

Article

The Uneven Convertibility of Family Cultural Capital to Academic Engagement and Research Self-Efficacy Among Chinese Graduate Students with Rural and Urban Backgrounds

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Abstract

This study examined how different forms of family cultural capital are linked to Chinese graduate students' academic engagement and research self-efficacy, and whether these pathways differ by rural–urban background. Drawing on cultural capital theory and social cognitive theory, the study distinguished embodied, objectified, and institutionalized family cultural capital and conceptualized academic engagement as a behavioral pathway through which family-based resources may become relevant to research. Survey data were collected from 412 graduate students at five public universities in China. Partial least squares structural equation modeling with 5000 bootstrap resamples was used to test direct and indirect pathways separately for students from rural and urban backgrounds. The results showed that embodied family cultural capital was positively related to academic engagement in both groups, and academic engagement was positively related to research self-efficacy. Academic engagement mediated the relationship between embodied family cultural capital and research self-efficacy for both rural- and urban-background students. However, embodied family cultural capital only had a significant direct relationship with research self-efficacy among urban-background students. Objectified family cultural capital was only negatively related to research self-efficacy among rural-background students, while institutionalized family cultural capital showed no significant relationships in either group. These findings suggest that family cultural capital is not uniformly converted into research self-efficacy in graduate education. Its role depends on the form of cultural capital and the rural–urban context in which academic engagement is enacted. Theoretically, this study shows that the conversion of family cultural capital into research self-efficacy is form-specific and context-dependent. Practically, it identifies academic engagement as a key leverage point for promoting equitable research development among graduate students from diverse family backgrounds.



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Keywords: family cultural capital; academic engagement; research self-efficacy; rural–urban background; graduate education

1. Introduction

Graduate education plays an important role in developing students' research capacity. For graduate students, research self-efficacy refers to their perceived capability to complete

research-related tasks, such as formulating research questions, reviewing literature, analyzing evidence, and writing scholarly texts. Recent research has linked scientific research self-efficacy to graduate students' innovation ability, suggesting that confidence in research tasks is closely related to academic development (Han et al., 2024).

Family cultural capital is one context in which such development may be shaped. In Bourdieu's theory, cultural capital refers to cultural resources that can be converted into educational advantage when they are recognized within a specific field (Bourdieu, 2018). This study distinguishes three forms of family cultural capital: embodied, objectified, and institutionalized. Embodied family cultural capital refers to learning dispositions, educational expectations, and cultural practices developed through family socialization. Objectified family cultural capital refers to cultural goods and learning resources available in the family. Institutionalized family cultural capital refers to parents' educational credentials.

Recent studies show that family cultural capital remains relevant to students' educational development, but its effects are not uniform. Wang and Huang (2021) found that family capital was associated with students' higher education gains through learning engagement. Yu et al. (2022) showed that family cultural capital was related to academic achievement among Chinese junior high school students. M. Jin et al. (2026) further emphasized that the effects of family cultural capital should be understood in relation to habitus and educational field. These studies suggest the need to examine how different forms of family cultural capital operate in specific educational stages.

Graduate education provides a useful context for examining this issue because research training requires sustained participation in academic reading, writing, supervisor interaction, and disciplinary learning. Embodied family cultural capital may be more directly connected to these practices because it is carried in students' learning orientations and academic habits. Objectified and institutionalized family cultural capital may provide supportive conditions, but they may not directly translate into research confidence unless they are enacted through students' current academic participation.

Academic engagement offers a mechanism for examining this conversion process. It captures students' behavioral, emotional, and cognitive investment in academic work. From a social cognitive perspective, self-efficacy develops through domain-relevant participation and mastery experiences (Bandura, 1986). Qi et al. (2023) found that academic self-efficacy was closely related to learning engagement among rural Chinese students. In the graduate education context, Han et al. (2024) further showed that scientific engagement was associated with scientific research self-efficacy. These findings support the view that engagement may connect students' academic participation with their research confidence.

This conversion process may differ by rural–urban background. Tan and Fang (2023) showed that family social and cultural capital were related to adolescents' educational outcomes in China, with rural–urban differences. Guo and Li (2024) further indicated that urban–rural disparities remain important in China's educational development. These findings suggest that rural- and urban-background students may differ not only in family resources, but also in how such resources are converted within education.

Departing from a mediation-centered framework, the present study proposes a form-specific and context-dependent conversion perspective. The central argument holds that family cultural capital is not uniformly convertible into research self-efficacy; rather, its convertibility depends on the form of capital under consideration and on the rural–urban context in which conversion is enacted. Embodied family cultural capital, internalized as learning dispositions and academic orientations, is theorized to be the most proximal and convertible form, whereas objectified and institutionalized forms occupy more distal positions whose research-related significance is contingent on activation through current academic practice. Within this framework, academic engagement functions not merely

as a statistical mediator but as the behavioral site of conversion—the practice through which family-based dispositions are rendered relevant to research. By comparing rural- and urban-background graduate students, the study further interrogates whether identical forms of cultural capital follow asymmetric conversion pathways across structurally distinct educational contexts.

2. Theoretical Framework and Hypotheses

2.1. Family Cultural Capital and Form-Specific Convertibility

Bourdieu (2018) conceptualized cultural capital as a resource that can be converted into educational advantage when it is recognized within specific institutional fields. He distinguished cultural capital into embodied, objectified, and institutionalized forms. Embodied cultural capital refers to internalized dispositions, orientations, and habits acquired through socialization. Objectified cultural capital refers to cultural goods and material resources, while institutionalized cultural capital refers to formally recognized educational credentials. This distinction is central to the present study because different forms of family cultural capital may not be equally convertible into graduate students' academic engagement and research self-efficacy.

Recent studies have continued to show that family cultural capital is associated with students' educational outcomes, particularly in Chinese educational contexts. Yu et al. (2022) found that family cultural capital was related to Chinese students' academic achievement, and Tan and Fang (2023) showed that family social and cultural capital were associated with adolescents' educational outcomes across rural–urban backgrounds. More recent work has further emphasized that the effects of family cultural capital should be understood through the interaction between habitus and educational field (M. Jin et al., 2026). These studies indicate that family cultural capital remains important, but they also suggest the need to examine how different forms of cultural capital operate in specific educational stages and contexts. However, prior research has generally treated family cultural capital as a unitary construct or examined only one of its forms, providing limited insight into whether different forms are differentially associated with graduate students' academic engagement and research self-efficacy. Consequently, the form-specific convertibility of family cultural capital—and the contextual conditions under which these associations vary—remains insufficiently understood. Our study addresses this gap by examining all three forms within a single analytical framework, while incorporating academic engagement as a behavioral mediator and rural–urban background as a contextual condition.

Graduate education provides a distinctive field for examining this issue. Unlike earlier schooling, graduate education requires students to engage in research training, academic writing, supervisor interaction, and disciplinary knowledge production. Embodied family cultural capital may be more directly connected to these practices because it is expressed through students' learning orientations, persistence, and academic habits. Objectified and institutionalized family cultural capital may provide supportive conditions, but their relevance to graduate research development depends on whether they are translated into students' current academic practices.

Accordingly, this study adopts a form-specific view of family cultural capital. The key issue is not only whether family cultural capital matters, but which forms are more readily converted into academic engagement and research self-efficacy in graduate education.

Based on this reasoning, the following hypotheses are proposed:

H1a. *Embodied family cultural capital is positively associated with academic engagement.*

H1b. *Objectified family cultural capital is positively associated with academic engagement.*

H1c. *Institutionalized family cultural capital is positively associated with academic engagement.*

H2a. *Embodied family cultural capital is positively associated with research self-efficacy.*

H2b. *Objectified family cultural capital is positively associated with research self-efficacy.*

H2c. *Institutionalized family cultural capital is positively associated with research self-efficacy.*

2.2. Academic Engagement and Research Self-Efficacy

Social cognitive theory explains why academic participation is central to the development of research self-efficacy. Bandura (1997) argued that efficacy beliefs are strengthened through mastery experiences, which allow individuals to judge their capability through successful task performance. In graduate education, research self-efficacy refers to students' perceived capability to complete research-related tasks, such as identifying research problems, reviewing literature, designing studies, analyzing data, and writing scholarly texts.

Recent studies have highlighted the importance of engagement and self-efficacy in graduate students' research development. Han et al. (2024) found that scientific engagement and scientific research self-efficacy were important mechanisms linking academic atmosphere to graduate students' innovation ability. Yao et al. (2024) also showed that self-efficacy-related processes were associated with graduate students' scientific research creativity. These findings suggest that research self-efficacy is closely connected to students' active participation in research-related academic practices.

Academic engagement provides the behavioral basis for this process. It captures students' investment of effort, attention, emotion, and cognition in academic activities. Stan et al. (2022) showed that learning engagement and self-efficacy are closely related in online learning contexts. Qi et al. (2023) further found that academic self-efficacy was associated with learning engagement among rural Chinese students. These findings support the expectation that academic engagement is positively associated with research self-efficacy among graduate students.

Accordingly, the following hypothesis is proposed:

H3. *Academic engagement is positively associated with research self-efficacy.*

2.3. Academic Engagement as a Behavioral Conversion Pathway

Academic engagement is conceptualized in this study as the behavioral pathway through which family cultural capital may become linked to research self-efficacy. Cultural capital theory explains how family-based resources and dispositions are unequally distributed and differentially recognized within educational fields. Social cognitive theory explains how efficacy beliefs are strengthened through participation and mastery experiences. Combining these perspectives suggests that family cultural capital becomes relevant to research when it influences students' engagement in academic and research-related activities.

This pathway is expected to be most evident for embodied family cultural capital. Embodied cultural capital is internalized as learning dispositions, academic orientations, and habits of participation. Wang and Huang (2021) found that family capital was linked to higher education gains through learning engagement. M. Jin et al. (2026) further emphasized that the effects of family cultural capital depend on the relation between habitus and educational field. These findings support the view that family-based resources become educationally meaningful through students' participation in specific academic contexts. However, not all forms of family cultural capital are equally close to students' current academic behavior. Objectified resources and parental educational credentials may shape

earlier educational opportunities, but they may not directly generate research confidence unless they are activated through the graduate students' own academic engagement.

Therefore, this study treats academic engagement as a behavioral conversion mechanism. It examines whether family cultural capital, especially embodied family cultural capital, is associated with research self-efficacy through students' sustained participation in academic work.

Based on this reasoning, the following hypotheses are proposed:

H4a. *Academic engagement mediates the association between embodied family cultural capital and research self-efficacy.*

H4b. *Academic engagement mediates the association between objectified family cultural capital and research self-efficacy.*

H4c. *Academic engagement mediates the association between institutionalized family cultural capital and research self-efficacy.*

2.4. Rural–Urban Background as a Contextual Condition

In this study, rural–urban background is treated as a contextual condition that may shape the conversion of family cultural capital. In China, rural–urban differences continue to influence educational resources, family educational environments, and access to institutional opportunities. Guo and Li (2024) showed that regional inequality in China's educational development remains closely related to urban–rural disparities. Tan and Fang (2023) also found that family social and cultural capital were associated with adolescents' educational outcomes in ways that reflected rural–urban differences.

These studies suggest that the same form of family cultural capital may not have the same meaning or effect across rural and urban contexts. For urban-background students, family-based cultural dispositions may be more closely aligned with institutional expectations in higher education. For rural-background students, similar dispositions may need to be converted through sustained academic engagement before they become linked to research confidence. This study therefore compares rural- and urban-background graduate students to examine whether direct and indirect pathways differ across backgrounds.

2.5. The Present Study

Figure 1 displays the conceptual framework of this study. The model distinguishes between embodied, objectified, and institutionalized family cultural capital; positions academic engagement as a behavioral conversion pathway; and links these elements to graduate students' research self-efficacy. The framework does not assume that all forms of family cultural capital are equally convertible. Embodied family cultural capital is conceptualized as the most proximal form because it is internalized in students' dispositions and learning orientations. Objectified and institutionalized family cultural capital are included as theoretically relevant but more distal forms whose research-related significance depends on their activation in current academic practices.

Guided by this framework, the study addresses three research questions:

RQ1. How are different forms of family cultural capital associated with graduate students' academic engagement and research self-efficacy?

RQ2. Does academic engagement serve as a behavioral pathway through which different forms of family cultural capital are linked to research self-efficacy?

RQ3. Do these direct and indirect pathways differ between rural- and urban-background graduate students?

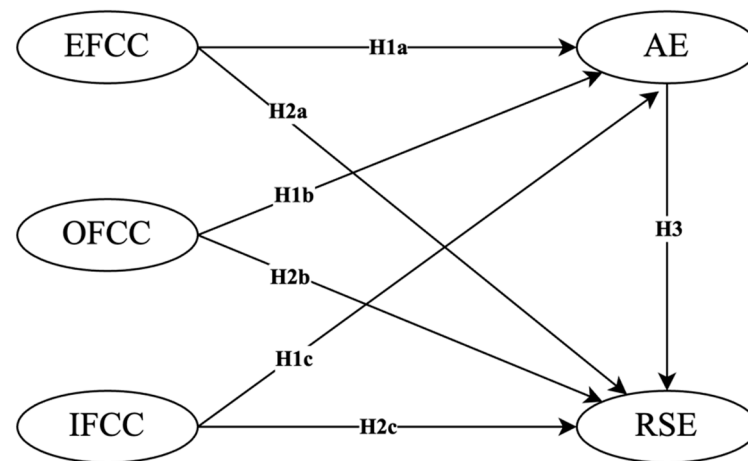


Figure 1. Conceptual framework of the form-specific conversion of family cultural capital into research self-efficacy. Note. EFCC = embodied family cultural capital; OFCC = objectified family cultural capital; IFCC = institutionalized family cultural capital; AE = academic engagement; RSE = research self-efficacy. Academic engagement is conceptualized as the behavioral pathway through which family-based cultural resources may become linked to research self-efficacy. Rural–urban background is treated as a grouping and contextual condition for comparing direct and indirect pathways.

The hypotheses correspond to these questions. H1a–H1c and H2a–H2c examine the direct associations between the three forms of family cultural capital, academic engagement, and research self-efficacy. H3 examines the association between academic engagement and research self-efficacy. H4a–H4c examine the indirect pathways from family cultural capital to research self-efficacy through academic engagement. RQ3 is addressed through rural–urban group comparison.

3. Method

3.1. Study Design

This study employed a cross-sectional survey design to examine how different forms of family cultural capital are associated with graduate students' academic engagement and research self-efficacy, and whether these associations differ by rural–urban background. This design was appropriate because the study aimed to measure students' perceived family cultural resources, current academic engagement, and research self-efficacy across multiple university settings without manipulating contextual factors. Partial least squares structural equation modeling was used to test the hypothesized direct and indirect pathways among the constructs. Group-specific models were estimated for rural- and urban-background students because rural–urban background was conceptualized as a contextual condition shaping the conversion of family cultural capital.

3.2. Participants and Procedure

Participants were graduate students enrolled at five public universities in China. The sampling procedure was designed to capture heterogeneity across China's higher education landscape while maintaining feasibility. Five public universities were purposively selected to represent three broad geographical regions—eastern (coastal, economically developed), central (inland, moderately developed), and western (less developed, interior) China—with at least one university from each region. Within each region, universities were selected to represent different levels of institutional prestige, including, where feasible, one comprehensive national key university and one provincial or regional university. This strategy was intended to capture the institutional stratification of China's higher education system. Data were collected through an online questionnaire covering demographic information, family cultural capital,

academic engagement, and research self-efficacy. Participants were recruited through multiple institutional channels. At each university, faculty members and departmental administrators assisted with participant recruitment by distributing the survey link through class messaging groups, departmental email lists, and online learning platforms.

Before the formal survey, a pilot test was conducted with 70 graduate students to examine the clarity of the questionnaire items and the reliability of the scales. The pilot data were not included in the formal analysis. The pilot results showed acceptable internal consistency for all scales, with Cronbach's alpha values above 0.70, indicating that the questionnaire was suitable for formal administration.

The study was conducted in accordance with ethical principles for research involving human participants. Institutional permission was obtained before data collection. Before completing the questionnaire, participants were informed about the purpose of the study, the voluntary nature of participation, the confidentiality and anonymity of their responses, and their right to withdraw from the survey at any time without penalty. Informed consent was obtained from all participants before they completed the questionnaire. No personally identifiable information was collected, and the data were only used for academic research purposes.

For the formal survey, 425 responses were collected. After excluding questionnaires with missing data or invalid response patterns, 412 valid responses were retained, yielding a valid response rate of 96.94%. Of the participants, 210 students were classified as having a rural background, accounting for 50.97% of the sample, and 202 students were classified as having an urban background, accounting for 49.03%. The sample included 139 male students and 273 female students. By discipline, 174 students were from humanities and social sciences, while 238 students were from natural sciences and engineering. Regarding degree type, 194 students were academic degree students and 218 were professional degree students.

Rural–urban background was determined based on students' hukou status at the time of registration for the National College Entrance Examination, commonly known as the Gaokao. Students registered as rural or township residents were classified as rural-background students, whereas those registered in county-level cities or above were classified as urban-background students. This classification was used because hukou status at the time of Gaokao registration reflects students' pre-university family and educational contexts and is closely related to rural–urban differences in educational resources and institutional access in China.

The demographic characteristics of the sample are presented in Table 1.

Table 1. Demographic Information of the Sample.

Demographic Feature		Frequency	Percentage (%)
Urban–Rural Background	Rural Background	210	50.97%
	Urban Background	202	49.03%
Discipline	Humanities and Social Sciences	174	42.23%
	Natural Sciences and Engineering	238	57.77%
Gender	Male	139	33.74%
	Female	273	66.26%
Degree Type	Academic Degree Student	194	47.09%
	Professional degree student	218	52.91%

3.3. Measures

The questionnaire included measures of family cultural capital, academic engagement, research self-efficacy, and demographic variables (See Appendix A). Higher scores indicated

higher levels of the corresponding construct. The measurement of family cultural capital followed Bourdieu's distinction among embodied, objectified, and institutionalized cultural capital. This multidimensional measurement strategy was consistent with the study's focus on whether different forms of family cultural capital are unevenly converted into academic engagement and research self-efficacy.

3.3.1. Family Cultural Capital

Family cultural capital was measured through three dimensions: embodied, objectified, and institutionalized family cultural capital.

Embodied family cultural capital was measured using 11 items adapted from the Family Cultural Capital Scale. The items were developed based on Bourdieu's distinction among embodied, objectified, and institutionalized cultural capital and informed by prior empirical studies on family cultural resources and educational outcomes (Tan & Fang, 2023). These items assessed family cultural habits, educational expectations, and learning-oriented family practices. Responses were rated on a 7-point Likert scale, with higher scores indicating higher levels of embodied family cultural capital. These items are conceptually grounded in Bourdieu's notion of embodied cultural capital, which encompasses not only explicit cultural knowledge but also the dispositions, tastes, and habitual practices transmitted through family socialization (Bourdieu, 2018). In this framework, family harmony represents a cultural environment conducive to intellectual development and scholarly habits; parents' cultivation of interests indicates the family's cultural orientation toward aesthetic and intellectual engagement; and parents' discussion of study life embodies the transmission of academic values and learning-oriented dispositions. These practices are therefore not merely affective support but rather represent the cultural dimension of family interactions that shape students' academic habitus and engagement orientations.

Objectified family cultural capital was measured by indicators of books and cultural goods in the family, which are commonly used to capture home-based cultural resources and scholarly culture (Sikora et al., 2019). These two items were specified as reflective indicators of the latent construct objectified cultural capital, following the theoretical logic that a greater number of books and cultural possessions jointly reflects a higher latent level of objectified cultural resources available in the household.

Institutionalized family cultural capital was measured based on parents' educational attainment, following Bourdieu's conceptualization of institutionalized cultural capital as formally recognized educational credentials (Bourdieu, 2018). Parental education levels (ranging from primary school to postgraduate degree) were specified as reflective indicators of the latent construct institutionalized cultural capital, based on the premise that higher parental education reflects a higher latent standing in formally credentialed cultural capital. This treatment aligns with established practices in cultural capital research (H. Jin et al., 2024) and is supported by the strong factor loadings observed in our measurement model.

This three-dimensional operationalization was used because the study did not treat family cultural capital as a single homogeneous resource. Instead, it examined whether embodied, objectified, and institutionalized forms differed in their associations with academic engagement and research self-efficacy.

3.3.2. Academic Engagement

Academic engagement was measured using an adapted student version of the Utrecht Work Engagement Scale, UWES-9. The original UWES-9 was developed to assess work engagement, and the items were reworded to fit academic settings while retaining the three dimensions of vigor, dedication, and absorption. To ensure linguistic and cultural validity, the scale was translated into Chinese through a standard translation and back-translation

procedure. Two bilingual researchers independently translated the original English items into Chinese, and discrepancies were resolved through discussion. The Chinese version was then back-translated into English by two other translators, and the back-translated version was compared with the original to check semantic equivalence. Subsequently, two experts in educational psychology reviewed the translated items to confirm their suitability for Chinese graduate students, suggesting minor wording modifications to enhance contextual relevance. These adaptations were further refined based on the pilot test feedback. The adapted scale consisted of 9 items: vigor was measured using D1, D2, and D5; dedication was measured using D3, D4, and D7; and absorption was measured using D6, D8, and D9. Participants responded on a 7-point Likert scale ranging from 1 = never to 7 = always. Higher scores indicated stronger academic engagement. In the present study, academic engagement represented students' behavioral, emotional, and cognitive investment in academic and research-related learning activities.

3.3.3. Research Self-Efficacy

Research self-efficacy was measured using a 15-item scale adapted from the Faculty Research Self-Efficacy Scale developed by [Pentang and Domingo \(2024\)](#). Because the original scale was designed for faculty members, the wording was revised to fit graduate students' research training context. We followed the same translation and back-translation procedure as described for the academic engagement scale, and the revised items were also reviewed by the same expert panel to ensure cultural appropriateness for graduate students in the Chinese context. Items were adapted to assess students' perceived capability to complete research-related tasks under graduate supervision, including identifying research problems, reviewing literature, selecting methods, analyzing data, writing scholarly texts, presenting findings, and following academic ethics. Graduate students were treated as developing researchers who acquire research competence through coursework, supervision, and research practice. The adapted items were reviewed during the pilot test to ensure clarity and appropriateness for graduate students. Participants responded on a 7-point Likert scale ranging from 1 = not confident at all to 7 = very confident. Higher scores indicated stronger research self-efficacy.

3.3.4. Control Variables

Gender and discipline were included as control variables because prior studies suggest that these characteristics may be associated with students' academic engagement or self-efficacy. Gender was dummy-coded as 1 = male and 0 = female. Discipline was dummy-coded as 1 = natural sciences and engineering and 0 = humanities and social sciences.

3.4. Data Analysis

Data were analyzed using SmartPLS 4, version 4.1.1.2. Partial least squares structural equation modeling was selected for three reasons. First, the study examined a theoretically specified model involving multiple latent constructs, direct paths, and indirect effects. Second, PLS-SEM is suitable for prediction-oriented models and imposes relatively modest requirements on distributional assumptions. Third, the method is appropriate for comparing group-specific path models when the research focus is on explaining variance and testing theoretically meaningful differences across groups ([Hair et al., 2019](#)).

The analysis proceeded in three stages. First, the measurement model was assessed separately for the rural- and urban-background groups. Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability. Convergent validity was assessed using indicator loadings and average variance extracted. Indicator loadings above 0.70 were considered desirable, although loadings slightly below 0.70 were retained when theoretically meaningful and when composite reliability and AVE remained acceptable.

Discriminant validity was examined using the heterotrait–monotrait ratio. HTMT values below 0.85 were treated as evidence of satisfactory discriminant validity.

Second, the structural model was evaluated. The analysis examined the direct effects of embodied, objectified, and institutionalized family cultural capital on academic engagement and research self-efficacy, as well as the direct effect of academic engagement on research self-efficacy. Model adequacy was assessed using the standardized root mean square residual, the coefficient of determination, and Stone–Geisser’s predictive relevance. Collinearity was examined using variance inflation factors. VIF values below 3 indicated that multicollinearity was not a serious concern.

Third, mediation effects were tested using bootstrapping with 5000 resamples. Indirect effects were considered statistically significant when the percentile 95% confidence interval did not include zero. This procedure was used because bootstrapping does not require the assumption of a normal sampling distribution for indirect effects and is commonly recommended for mediation analysis.

To address rural–urban differences, the structural model was estimated separately for rural- and urban-background students. The group-specific patterns of direct and indirect pathways were then compared to examine whether the conversion of family cultural capital differed across backgrounds. Because the analysis focused on group-specific pathway patterns, the results should be interpreted as evidence of different structural patterns rather than as formal tests of coefficient differences unless measurement invariance is established and permutation-based multi-group comparisons are performed.

3.5. Common Method Bias

Because all variables were collected through self-report questionnaires, procedural and statistical steps were taken to reduce and assess common method bias. Procedurally, participants completed the questionnaire anonymously and were informed that there were no right or wrong answers. The questionnaire also included different constructs in separate sections to reduce response consistency.

Statistically, common method bias was assessed using variance inflation factors. The results indicated that variance inflation factors for all constructs were below 3 in both groups, suggesting that common method bias was unlikely to substantially affect the results in this study (See Appendix E). In addition, the measurement model distinguished among family cultural capital, academic engagement, and research self-efficacy, further supporting the empirical separability of the main constructs.

4. Results

4.1. Measurement Model

The measurement model was assessed separately for the rural- and urban-background groups. Reliability, convergent validity, discriminant validity, and collinearity were examined before testing the structural paths (See Appendices C and D).

For the rural-background group, all indicator loadings exceeded 0.70 and were statistically significant. Cronbach’s alpha values were above 0.87 for all constructs except objectified family cultural capital, whose alpha was below 0.70 but remained acceptable given the small number of indicators. Composite reliability values were all above 0.86, and average variance extracted values were all above 0.65, indicating satisfactory internal consistency and convergent validity.

For the urban-background group, all indicator loadings were statistically significant. Most loadings exceeded 0.70, although A1, E14, and E15 were approximately 0.65. These items were retained because they were theoretically meaningful and because the corresponding constructs showed acceptable composite reliability and average variance

extracted. To further address the low loading of E15, we conducted a sensitivity analysis by re-estimating the full structural model without this item; the direction, significance, and magnitude of all path coefficients remained virtually unchanged, confirming that its inclusion does not materially affect our substantive conclusions. In addition, the adapted research self-efficacy scale demonstrated satisfactory psychometric properties across both groups (CRs > 0.70, AVEs > 0.50, HTMT < 0.85), and MICOM results confirmed compositional invariance for this construct (original correlation = 1.000, $p = 0.900$), supporting the validity of cross-group comparisons (See Appendix B). Cronbach's alpha values were above 0.89 for all constructs except objectified family cultural capital, whose alpha was below 0.70 but was acceptable for a two-item construct. Composite reliability values were all above 0.84, and average variance extracted values were all above 0.62.

Discriminant validity was examined using the heterotrait–monotrait ratio. In both groups, HTMT values below 0.85, together with confidence interval upper bounds below 0.90, were treated as evidence of satisfactory discriminant validity. Variance inflation factors for all constructs were below 3 in both groups, suggesting that multicollinearity was not a concern.

4.2. Structural Model Assessment and Predictive Relevance

Model adequacy was further evaluated based on explanatory and predictive power. Using the PLS algorithm, the rural-background model showed R² values above 0.30 for the endogenous constructs. Specifically, family cultural capital explained 0.325 of the variance in academic engagement and 0.645 of the variance in research self-efficacy (direct and indirect effects combined), indicating good explanatory power. Blindfolding results yielded Q² = 0.310 for academic engagement and Q² = 0.225 for research self-efficacy; both values exceeded 0, supporting predictive relevance. In addition, the SRMR was 0.073, below the recommended cutoff of 0.08, suggesting acceptable model adequacy (Hair et al., 2021). Overall, the rural-background model demonstrated satisfactory fit and was suitable for subsequent analyses.

For the urban-background model, R² values were also above 0.30 for the endogenous constructs. Family cultural capital explained 0.300 of the variance in academic engagement and 0.581 of the variance in research self-efficacy (direct and indirect effects combined), indicating good explanatory power. Blindfolding results showed Q² = 0.276 (academic engagement) and Q² = 0.334 (research self-efficacy), both greater than 0, indicating adequate predictive relevance. The SRMR was 0.064, again below 0.08, suggesting acceptable model adequacy (Hair et al., 2021). Taken together, the urban-background model also showed satisfactory fit and supported further hypothesis testing.

4.3. Direct Effects in the Rural-Background Group

Table 2 displays the path coefficients for the rural-background group. Embodied family cultural capital was positively associated with academic engagement ($\beta = 0.583$, $p < 0.001$), supporting H1a. Academic engagement was positively associated with research self-efficacy ($\beta = 0.745$, $p < 0.001$), supporting H3.

However, embodied family cultural capital was not directly associated with research self-efficacy ($\beta = 0.103$, $p = 0.121$). Objectified family cultural capital was not significantly associated with academic engagement ($\beta = -0.020$, $p = 0.779$), but it was negatively associated with research self-efficacy ($\beta = -0.101$, $p = 0.046$). Institutionalized family cultural capital was not significantly associated with either academic engagement ($\beta = 0.008$, $p = 0.883$) or research self-efficacy ($\beta = -0.051$, $p = 0.187$).

Overall, in the rural-background group, H1a and H3 were supported, whereas H1b, H1c, H2a, H2b, and H2c were not supported.

Table 2. Model Path Coefficients for the Rural-Background Sample.

Hypothesis	Standardized Estimate	Standard Error (SE)	t-Value	p-Value	Result
EFCC → AE	0.583	0.062	9.442	0.000	Supported
EFCC → RSE	0.103	0.067	1.551	0.121	Not supported
OFCC → AE	−0.020	0.071	0.280	0.779	Not supported
OFCC → RSE	−0.101	0.051	1.994	0.046	Significant negative effect
IFCC → AE	0.008	0.057	0.148	0.883	Not supported
IFCC → RSE	−0.051	0.039	1.320	0.187	Not supported
AE → RSE	0.745	0.063	11.805	0.000	Supported

Note. EFCC = embodied family cultural capital; OFCC = objectified family cultural capital; IFCC = institutionalized family cultural capital; AE = academic engagement; RSE = research self-efficacy.

The estimated structural model for the rural-background group is presented in Figure 2. The figure visually summarizes the standardized path coefficients reported in Table 2 and shows the pattern of significant and nonsignificant relationships in the rural-background sample.

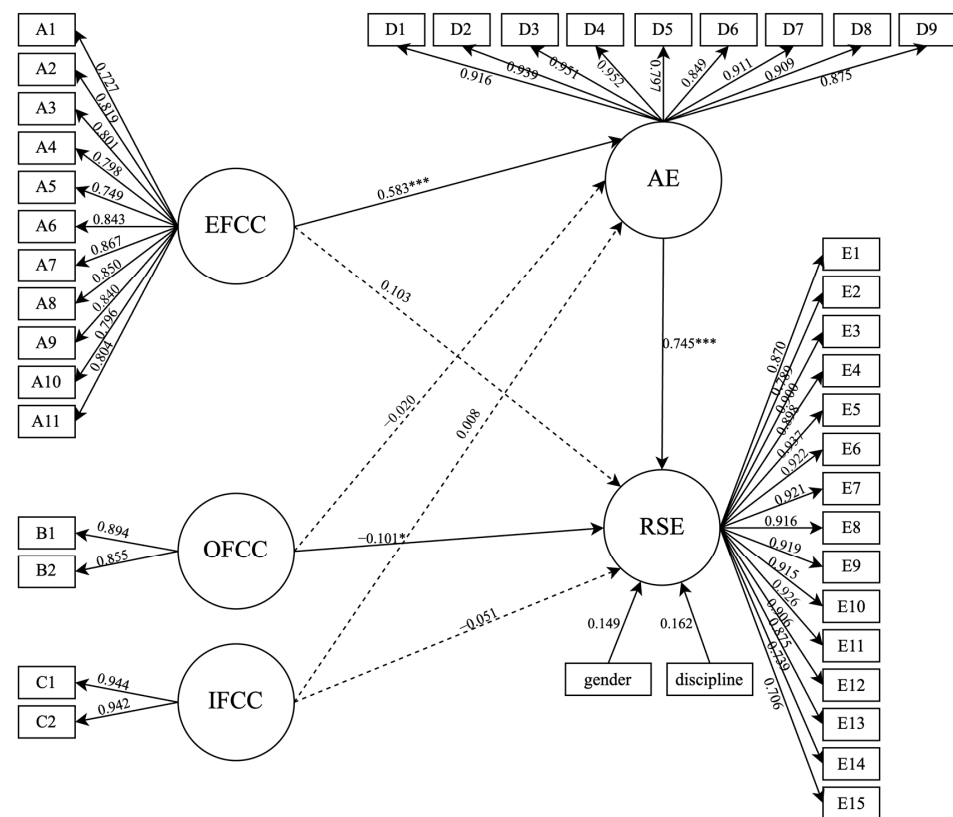


Figure 2. Path Diagram for Hypothesis Testing in the Rural-Background Sample Model. Note. EFCC = embodied family cultural capital; OFCC = objectified family cultural capital; IFCC = institutionalized family cultural capital; AE = academic engagement; RSE = research self-efficacy. Standardized coefficients are reported. Solid lines indicate statistically significant paths, whereas dashed lines indicate nonsignificant paths (* $p < 0.05$, *** $p < 0.001$).

4.4. Direct Effects in the Urban-Background Group

Table 3 displays the path coefficients for the urban-background group. Embodied family cultural capital was positively associated with academic engagement ($\beta = 0.571$, $p < 0.001$), supporting H1a. It was also positively associated with research self-efficacy ($\beta = 0.300$, $p = 0.001$), supporting H2a. Academic engagement was positively associated with research self-efficacy ($\beta = 0.565$, $p < 0.001$), supporting H3.

Objectified family cultural capital was not significantly associated with academic engagement ($\beta = -0.021, p = 0.768$) or research self-efficacy ($\beta = -0.011, p = 0.832$). Institutionalized family cultural capital was also not significantly associated with academic engagement ($\beta = -0.017, p = 0.822$) or research self-efficacy ($\beta = -0.004, p = 0.945$).

Overall, in the urban-background group, H1a, H2a, and H3 were supported, whereas H1b, H1c, H2b, and H2c were not supported.

The estimated structural model for the urban-background group is shown in Figure 3. The path diagram visually summarizes the standardized coefficients reported in Table 3. Solid lines indicate statistically significant paths, whereas dashed lines indicate nonsignificant paths.

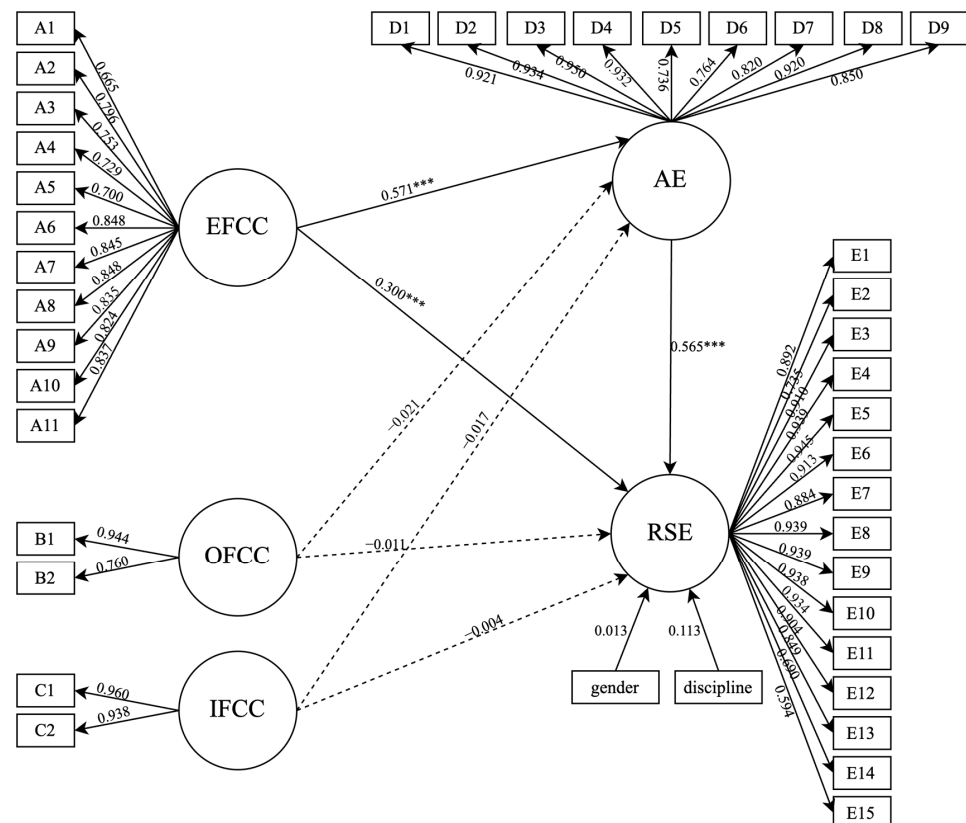


Figure 3. Path Diagram for Hypothesis Testing in the Urban-Background Sample Model. Note. EFCC = embodied family cultural capital; OFCC = objectified family cultural capital; IFCC = institutionalized family cultural capital; AE = academic engagement; RSE = research self-efficacy. Standardized path coefficients are shown. Solid lines indicate statistically significant paths, and dashed lines indicate nonsignificant paths (** $p < 0.001$).

Table 3. Model Path Coefficients for the Urban-Background Sample.

Hypothesis	Standardized Estimate	Standard Error (SE)	t-Value	p-Value	Result
EFCC → AE	0.571	0.060	9.540	0.000	Supported
EFCC → RSE	0.300	0.087	3.444	0.001	Supported
OFCC → AE	−0.021	0.072	0.295	0.768	Not supported
OFCC → RSE	−0.011	0.051	0.212	0.832	Not supported
IFCC → AE	−0.017	0.074	0.225	0.822	Not supported
IFCC → RSE	−0.004	0.056	0.069	0.945	Not supported
AE → RSE	0.565	0.085	6.669	0.000	Supported

Note. EFCC = embodied family cultural capital; OFCC = objectified family cultural capital; IFCC = institutionalized family cultural capital; AE = academic engagement; RSE = research self-efficacy.

4.5. Indirect Effects Through Academic Engagement

Bootstrapping with 5000 resamples was used to test the mediating role of academic engagement. The results are reported in Tables 4 and 5.

Table 4. Mediation Effect Test Results for the Rural-Background Sample.

Path	Point Estimate (β)	Standard Error (SE)	Z	p-Value	Percentile 95% CI	Result
EFCC $\rightarrow$ AE $\rightarrow$ RSE	0.435	0.052	8.305	0.000	[0.327, 0.535]	Supported
IFCC $\rightarrow$ AE $\rightarrow$ RSE	0.006	0.043	0.148	0.882	[−0.081, 0.087]	Not Supported
OFCC $\rightarrow$ AE $\rightarrow$ RSE	−0.015	0.053	0.282	0.778	[−0.112, 0.099]	Not Supported

Table 5. Mediation Effect Test Results for the Urban-Background Sample.

Path	Point Estimate (β)	Standard Error (SE)	Z	p-Value	Percentile 95% CI	Result
EFCC $\rightarrow$ AE $\rightarrow$ RSE	0.323	0.065	4.980	0.000	[0.209, 0.461]	Supported
IFCC $\rightarrow$ AE $\rightarrow$ RSE	−0.009	0.043	0.219	0.827	[−0.100, 0.071]	Not Supported
OFCC $\rightarrow$ AE $\rightarrow$ RSE	−0.012	0.041	0.293	0.769	[−0.086, 0.079]	Not Supported

For the rural-background group, the indirect effect of embodied family cultural capital on research self-efficacy through academic engagement was significant ($\beta = 0.435$, 95% CI [0.327, 0.535], $p < 0.001$), supporting H4a. The indirect effects of objectified family cultural capital and institutionalized family cultural capital were not significant. Specifically, the indirect effect of objectified family cultural capital was $\beta = -0.015$ (95% CI [−0.112, 0.099], $p = 0.778$) and the indirect effect of institutionalized family cultural capital was $\beta = 0.006$ (95% CI [−0.081, 0.087], $p = 0.882$). Thus, H4b and H4c were not supported in the rural-background group.

For the urban-background group, the indirect effect of embodied family cultural capital on research self-efficacy through academic engagement was also significant ($\beta = 0.323$, 95% CI [0.209, 0.461], $p < 0.001$), supporting H4a. The indirect effects of objectified and institutionalized family cultural capital were not significant. The indirect effect of objectified family cultural capital was $\beta = -0.012$ (95% CI [−0.086, 0.079], $p = 0.769$) and the indirect effect of institutionalized family cultural capital was $\beta = -0.009$ (95% CI [−0.100, 0.071], $p = 0.827$). Therefore, H4b and H4c were not supported in the urban-background group.

Taken together, the mediation results show that academic engagement mediated the association between embodied family cultural capital and research self-efficacy in both groups. However, academic engagement did not mediate the associations between objectified or institutionalized family cultural capital and research self-efficacy.

4.6. Summary of Hypothesis Testing and Group Patterns

Table 6 summarizes the hypothesis testing results across the rural- and urban-background groups.

The results indicate three main patterns. First, embodied family cultural capital was consistently associated with academic engagement in both groups. Second, academic engagement was positively associated with research self-efficacy in both groups and mediated the association between embodied family cultural capital and research self-efficacy. Third, objectified and institutionalized family cultural capital did not show significant indirect effects through academic engagement. The main group difference was that embodied family cultural capital only had a significant direct association with research self-efficacy among urban-background students, whereas objectified family cultural capital only showed a significant negative association with research self-efficacy among rural-background students.

Table 6. Summary of hypothesis testing.

Hypothesis	Path	Rural-Background Group	Urban-Background Group
H1a	EFCC → AE	Supported	Supported
H1b	OFCC → AE	Not supported	Not supported
H1c	IFCC → AE	Not supported	Not supported
H2a	EFCC → RSE	Not supported	Supported
H2b	OFCC → RSE	Significant negative effect	Not supported
H2c	IFCC → RSE	Not supported	Not supported
H3	AE → RSE	Supported	Supported
H4a	EFCC → AE → RSE	Supported	Supported
H4b	OFCC → AE → RSE	Not supported	Not supported
H4c	IFCC → AE → RSE	Not supported	Not supported

5. Discussion

5.1. The Differential Convertibility of Family Cultural Capital Across Forms

The findings provide empirical support for a form-specific reading of cultural capital theory in the context of Chinese graduate education. Across both rural- and urban-background groups, embodied family cultural capital emerged as the only form positively associated with academic engagement, while neither objectified nor institutionalized forms exhibited significant associations with engagement. This asymmetry stands in productive tension with [Yu et al. \(2022\)](#), whose work on Chinese junior high school students documented robust associations between family cultural capital—measured as a relatively unified construct—and academic achievement. The present results suggest that what appears as a coherent family-capital effect at earlier educational stages disaggregates at the graduate stage, where the three Bourdieusian forms diverge sharply in their convertibility. [Bourdieu \(1984\)](#) himself anticipated such divergence in distinguishing internalized dispositions from material goods and credentialed recognition, yet empirical operationalizations have frequently collapsed the distinction.

Embodied cultural capital, carried in students' learning dispositions and academic orientations, operates at the same behavioral register as graduate research training. Such alignment resonates with [M. Jin et al. \(2026\)](#), who emphasized that the effects of family cultural capital must be understood through the interaction between habitus and educational field. The present results extend [M. Jin et al.'s \(2026\)](#) field-dependent argument by specifying that, within the field of graduate research training, embodied dispositions retain their convertibility precisely because they have been internalized as habitus, while objectified resources—books and cultural goods—and parental credentials occupy structural positions more distal to the daily activities of doctoral and master's studies. [Tan and Fang \(2023\)](#) similarly observed that family cultural capital matters for adolescents' educational outcomes in ways that vary across contexts; the present study locates an analogous variation across forms rather than across age groups.

What the results, taken together, imply is that the direct associations of objectified and institutionalized capital with current academic engagement appear to be limited or no longer directly detectable by the time students enter graduate programs. [Wang and Huang \(2021\)](#) demonstrated that family capital was associated with higher education gains through learning engagement but did not separate the three forms; the present finding suggests a refinement of that conclusion by indicating that the engagement-mediated effect documented by [Wang and Huang \(2021\)](#) is, at the graduate level, most strongly associated with the embodied form.

5.2. Academic Engagement as the Behavioral Site of Conversion

Academic engagement was positively associated with research self-efficacy in both groups and mediated the relationship between embodied family cultural capital and research self-efficacy. Objectified and institutionalized family cultural capital did not show significant indirect effects through academic engagement. Theoretically, this pattern indicates that embodied cultural capital is proximal and behavioral, readily translating into academic engagement, whereas objectified and institutionalized forms are external resources that require additional activation steps and thus are less likely to convert through engagement. These nonsignificant indirect effects are revealing boundary conditions for the engagement-mediated pathway, reinforcing our argument that conversion is form-specific. The mediation result also reframes engagement beyond its conventional role as a statistical intermediary. Drawing on Bandura's (2001) social cognitive theory, efficacy beliefs are strengthened through mastery experiences that allow individuals to judge their capability through successful task performance. Engagement, in the present framework, supplies the behavioral substrate within which such mastery experiences become possible.

The interpretation aligns with and extends Han et al. (2024), who reported that scientific engagement and scientific research self-efficacy jointly mediated the relationship between academic atmosphere and graduate students' innovation ability. Whereas Han et al. (2024) treated engagement and self-efficacy as parallel mechanisms downstream of an institutional condition, the present results position engagement as the upstream behavioral conversion site through which a family-level resource becomes consolidated into research-specific confidence. Yao et al. (2024) likewise showed that self-efficacy-related processes underlie graduate students' scientific research creativity but did not interrogate where such efficacy originates; the present mediation pathway addresses precisely that question by tracing efficacy back through engagement to its dispositional roots.

The behavioral-site reading also speaks to Qi et al. (2023), whose findings on rural Chinese students demonstrated a close link between academic self-efficacy and learning engagement. Qi et al. (2023) interpreted the engagement–efficacy relation as bidirectional within rural school contexts. The present study, situated at the graduate stage, identifies a directional pathway in which engagement carries the influence of prior dispositional resources forward into research-specific efficacy, suggesting that the engagement–efficacy nexus may shift in functional emphasis as students' progress through educational stages. Stan et al. (2022) reported analogous engagement–efficacy linkages in online learning contexts, and the convergence across rural school, online, and graduate research settings indicates that engagement constitutes a robust conversion mechanism whose specific content is shaped by the field in which it is enacted.

Family-based dispositions, however well cultivated, do not automatically produce research confidence; they must be activated through sustained participation in academic work. The argument complicates accounts that treat self-efficacy as a direct downstream product of background resources, foregrounding instead the practice through which resources are rendered consequential.

5.3. Asymmetric Conversion Pathways Across Rural–Urban Contexts

The most distinctive contribution of the present study lies in revealing that the conversion of embodied family cultural capital follows asymmetric pathways across rural- and urban-background students. Among urban-background students, embodied cultural capital was associated with research self-efficacy through both a direct pathway and an indirect pathway via academic engagement. Among rural-background students, only the indirect pathway reached statistical significance.

The asymmetry reframes a long-standing concern in the Chinese higher education literature. Guo and Li (2024) documented that regional inequality in China's educational development remains closely tied to urban–rural disparities, and Tan and Fang (2023) showed that family social and cultural capital operate differently across rural–urban backgrounds for adolescents. Both lines of work, however, conceptualized rural–urban differences primarily as differences in resource distribution. The present results reposition the rural–urban divide as a difference in conversion mechanism—identical forms of embodied capital follow distinct routes to research self-efficacy depending on the structural context in which conversion is enacted. Such repositioning responds to M. Jin et al.'s (2026) call to attend to the field-dependent operation of cultural capital, while specifying that field-dependence at the graduate stage takes the form of asymmetric pathway availability rather than uniform path attenuation.

Theoretically, urban-background students inhabit an institutional context in which family-cultivated dispositions are recognized and rewarded with relative immediacy. Their habitus aligns more readily with the implicit expectations of Chinese research universities, allowing embodied cultural capital to translate into research confidence through a direct dispositional channel that supplements the engagement-mediated route. Rural-background students, by contrast, traverse a longer conversion route. For them, embodied cultural capital becomes relevant to research only through its enactment in academic engagement; in the absence of such enactment, the dispositional resources cultivated in rural family contexts do not directly yield research self-efficacy. This asymmetry resonates with Bourdieu's (1984) argument that the convertibility of cultural capital depends on its recognition within a specific field, and indicates that recognition itself is unevenly distributed across rural- and urban-background students even when the dispositional content is comparable.

A further finding deserving discussion is the negative association between objectified family cultural capital and research self-efficacy observed exclusively among rural-background students. Given that our quantitative data do not directly measure the underlying psychological or sociocultural processes, the following interpretation is speculative. The result is interpretable through the lens of cultural incongruence between home-accumulated cultural goods and the disciplinary culture of urban research universities. Material cultural objects accumulated in rural family contexts may carry meanings and reference points that diverge from those valued in graduate research environments, potentially generating a sense of mismatch rather than support when rural-background students enter such environments. The interpretation extends Tan and Fang's (2023) observation that family capital operates differently across rural–urban contexts by identifying a specific form—the objectified form—through which the differential operation may, paradoxically, take an inhibiting form. The interpretation remains tentative pending qualitative investigation, yet it underscores that possessing more cultural objects does not guarantee greater research confidence and may, under conditions of cultural mismatch, exert a counterproductive effect.

5.4. Theoretical and Practical Implications

Taken together, the findings reposition family cultural capital from a static endowment to a conditionally convertible resource. Three theoretical implications follow. First, Bourdieu's (2018) tripartite distinction must be operationalized rather than collapsed; treating cultural capital as a unitary construct, as much existing work has done, conceals the very mechanisms through which it operates. Yu et al. (2022) and Wang and Huang (2021) advanced our understanding of family-capital effects on educational outcomes through unified or partially differentiated measures, and the present study contributes to that trajectory by showing that the three Bourdieusian forms diverge sharply at the graduate stage. Second, social cognitive theory (Bandura, 1986) and cultural capital theory (Bourdieu & Passeron, 1990) are productively integrated through the construct of academic engagement,

which supplies the behavioral bridge that neither framework alone fully specifies. Han et al. (2024) and Yao et al. (2024) demonstrated the relevance of self-efficacy mechanisms to graduate research outcomes; the present integration locates the dispositional origins of such efficacy within family-based habitus and traces the behavioral pathway through which the origins become consequential. Third, rural–urban background should be theorized not merely as a distributional axis along which resources differ in quantity, but as a structural condition under which identical resources follow distinct conversion pathways—a reformulation that extends the work of Guo and Li (2024) and Tan and Fang (2023) by shifting analytic focus from possession to mechanism.

Practically, the results suggest that interventions aimed at strengthening rural-background graduate students' research self-efficacy should prioritize the cultivation and recognition of academic engagement, given that engagement may constitute the singular convertible pathway available to them. Programs that rely on transferring urban cultural goods or credential-based resources are unlikely to yield equivalent effects, since neither objectified nor institutionalized capital exhibited convertibility into engagement in either group. Supervisors and graduate programs may instead invest in engagement-supporting practices—structured research participation, sustained dialogic supervision, and disciplinary apprenticeship—that activate rural-background students' embodied dispositions and render them relevant to research. The recommendation aligns with Qi et al.'s (2023) emphasis on the engagement–efficacy linkage in rural educational contexts and translates that linkage into a graduate-stage intervention logic. However, we emphasize that these implications are derived from correlational findings; future longitudinal or experimental research would be needed to establish whether such practices causally improve research self-efficacy. We also acknowledge that the cross-sectional nature of our data precludes causal or temporal inferences; our findings support statistical associations rather than causal sequences. To address this limitation, we plan to conduct follow-up qualitative interviews in future research to complement the quantitative findings and to explore the causal mechanisms implied by our theoretical model.

6. Conclusions

This study examined the form-specific and context-dependent convertibility of family cultural capital among Chinese graduate students. By distinguishing embodied, objectified, and institutionalized family cultural capital, the study showed that family cultural capital does not operate as a uniform advantage in graduate education. Its relevance to research self-efficacy depends on both the form of capital and the pathway through which it is enacted.

The findings indicate that embodied family cultural capital was the most convertible form. It was positively associated with academic engagement among both rural- and urban-background students, and academic engagement was positively associated with research self-efficacy in both groups. Academic engagement mediated the relationship between embodied family cultural capital and research self-efficacy, suggesting that family-shaped dispositions become relevant to research when translated into active academic participation.

The study also found rural–urban differences in this conversion process. Among urban-background students, embodied family cultural capital was associated with research self-efficacy both directly and indirectly through academic engagement. Among rural-background students, this relationship operated only through academic engagement. This pattern suggests that rural-background students may rely more strongly on current academic participation to transform family-based dispositions into research confidence.

In contrast, objectified and institutionalized family cultural capital showed limited roles in the model. Neither form had a significant indirect effect on research self-efficacy through academic engagement, and institutionalized family cultural capital showed no

significant direct association with either academic engagement or research self-efficacy. Overall, the findings highlight academic engagement as a key pathway through which embodied family cultural capital is converted into research self-efficacy and show that rural–urban background shapes this process in graduate education.

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Institutional Review Board Statement: Pursuant to the Measures for Ethical Review of Life Sciences and Medical Research Involving Humans (promulgated in February 2023 by the National Health Commission of China, the Ministry of Education, the Ministry of Science and Technology, and the National Administration of Traditional Chinese Medicine), this study qualifies for exemption from ethical review. Article 32 of these Measures stipulates: “For life sciences and medical research involving humans that uses human information data or biological samples, where no harm is caused to the human body, no sensitive personal information is involved, and no commercial interests are concerned, ethical review may be exempted so as to reduce unnecessary burdens on researchers and promote the conduct of life sciences and medical research involving humans.”

Informed Consent Statement: Written informed consent was obtained from all subjects involved in the study to publish this paper.

Data Availability Statement: Data are available upon reasonable request.

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

Appendix A

Table A1. Items in the Family Cultural Capital Scale.

Variable	Dimension	Items
EFCC	Family Educational Expectations	A3: Your parents expect you to have a rich spiritual life. A4: Your parents hope you become an expert in a certain field. A5: Your parents hope you continue your studies.
	Family Cultural Habits	A1: Your family environment is very harmonious and loving. A2: Your parents pay great attention to cultivating your interests. A6: Your parents regularly pay attention to current events. A7: Your father has a habit of reading and learning regularly. A8: Your mother has a habit of reading and learning regularly. A9: Your parents frequently take you to movies or travel. A10: Your parents frequently take you to cultural and artistic activities (such as watching performances, art exhibitions, visiting museums, etc.). A11: Your parents frequently discuss your study life with you and offer advice.
OFCC	Durable Goods Quantity	B1: The number of cultural souvenirs in your home. B2: The number of books in your home.
IFCC	Parents' Educational Level	C1: The education level of your mother is: C2: The education level of your father is:

Table A2. Items in the Academic Engagement Scale.

Variable	Items
AE	D1: I feel energized when studying.
	D2: I feel strong and full of vitality when studying.
	D3: I am passionate about my study work.
	D4: Studying inspires me.
	D5: As soon as I wake up in the morning, I want to engage in study work.
	D6: I feel happy when my studying is progressing smoothly.
	D7: I feel proud of the study work I am involved in.
	D8: I become immersed in my studies.
	D9: I enter a state of flow while studying.

Table A3. Items in the Research Self-Efficacy Scale.

Variable	Items
RSE	E1: Under the guidance of my supervisor, I am able to conceive research topics that are of research significance and practical value.
	E2: I am proficient in using Chinese and English literature databases (such as CNKI, Web of Science) to search for literature on specific research topics.
	E3: Under the guidance of my supervisor, I am able to systematically organize and write literature reviews on specific research topics.
	E4: Under the guidance of my supervisor, I am able to propose research questions with scientific value.
	E5: Under the guidance of my supervisor, I am able to select appropriate research methods (such as experiments, surveys, interviews, etc.) for the research questions.
	E6: Under the guidance of my supervisor, I am able to write project proposals that meet standards and pass my supervisor's review.
	E7: I am able to systematically collect and organize research data (such as conducting experiments, surveys, transcribing interviews, or coding texts).
	E8: Under the guidance of my supervisor, I am able to use appropriate data management and analysis tools to process research data.
	E9: Under the guidance of my supervisor, I am able to complete data analysis and identify the most meaningful results.
	E10: Under the guidance of my supervisor, I am able to reasonably interpret data analysis results and avoid overgeneralization.
	E11: Under the guidance of my supervisor, I am able to derive the most valuable research conclusions based on theoretical and empirical analysis, while pointing out limitations.
	E12: Under the guidance of my supervisor, I am able to write a thesis or journal article that meets academic standards.
	E13: I am able to effectively present research findings in group meetings or academic conferences.
	E14: I am able to follow academic ethical standards (such as citation format, experimental ethics review).
	E15: I am able to adhere to graduate academic integrity rules (such as avoiding plagiarism, data fabrication).

Appendix B

Table A4. Compositional Invariance Assessment (MICOM Step 2).

Construct	Original Correlation (c)	Correlation Permutation Mean	5.0% Quantile	Permutation p-Value	Passed
EFCC	0.999	0.999	0.998	0.193	Yes
IFCC	1.000	0.985	0.947	0.822	Yes
AE	1.000	1.000	1.000	0.388	Yes
OFCC	0.991	0.977	0.920	0.471	Yes
RSE	1.000	1.000	1.000	0.900	Yes

Appendix C

Table A5. Measurement Model Results for the Rural-Background Sample.

Dimension and Item	Factor Loading	Cronbach's α	CR	AVE
EFCC				
A1	0.727	0.947	0.954	0.655
A2	0.819			
A3	0.801			
A4	0.798			
A5	0.749			
A6	0.843			
A7	0.867			
A8	0.850			
A9	0.840			
A10	0.796			
A11	0.804			
OFCC				
B1	0.894	0.694	0.867	0.765
B2	0.855			
IFCC				
C1	0.944	0.875	0.941	0.889
C2	0.942			
AE				
D1	0.916	0.971	0.975	0.812
D2	0.939			
D3	0.951			
D4	0.952			
D5	0.797			
D6	0.849			
D7	0.911			
D8	0.909			
D9	0.875			
RSE				
E1	0.870	0.978	0.981	0.772
E2	0.789			
E3	0.900			
E4	0.898			
E5	0.937			
E6	0.922			
E7	0.921			
E8	0.916			
E9	0.919			
E10	0.915			
E11	0.926			
E12	0.906			
E13	0.875			
E14	0.739			
E15	0.706			

Table A6. Measurement Model Results for the Urban-Background Sample.

Dimension and Item	Factor Loading	Cronbach's α	CR	AVE
EFCC				
A1	0.665	0.939	0.948	0.627
A2	0.796			
A3	0.753			
A4	0.729			
A5	0.700			
A6	0.848			
A7	0.845			
A8	0.848			
A9	0.835			
A10	0.824			
A11	0.837			
OFCC				
B1	0.944	0.668	0.845	0.734
B2	0.760			
IFCC				
C1	0.960	0.891	0.948	0.900
C2	0.938			
AE				
D1	0.921	0.960	0.966	0.762
D2	0.934			
D3	0.950			
D4	0.932			
D5	0.736			
D6	0.764			
D7	0.820			
D8	0.920			
D9	0.850			
RSE				
E1	0.892	0.976	0.979	0.762
E2	0.735			
E3	0.910			
E4	0.939			
E5	0.945			
E6	0.913			
E7	0.884			
E8	0.939			
E9	0.939			
E10	0.938			
E11	0.934			
E12	0.904			
E13	0.849			
E14	0.690			
E15	0.594			

Appendix D

Table A7. Discriminant Validity Test for Variables in the Rural-Background Sample.

Latent Variable Pair	HTMT Value	Percentile 95% CI		Is It Valid?
		Lower	Upper	
EFCC ↔ OFCC	0.366	0.186	0.568	Yes
EFCC ↔ IFCC	0.114	0.087	0.254	Yes
EFCC ↔ AE	0.595	0.473	0.703	Yes
EFCC ↔ RSE	0.520	0.386	0.645	Yes
OFCC ↔ IFCC	0.494	0.295	0.664	Yes
OFCC ↔ AE	0.190	0.081	0.372	Yes
OFCC ↔ RSE	0.078	0.066	0.260	Yes
IFCC ↔ AE	0.052	0.041	0.199	Yes
IFCC ↔ RSE	0.073	0.049	0.260	Yes
AE ↔ RSE	0.807	0.726	0.876	Yes

Table A8. Discriminant Validity Test for Variables in the Urban-Background Sample.

Latent Variable Pair	HTMT Value	Percentile 95% CI		Is It Valid?
		Lower	Upper	
EFCC ↔ OFCC	0.608	0.468	0.746	Yes
EFCC ↔ IFCC	0.272	0.161	0.410	Yes
EFCC ↔ AE	0.585	0.460	0.701	Yes
EFCC ↔ RSE	0.627	0.525	0.720	Yes
OFCC ↔ IFCC	0.638	0.486	0.788	Yes
OFCC ↔ AE	0.289	0.161	0.444	Yes
OFCC ↔ RSE	0.317	0.175	0.461	Yes
IFCC ↔ AE	0.129	0.047	0.286	Yes
IFCC ↔ RSE	0.130	0.049	0.285	Yes
AE ↔ RSE	0.756	0.649	0.841	Yes

Appendix E

Table A9. Multicollinearity Test for the Rural-Background Sample.

Dependent Variable	Independent Variable	VIF	Results
AE	EFCC	1.101	Pass
	OFCC	1.291	Pass
	IFCC	1.182	Pass
RSE	EFCC	1.629	Pass
	OFCC	1.293	Pass
	IFCC	1.184	Pass
	AE	1.505	Pass

Table A10. Multicollinearity Test for the Urban-Background Sample.

Dependent Variable	Independent Variable	VIF	Results
AE	EFCC	1.339	Pass
	OFCC	1.608	Pass
	IFCC	1.286	Pass
RSE	EFCC	1.812	Pass
	OFCC	1.619	Pass
	IFCC	1.301	Pass
	AE	1.452	Pass

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