 0.95). This study received ethical approval from the first author' s institutional review board.

2.2.1 Parental Educational Involvement

We assessed parental involvement using the Parental Involvement Scale (Cheung & Pomerantz, 2011). This 23-item scale comprises three subscales: emotional involvement (9 items, e.g., "My parents help me cope with difficult emotions about schoolwork"), intellectual involvement (8 items, e.g., "My parents tutor my schoolwork"), and behavioral involvement (6 items, e.g., "My parents manage my daily schedule"). Students responded using a 5-point scale from 1 (completely disagree) to 5 (completely agree). Subscale scores were computed as item averages, with higher scores indicating greater involvement. Cronbach' s α coefficients across the three waves were 0.86, 0.84, and 0.85 for emotional

involvement; 0.80, 0.76, and 0.83 for intellectual involvement; and 0.78, 0.74, and 0.75 for behavioral involvement.

2.2.2 Learning Engagement

We measured learning engagement using the Learning Engagement Scale (Lam et al., 2014). This 10-item scale (e.g., "When studying, I feel energetic") uses a 5-point response format from 1 (completely disagree) to 5 (completely agree). The scale has demonstrated strong reliability and validity in Chinese primary school samples (Yang et al., 2024). Cronbach' s α was 0.92 at Wave 1 and 0.95 at Wave 3.

2.2.3 Academic Achievement

Following previous research (Zhou et al., 2016), we obtained students' final exam scores from the spring 2023 semester (July 2023, T3) from school records. Five subjects were assessed: Chinese, mathematics, English, ethics, and science, using original 100-point scales. The mean across these five subjects served as the overall achievement indicator. All exams aligned with national primary school curriculum standards.

2.3 Procedure

After obtaining informed consent from parents and students, we administered group assessments at the classroom level. Wave 1 (June 2021, T1) involved a 20-30 minute session collecting demographic data, parental involvement, and engagement. Wave 2 (January 2023, T2) consisted of a 10-15 minute assessment of parental involvement only. Wave 3 (July 2023, T3) included a 20-25 minute assessment of parental involvement and engagement. Academic achievement data were collected from school records at T3. Students with reading difficulties or intellectual disabilities were excluded based on teacher reports. During each assessment, two graduate students in psychology read standardized instructions, monitored comprehension, answered questions individually, and collected completed questionnaires. Participants received small gifts after each wave.

2.4 Data Analysis

We conducted analyses using SPSS 23.0 and Mplus 8.0. First, we addressed missing data. Due to non-response and careless responding, missing data ranged from 0.76% to 0.83% for parental involvement across T1-T3, 1.19% for T1 engagement, 0.2% for T3 engagement, and 0% for achievement. We used multiple imputation to handle missing data (Rubin, 1978). Second, we performed descriptive statistics and correlation analyses. Third, to examine trajectories and their relationships with outcomes, we conducted two-step latent growth modeling (Grimm et al., 2017). Step 1 estimated unconditional linear growth trajectories for each involvement subdimension, extracting individual intercepts (initial levels) and slopes (change rates). Following Grimm et al. (2017), we constrained

residual variances to equality across time points and fixed intercept factor loadings to 1. Slope factor loadings were set to 0 (T1 baseline), 3 (18-month interval at T2), and 4 (24-month interval at T3), using half-year units to standardize the time metric for precise linear change estimation (Grimm et al., 2017; Cheng et al., 2023; Xiao et al., 2023). We estimated correlations between intercepts and slopes to examine their relationship. Step 2 built conditional latent growth models predicting T3 engagement and achievement from initial levels, change rates, and their interactions (El-Sheikh et al., 2019; Maslowsky et al., 2015), controlling for age and T1 engagement. Models used robust maximum likelihood estimation. Following Hu and Bentler (1999), acceptable fit was defined as CFI $\geq$ 0.90, TLI $\geq$ 0.90, RMSEA $\leq$ 0.08, and SRMR $\leq$ 0.08.

3.1 Common Method Bias Test

We used Harman' s single-factor test to assess common method bias. Results showed seven factors with eigenvalues greater than 1 at T1, with the first factor explaining 26.79% of variance; five factors at T2, with the first factor explaining 29.67%; and six factors at T3, with the first factor explaining 31.91%. All were below the 40% threshold, indicating minimal common method bias (Zhou & Long, 2004).

3.2 Descriptive Statistics and Correlations

Descriptive statistics and correlations appear in Table 1 . T1 emotional involvement correlated positively with T1 engagement. T2 and T3 emotional involvement correlated positively with T3 engagement. T1 intellectual involvement correlated positively with T1 engagement, while T2 and T3 intellectual involvement correlated positively with T3 engagement. T1 behavioral involvement correlated positively with T1 and T3 engagement, and T2 and T3 behavioral involvement correlated positively with T3 engagement and achievement. T1 engagement correlated positively with T3 engagement and achievement.

3.3 Trajectories of Parental Involvement Before and After the "Double Reduction" Policy

We estimated unconditional linear growth models for each involvement subdimension. Slope factor loadings were set to 0, 3, and 4 to represent linear trends. As shown in Table 2 , all unconditional models fit adequately. Emotional, intellectual, and behavioral involvement all decreased linearly after policy implementation. Significant intercept variance ($\sigma^2 = 0.05$, SE = 0.03, p = 0.048) and slope variance ($\sigma^2 = 0.02$, SE = 0.00, p $<$ 0.001) for emotional involvement indicated individual differences in initial levels and change rates. Similarly, intellectual involvement showed significant intercept variance ($\sigma^2 = 0.07$, SE = 0.03, p = 0.011) and slope variance ($\sigma^2 = 0.02$, SE $<$ 0.01, p $<$ 0.001), as did behavioral involvement (intercept: $\sigma^2 = 0.08$, SE = 0.03, p = 0.002; slope: $\sigma^2 = 0.02$, SE = 0.00, p $<$ 0.001). However, intercept-slope correlations were

non-significant across all subdimensions, indicating a stable differences pattern where individual disparities remained constant over time.

3.4 Differential Effects of Involvement Trajectories on Engagement and Achievement

To examine how involvement trajectories predicted T3 engagement and achievement, we estimated conditional latent growth models (Figure 3 [Figure 3: see original paper]) including initial levels, change rates, and their interactions as predictors. Gender showed no significant correlations with study variables, so we controlled only for age and T1 engagement (in engagement prediction models).

Results indicated that, after controlling for covariates, emotional involvement' s initial level ($b = 0.99$, $p < 0.001$) and change rate ($b = 3.21$, $p < 0.001$) significantly positively predicted T3 engagement, but their interaction did not ($b = -1.96$, $p > 0.05$), supporting a cumulative effects model. For achievement, only emotional involvement' s change rate was significant ($b = 1.12$, $p = 0.016$), while its initial level ($b = 0.16$, $p > 0.05$) and interaction term ($b = 2.08$, $p > 0.05$) were not.

Intellectual involvement' s initial level ($b = -1.32$, $p > 0.05$), change rate ($b = 4.59$, $p > 0.05$), and their interaction ($b = 5.38$, $p > 0.05$) showed no significant effects on engagement. Similarly, intellectual involvement' s initial level ($b = 1.23$, $p > 0.05$), change rate ($b = -0.69$, $p > 0.05$), and interaction ($b = -0.12$, $p > 0.05$) did not significantly predict achievement.

Behavioral involvement' s initial level ($b = 0.63$, $p = 0.013$) and change rate ($b = 2.55$, $p < 0.001$) significantly positively predicted engagement, with a non-significant interaction ($b = -0.21$, $p > 0.05$), again supporting a cumulative effects model. For achievement, behavioral involvement' s initial level ($b = 0.90$, $p = 0.001$) and change rate ($b = 2.99$, $p < 0.001$) significantly predicted achievement, with a significant interaction ($b = -2.54$, $p = 0.029$). Simple slope analysis (Figure 4 [Figure 4: see original paper]) revealed marginally significant differences between low and high initial level groups ($t = -1.97$, $p = 0.05$). The slope for the low initial level group ($b = 3.80$, $p < 0.001$) was significantly steeper than for the high initial level group ($b = 2.17$, $p = 0.001$) (Aiken & West, 1991). This indicates that initial level moderated the relationship between change rate and achievement. For students with high initial behavioral involvement, the association between change rate and achievement was weaker ($b = 2.17$, $p = 0.001$), suggesting smaller achievement declines even when involvement decreased rapidly. Conversely, for students with low initial involvement, the association was stronger ($b = 3.80$, $p < 0.001$), indicating larger achievement declines when involvement decreased rapidly.

In summary, post-"Double Reduction,"all three parental involvement dimensions decreased linearly, with stable individual differences over time. For engagement, emotional and behavioral involvement showed cumulative effects, where both initial levels and change rates independently contributed. For achievement, only

emotional involvement' s change rate mattered, while behavioral involvement demonstrated an amplification effect where initial levels and change rates jointly influenced outcomes. Intellectual involvement showed no significant effects on either outcome.

4.1 Trajectories of Parental Involvement in the "Double Reduction" Context

This study found linear decreases across emotional, intellectual, and behavioral involvement dimensions, consistent with Flack et al.' s (2023) finding that parental involvement declines with grade level, confirming its dynamic nature. Several factors may explain this trend. First, as children age, their need for autonomy increases (Pomerantz & Wang, 2009), leading them to prefer independent learning and reducing the need for parental participation. Second, parents increasingly focus on fostering autonomous learning skills rather than direct involvement as children advance (Li et al., 2022). Third, the "Double Reduction" policy altered educational demands, prompting parental strategy adjustments. For instance, emotional involvement may shift from academic focus to holistic development in moral, emotional, and social domains (He & Guo, 2024), reducing academic emotional involvement. The reduction of after-school tutoring also decreased learning resources, leading to declining intellectual involvement. Finally, reduced academic burdens directly decreased behavioral involvement in homework supervision (Luo, 2023).

Additionally, the non-significant correlations between initial levels and change rates across all dimensions indicate a stable differences pattern, suggesting that individual disparities in parental involvement remained unchanged by the policy. This may reflect parents' wait-and-see attitudes during the early policy period, where policy uncertainty and parental cognitive uncertainty prevented disparity expansion (He & Guo, 2024). Moreover, relatively simple primary school content allowed most parents to provide guidance without tutoring support, resulting in similar decline rates across families with different initial involvement levels.

4.2 Effects of Emotional and Behavioral Involvement on Engagement: Cumulative Model

Results show that emotional and behavioral involvement' s initial levels and change rates consistently and positively predicted T3 engagement, aligning with prior research on initial level effects (Li et al., 2023). Intellectual involvement showed no significant effects on T3 engagement.

First, initial levels of emotional and behavioral involvement positively predicted engagement. The developmental-contextual model (Wang et al., 2019) suggests that early family interaction patterns shape children's resources and have lasting effects on development. High initial emotional involvement (e.g., "My parents help me cope with difficult emotions about schoolwork") creates a supportive parent-child relationship, establishing parents as a secure base during academic

challenges. This supportive approach, which respects children' s feelings, fosters autonomy and promotes sustained engagement (Kim & Kim, 2021). High initial behavioral involvement (e.g., "My parents manage my daily schedule") creates a structured, predictable learning environment. Given primary students' limited self-management skills, structured support (e.g., regular routines) scaffolds learning by transforming academic requirements into manageable daily practices, helping children complete tasks efficiently and internalize learning habits (Moroni et al., 2015). These daily companionship behaviors also strengthen relational bonds. Thus, high initial levels of emotional and behavioral involvement create a favorable developmental context, providing "developmental capital" that sustains engagement despite subsequent changes.

Second, change rates in emotional and behavioral involvement positively predicted engagement, with non-significant interactions, indicating independent effects where decline rate impacts engagement regardless of initial level. This supports the cumulative model rather than the amplification model. The amplification model suggests that high initial levels buffer against rapid decline effects. However, our findings show that for high initial level families, once involvement begins declining, engagement drops rapidly despite accumulated advantages. In other words, involvement decline constitutes a powerful risk factor independent of starting point. The developmental-contextual model explains this: rapid parental involvement reduction means sudden support loss, directly undermining children' s sense of belonging and autonomy regardless of initial level, thereby reducing engagement (Ryan & Deci, 2000). In contrast, gradual decline provides an adaptation buffer, allowing children to develop self-regulation skills and transition from external to internal support, ultimately maintaining higher engagement (Pomerantz & Wang, 2009).

Intellectual involvement' s initial level and change rate showed no significant effects on engagement. Conceptually, intellectual involvement provides resources for intellectual development (e.g., tutoring) (Li et al., 2023). However, such direct intervention may hinder development by suppressing autonomy and metacognitive skills (Ryan & Deci, 2000) and potentially causing cognitive overload if explanations exceed children's comprehension (Sweller, 1988). These negative effects may render children insensitive to intellectual involvement, explaining why neither its initial level nor change rate significantly predicted engagement.

4.3 Effects of Behavioral Involvement on Achievement: Amplification Model

Results show that only emotional involvement' s change rate significantly predicted achievement, while intellectual involvement showed no effects. Behavioral involvement' s initial level and change rate significantly predicted achievement, demonstrating an amplification pattern. These findings partially diverge from prior research showing initial level effects on achievement (Wang & Sheikh-Khalil, 2014; Moroni et al., 2015).

Emotional involvement's change rate alone predicted achievement because previous research confounded static levels with dynamic changes without distinguishing their effects (Lv et al., 2016). Initial level only reflects parents' attitudes at a specific time point, with limited explanatory power (Ogg & Anthony, 2020). Change rate reveals dynamic trends: when emotional involvement continuously declines, children may interpret this as waning parental interest or disappointment, undermining learning motivation (Teuber et al., 2023). This suggests that loss of emotional support itself constitutes a risk factor, with detrimental effects exceeding those of chronically low involvement.

Behavioral involvement' s initial level and change rate both predicted achievement, showing an amplification pattern consistent with some prior research (Moroni et al., 2015). This aligns with family systems theory' s emphasis on microsystem determinants of development (Bronfenbrenner, 1979; Li et al., 2023). Our study reveals the dynamic mechanism: both initial level and change rate matter, with significant interaction demonstrating a "1+1>2" 叠加效应 (amplification model). Specifically, early behavioral involvement cultivates academic habits and key competencies. Students with high initial levels develop strong self-efficacy and regulation skills, showing greater adaptability and resilience to policy changes. Conversely, students with low initial behavioral involvement lack autonomous learning strategies and intrinsic motivation (Hayek et al., 2022), depending heavily on external support. When "Double Reduction" caused rapid involvement decline, these students' external scaffolding suddenly weakened, leading to rapid achievement deterioration. This demonstrates a "rich get richer, poor get poorer" effect where low initial level forms the foundation for decline, and rapid decline exacerbates deterioration—creating a "snowball effect."

Intellectual involvement' s initial level and change rate showed no achievement effects. According to Vygotsky' s (1978) zone of proximal development, effective support must slightly exceed current ability levels. However, primary students' metacognitive abilities remain underdeveloped (Flavell, 2000), making direct intellectual involvement (e.g., explaining problem-solving strategies) potentially exceed their comprehension threshold and cause cognitive overload (Sweller, 1988), thereby failing to improve achievement. Thus, neither initial level nor change rate in intellectual involvement significantly predicted achievement.

4.4 Implications and Educational Applications

Our findings reveal linear declines across all parental involvement dimensions post- "Double Reduction," alerting parents to the importance of involvement quality and approach. For parents, both low initial levels and rapid decline—regardless of starting point—hinder child development, necessitating improved involvement quantity and quality. Given emotional and behavioral involvement' s critical roles, parents should prioritize these dimensions, particularly behavioral involvement, by providing clear, consistent guidance to increase structured involvement (Luo et al., 2014).

For educators, teachers should implement targeted interventions for different student types. They should focus on low initial level students to help them adapt to policy changes, while assisting high initial level students with rapid decline to develop self-management skills (Xu, 2024). Teachers should also strengthen parent communication to foster educational responsibility and build supportive networks for child development.

4.5 Contributions, Limitations, and Future Directions

This study makes several contributions. First, it is the first to examine trajectories of multidimensional parental involvement before and after the "Double Reduction" policy among Chinese primary students, depicting overall decline patterns and revealing stable individual differences during the early policy period. Second, it clarifies how initial levels and change rates jointly affect learning processes (engagement) and outcomes (achievement), identifying which factor is more critical for targeted interventions. Third, it responds to the policy call by examining involvement change effects on both processes and outcomes, encouraging parents to shift from sole focus on achievement to holistic development.

Limitations include: First, the sample was restricted to one region without socioeconomic status control, limiting generalizability regarding group differences across regions. Future research should include diverse urban and rural samples to examine regional adaptation differences. Second, due to pandemic-related exam cancellations, we could not collect T1 achievement data for third graders, preventing inclusion of baseline achievement as a covariate in achievement models. Future studies should verify findings using models with baseline achievement. Third, although research indicates engagement mediates involvement' s effects on achievement (Yu et al., 2022), this study focused on independent effects of involvement trajectories on engagement and achievement without testing mediation. Future research should examine engagement' s mediating role between involvement trajectories and achievement.

Conclusion

1. Emotional, intellectual, and behavioral parental involvement among Chinese primary students showed linear decreasing trajectories before and after the "Double Reduction" policy, with stable individual differences over time.
2. For learning engagement, emotional and behavioral involvement demonstrated cumulative effects, where initial levels and change rates independently contributed. For academic achievement, only emotional involvement' s change rate was significant, while behavioral involvement showed an amplification effect where initial levels and change rates jointly influenced outcomes. Intellectual involvement had no significant effects on either outcome.

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Note: Figure translations are in progress. See original paper for figures.