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Whether Socioeconomic Status Matters in Accessing Residential College: Role of RC in Addressing Academic Achievement Gaps to Ensure Sustainable Education

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Abstract: Following the fourth objective of the United Nations' Sustainable Development Goals (SDGs), education disparities are one of the most serious issues holding back national development. Despite efforts being made to tackle this discrepancy, it has long been a source of concern for many communities. It is important to note that residential colleges (RCs) have evolved and contributed to higher education for several decades now, aiming to provide an equal and inclusive living and learning environment. Having said that, while disparity is still one of the most challenging issues in this system, it has not been fully examined. Using stratified random sampling on RC students' data from undergraduate universities piloting RC programs up to 2018 in different parts of China, this study examines the effects of socioeconomic status (SES) on RC access. The study further explores the difference in academic achievement among RC students from diverse SES backgrounds and comprehensively analyzes the impact of RC on sustainable education. The study finds that disparities exist in accessing RC for individuals from varied SES backgrounds. However, RC mitigates the influence of SES on academic achievement to curtail these differences. The findings imply that ensuring access to RC for individuals from underprivileged SES backgrounds should be prioritized to address education-disparity-related challenges.

Keywords: China; residential college; socioeconomic status; education disparity; sustainable education

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1. Introduction

Securing fair access for individuals seeking top-notch education to improve their learning and job prospects is a fundamental goal of the global development strategies [1,2]. In 2015, the United Nations introduced 17 Sustainable Development Goals (SDGs) to address critical global social, environmental, and economic issues [3,4]. The fourth SDG intends to guarantee inclusive and fair access to high-quality education while fostering lifelong learning opportunities for everyone [5]. Tertiary education has played a crucial role in driving national economic growth, not just through teaching and research but also via societal engagement, governance policies, and collaborative initiatives among universities [6,7]. However, persistent challenges hinder international efforts to ensure sustainable education [8], with disparities in socioeconomic status (SES) stemming from individuals' family backgrounds posing a notable obstacle [9].

Theoretical and empirical evidence underscores the significant influence of SES on students' educational opportunities and academic performance [10–12]. Students from less affluent SES backgrounds often face pronounced setbacks, delays, and disparities [12]. Conversely, those with higher SES backgrounds typically enjoy enhanced access to educational resources and opportunities, including a broader choice of schools, homeschooling support, and academic counseling [9,11]. Unfortunately, students from lower SES backgrounds often lack crucial educational resources, hindering their school attendance and academic

achievement [12]. Despite these disparities, the right to access quality education should be universal and not confined to specific societal groups, cohorts, or classes [13].

There is widespread consensus that education stands as one of the most potent tools for dismantling social barriers and fostering a more equitable national economic development [14]. A well-functioning education system, spanning from primary schools to universities, plays a pivotal role in preventing discrimination or privilege [9]. In particular, higher education contributes significantly to enhancing social mobility by enabling students from underprivileged backgrounds to enter professional fields and build meaningful careers [15]. While tertiary education enrolments are rapidly increasing in many nations, indicating a more socially inclusive character, it is essential to recognize that the role of education in promoting social mobility varies across countries, evolves over time, and depends on specific circumstances [16].

Residential colleges (RCs) boast a rich history, closely tied to esteemed institutions, such as Cambridge, Oxford, Yale, and Harvard [17,18]. Functioning as distinctive living and learning communities within tertiary institutions, RCs have played a pivotal role in shaping the landscape of higher education [18–20]. The character and reforms of RCs have undergone continual evolution. By establishing seamless learning communities, RCs strive to cultivate a supportive and inclusive learning environment, enabling students to engage in academic pursuits, personal development, and meaningful social interactions [19–21]. Recognized as high-impact learning institutions, RCs significantly contribute to students' academic success and overall development in numerous countries [22].

However, a crucial question arises: Does the transformation of RCs enhance access for students from diverse socioeconomic backgrounds, promoting inclusive and quality education? Can this educational model be deemed 'sustainable' in alignment with the attainment of SDGs? This query remains unanswered, and the subsequent section elucidates the research questions formulated for this study.

Research Gap, Scope: Objectives and Questions

Numerous studies have extensively explored the efficacy of RCs, with theoretical and empirical investigations [19,21–23]. Their findings underscore that RCs play a positive role in enhancing school engagement, academic achievement, and personal growth. Additionally, a wealth of research consistently establishes SES as a significant predictor of academic success [9,10,24–27]. The prevailing consensus strongly indicates a positive correlation between SES and academic performance [6–29].

Moreover, parallel research has delved into the role of educational institutions and systems in addressing SES disparities. For instance, a study drawing on data from the 2015 Program for International Student Assessment (PISA) across seven east Asian countries reveals that the use of information and communications technology (ICT) does not act as a mediator in the relationship between SES and academic performance [30]. Another study conducted in Bangladesh, as highlighted by Alam and Forhad [31], combines qualitative and quantitative analyses to reveal that engineering education does not resolve the influence of SES on academic and professional advancement. Nonetheless, insights from Downey and Condorn [24] emphasize that schools have the potential to counteract the constraints imposed by socioeconomic inequality by ensuring the effective teaching of academic and other essential learning skills.

Insufficient research has delved into the SES dynamics related to students' access to and participation in RCs, particularly within the context of how tertiary institutions contribute to the SDGs [6]. This study endeavors to bridge this gap in our understanding, focusing on China as the case study. Having identified this knowledge gap and the study's scope, the research objectives and questions are outlined. The primary aim is to explore whether RCs in China contribute to leveling socioeconomic disparities or whether a privileged SES background dictates access to RC education. The specific objectives include, first, mapping the socioeconomic diversity of RC students; second, investigating how RCs mitigate academic performance gaps among different SES groups; and third,

discerning the impact of RCs on sustainable education. The ensuing questions aim to address these objectives:

RQ1. Does SES matter in accessing RC?

RQ2. Does RC mitigate academic achievement discrepancies between different SES groups?

RQ3. Does RC play a significant role in supporting sustainable education?

The subsequent section comprises the literature review, followed by an elucidation and justification of the research methodology. The concluding section will summarize the findings and lead to a discussion.

2. Literature Review and Hypothesis Development

This section begins by examining the correlation between SES and education. Subsequently, it delves into the transformations of RCs. The literature review culminates in an exploration of the effectiveness of RCs, with particular emphasis on their impact on sustainable education.

2.1. Relationship between SES and Education

SES is commonly defined as a hierarchical ranking system based on varying levels of access to resources and social status, which individuals either inherit or acquire. It is typically assessed through three dimensions: parents' education attainment, occupation, and income [30,32,33]. The relationship between SES and education is reciprocal and complementary in nature [34]. Numerous studies have underscored the significance of SES in predicting the quality of one's education, including academic achievement [10–12,14,15]. Students from higher SES backgrounds tend to attain higher grades and academic success due to better access to school resources and higher participation rates, in contrast to their peers from lower SES backgrounds [26–29]. Therefore, it is hypothesized that SES positively influences students' academic achievement.

However, it is a fundamental right for individuals from diverse and often less affluent backgrounds to have access to education. Education acts as a catalyst for enhancing individuals' human capital, potentially overcoming and surpassing socioeconomic dis-advantages in many instances [35]. By opening the doors to higher income and social status, individuals with more years of schooling are better equipped to counteract the adverse effects of disadvantaged SES in their future professional lives [36]. Higher education, particularly for individuals from rural backgrounds, serves as an institutionalized pathway, offering an opportunity to attain status in urban environments and achieve upward mobility [15]. Education not only elevates the individuals' SES but also plays a crucial role in facilitating the sustainable development of society [2,6,31].

2.2. Transformation of RCs in Higher Education

RCs represent self-contained communities within larger universities, where students from diverse backgrounds reside together and actively engage in social, academic, and extracurricular activities under the guidance of faculty and staff [18]. What sets RCs apart from traditional dormitories is their primary objective of seamlessly integrating students' social and academic experiences. This integration is fostered through increased interaction with faculty and peers, coordinated learning activities, and the creation of a supportive living environment [37,38].

The roots of RCs trace back to the medieval colleges of Oxford and Cambridge in the United Kingdom [17]. Originating in institutions closely affiliated with the church, these early models prioritized providing a residential environment for scholars to live and study together in [18]. The collegiate system pioneered by Oxbridge universities became a global inspiration, leading to the establishment of RCs in countries such as the United States, Australia, Singapore, China, and beyond [18].

Furthermore, the nature and structure of RCs have continuously evolved to align with the changing needs and expectations of students and society at large [18,38]. RCs are

typically characterized by four key dimensions: residential environment, faculty interaction, peer communication, and engagement in co-curricular activities [37–39]. Transitioning from conventional housing models to dynamic hubs of academic and social integration, RCs have become indispensable components of the overall student experience at numerous universities worldwide.

2.3. Sustainable Education Perspective on RCs

Numerous studies have investigated the role of RCs in enhancing the quality of education by cultivating an environment, which encourages meaningful interactions with both faculty and peers, in and out of the classroom [40]. Through the provision of shared living spaces and collaborative learning activities, RCs contribute to an enriched overall student experience, fostering a strong sense of community and belonging [23]. Furthermore, RCs offer tailored academic support services aimed at promoting intellectual growth and improving learning outcomes [19,22]. Some researchers have observed that RC students demonstrate heightened social interaction, increased GPAs, and higher academic success rates compared to their non-RC counterparts [21,41]. However, it is imperative to acknowledge that the context of RCs plays a pivotal role, as students' achievements are significantly impacted by the learning environments and programs provided [40,42].

In addition, schools and education systems have been acknowledged as effective tools for mitigating the impact of SES on academic outcomes [9,25]. The social reproduction theory, proposed by sociologists Bourdieu and Passeron [43], offers an alternative perspective, suggesting that the education system can perpetuate existing social and economic inequalities by transmitting advantages and disadvantages across generations. This theory challenges the notion that equal educational opportunities alone, provided by schools or political initiatives, can entirely eliminate societal inequalities [44,45]. Consequently, the social reproduction theory prompts a critical examination of whether RCs predominantly serve privileged students, reinforcing existing socioeconomic or political hierarchies, or whether they genuinely contribute to achieving sustainable equality in higher education. Based on these considerations, the following hypotheses are posited:

Hypothesis 1 (H1). *RC positively impacts academic achievement for students who come from diverse SES backgrounds.*

Hypothesis 2 (H2). *SES differences do not affect RC in supporting academic achievement, and there are no significant differences in RCs' impact between various SES groups. In fact, the RC mitigates academic achievement gaps among different SES groups.*

The research framework illustrating these hypothesized relationships among the constructs is presented in Figure 1.

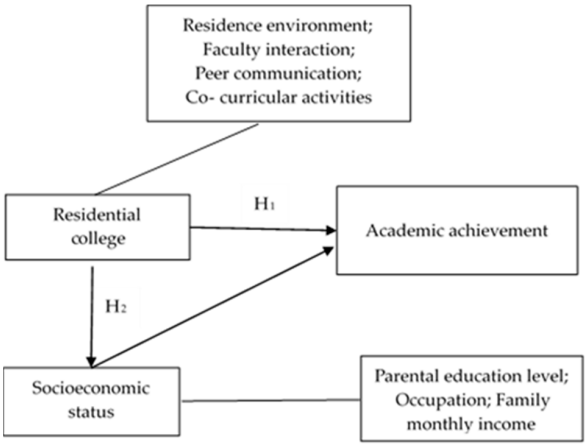

Figure 1. Research framework.

After establishing the hypotheses with the aid of the existing literature, it is essential to highlight pertinent details about the research context. This will provide a solid rationale for justifying the chosen research methodology.

3. Methodology

This study employs a quantitative methodology. First, the research context is presented, providing support for the rationale behind the chosen research methodology. This is followed by an explanation of the population and sampling. Subsequently, the outlined instrument is introduced, and this is followed by an explanation of the methods employed for data collection and data analysis.

3.1. Context of the Study

This section elucidates the research context and subsequently provides support for the rationale behind the chosen research methodology. In China, the government's policy of compulsory education and the expansion of the school system have greatly raised the literacy levels of millions of people in recent decades. However, persistent disparities in access to educational resources persist in urban and rural areas, across different regions, and social class divisions continue to impede the pursuit of educational equity [46]. Studies illustrated that SES has remained a crucial factor influencing educational equality since China's economic reforms and global integration, and this influence persists despite the increased enrolment in schools [15,47].

Throughout compulsory and secondary education, families from advantaged SES backgrounds often leverage social resources to enroll their children in schools equipped with better teaching facilities, granting them access to superior faculty resources and a conducive learning environment [46]. Conversely, families from disadvantaged SES backgrounds lack the economic and social means to provide additional support beyond their children's personal efforts. These circumstances contribute to academic disadvantages for students from underprivileged SES backgrounds, particularly when they progress to tertiary education [46].

In the realm of tertiary education, China boasts the world's largest system, with tertiary gross enrolment increasing from 30% in 2012 to 57.8% in 2021 [48]. This expansion has significantly widened access to college education for individuals from economically challenged backgrounds [49]. However, the substantial growth in tertiary education has not consistently translated into more equitable access to elite universities and education of equivalent quality [50,51]. In response to this challenge, RCs have developed as a novel strategy to reform higher education in China. In the Chinese context, RCs represent a unique student affairs management system designed to cultivate well-rounded and innovative talents through a synthesis of liberal and professional education [51,52]. The initiative of RC reforms can be traced back to 2005 when several top first-class central public universities in China, including Fudan University and Xi'an Jiao-tong University, implemented this system [53]. The Chinese government implemented a set of regulations concerning RCs in 2012, raising their growth from an institutional effort to a national-level education policy.

As a result, an increasing number of universities have adopted this system, rising from 5 to 97 by 2020 [53]. Significantly, this expansion encompasses a broader spectrum of university categories, encompassing both large, medium, and small-sized universities, as well as public and private institutions, among others. The evolution of RCs in China reflects a shift from elite to mass education, emphasizing a commitment to delivering equitable and high-quality education to students from diverse backgrounds. However, the degree to which this system genuinely promotes educational equality and quality within the Chinese context necessitates further investigation, rendering this study highly pertinent.

3.2. Target Population, Sampling, and Sample Size

Informed by the fieldwork, the institution of interest in this study consisted of 77 universities, which initiated the implementation of RCs in 2018 or earlier. This decision was guided by the typical duration of 4–5 years required for completing undergraduate education in China, ensuring the availability of comprehensive academic performance records for all participants.

The stratified random sampling method was employed to ensure the creation of a representative sample from the target 77 universities, which were categorized based on their geographical locations. There were 12 universities in the central district, 14 in the western district, and 51 in the eastern district. To achieve triangulation, respondents from each district's universities were sampled, maintaining an approximate ratio of 1:1:4 for each region to account for the significant difference in the total number of universities. This resulted in selection of one sample university from both the central and western districts and four from the eastern district.

The western, central, and eastern sample universities contributed 112, 739, and 3600 RC students, respectively, leading to a total population size of 4451. According to the Re-search Advisor [54], the required sample size for 4451 RC students at a 95% confidence level and a 3.5% margin of error is 667. This method reduces the margin of error for sampling and increases the required confidence interval to obtain a larger and representative sample size. Then, a proportional stratified selection strategy was employed to choose the actual study sample from each sample institution. This led to selection of 17 RC students from the western university, 111 from the central university, and 539 from the eastern university (Table 1). This sampling strategy converts a segmented or separated target population into a homogeneous population, guaranteeing that each segment has an equal probability of being chosen, thus enhancing the representativeness of the sample [55].

Table 1. Sample and sampling.

District	Number of Universities	Sample Universities	Number of RC Students	RC Sample Students
Western	14	1	112	17
Central	12	1	739	111
Eastern	51	4	3600	539
Total	77	6	4451	667

Note: Extracted by authors.

3.3. Instrumentation

The questionnaire employed in this study draws upon instruments validated in previous research [41,56]. It comprises three sections aligned with the research framework. The initial section encompasses personal profiles, capturing seven factors, including gender, ethnicity, family district, schooling year, major, name, and matric number. Consistent with established literature on the economics of education, academic achievement is assessed using the cumulative grade point average (CGPA) on a 4.0 scale [8]. To ensure data accuracy, the respondents' names and matric numbers are identified, facilitating the collection of secondary data on precise CGPA from academic records at the sample universities. The second section delves into SES background, incorporating three dimensions with five indicators each (parents' education level, occupation, and family monthly income). The third section evaluates RCs across four dimensions—residence hall environment, faculty interaction, peer communication, and engagement in co-curricular activities—further divided into seven factors. Simultaneously, the third section of the questionnaire utilizes a 5-point Likert-type scale.

A pilot study was conducted at another university, which was not part of the sample institutions. The questionnaire's reliability was tested using the internal consistency coefficient Alpha (α) during the pilot study. Once the pilot study was completed, certain changes were made to the instruments to improve their face and content validity. These changes

were made in response to feedback from education professionals, RC faculty members, and some student viewpoints.

Additionally, the structural validity of the scales was verified using confirmatory factor analysis (CFA). As presented in Table 2, all constructs in this analysis had α values exceeding 0.70. If α values are greater than 0.70, the instrument is deemed to be reliable [57]. Therefore, reliability was established in this research, and the CFA showed good data fit for the scale ($\chi 2 = 338.283$, df = 329, $p = 0.350$, RMSEA = 0.007; CFI = 0.999; TLI = 0.998) [58]. Moreover, the seven components had AVE values greater than 0.5, and the composite reliability (CR) values were greater than 0.7. All factors were remarkably correlated ($p < 0.01$). The diagonal values were all greater than the other values in the same row and column (Table 2). The constructs of this scale differed greatly from each other. Hence, the validity of the data in this study was clearly demonstrated.

Table 2. Reliability and correlation matrix.

Factors	RHE1	RHE2	FI1	FI2	PC1	PC2	CA1
RHE1: Academic support	**0.707**						
RHE2: Social support	0.232 **	**0.711**					
FI1: Course-related interaction	0.261 **	0.354 **	**0.733**				
FI2: Faculty mentorship	0.228 **	0.356 **	0.323 **	**0.715**			
PC1: Discuss academic/career issues	0.246 **	0.337 **	0.346 **	0.289 **	**0.717**		
PC2: Discuss sociocultural issues	0.268 **	0.344 **	0.322 **	0.334 **	0.335 **	**0.726**	
CA: Attend co-curricular activities	0.187 **	0.348 **	0.303 **	0.355 **	0.276 **	0.324 **	**0.776**
Cronbach's α	0.745	0.836	0.823	0.806	0.823	0.817	0.850

Note: RHE = residential hall environment, FI = faculty interaction, PC = peer communication, CA = co-curricular activities. ** $p < 0.01$. Extracted by authors.

3.4. Data Collection

To ensure objectivity and minimize personal subjectivity in this study, a systematic approach was employed for data collection. Initially, the primary data were systematically gathered through an online survey conducted over a 3-month period. Afterward, according to the respondents' name and matric number, the participants' academic performance data, specifically CGPA, were acquired from the academic offices of each sampled institution to ensure data accuracy. Prior to initiating the collection of data, explicit permission and support were obtained from the universities comprising the sample. More importantly, participants were explicitly notified that their data would be utilized exclusively for the purposes of this study, with an assurance of confidentiality. Furthermore, participants' involvement was voluntary, and they retained the option to withdraw at any point without facing repercussions. Questionnaires were distributed to RC students with the assistance of the administrative faculty from the sample institutions to enhance the response rate and acquire the secondary data on academic achievement.

3.5. Data Analysis

The data analysis encompasses both descriptive and inferential statistics using SPSSAU. Initially, the descriptive analysis aims to evaluate the SES diversity of RC respondents by referencing the population ratio at various SES levels across the nation. Furthermore, a grouped linear regression analysis is undertaken to investigate the impact of RC on the relationship between SES and academic performance. Initially, potential control variables, such as gender, ethnicity, family district, and school year, will undergo testing. Through the control of these variables, the study seeks to effectively isolate the academic performance factors attributable to RC.

Subsequently, linear regression on SES grouped data will be employed to scrutinize the statistical correlation between RC and SES. This approach objectively assesses the impact of RC on education equality and quality from a statistical standpoint. By facilitating the differentiation of between-group effects, this method strengthens the robustness of causal

claims [59]. Additionally, the study will explore the resultant impacts of RC on sustainable education, extending the preceding analyses. An overview of the statistical methods is summarized in Table 3.

Table 3. Research questions and statistical methods.

Research Question	Hypothesis	Method	Analysis	Utilized Software
RQ1. Does SES matter in accessing RC?	H1 and H2	Quantitative	Descriptive analysis	SPSSAU v2013
RQ2. Does RC mitigate academic achievement discrepancies between different SES groups?		Quantitative	Grouped linear regression analysis	
RQ3. Does RC play a significant role in supporting sustainable education?		Quantitative	Results from RQ1 and RQ2	

Note: Extracted by authors.

4. Findings and Discussion

In this section, the findings and discussion are presented simultaneously, followed by an exploration of the research implications and conclusions in the final section. The initial sub-section outlines the demographics of the respondents. The second sub-section delves into addressing the first research question (RQ1), while the subsequent two sub-sections concentrate on the second (RQ2) and third research questions (RQ3), respectively.

4.1. Respondents' Demographic Statistics

There are 623 respondents in this study, yielding a robust response rate of 93.4%. As shown in Table 4, the male respondents constitute 55.5% of the sample, while female respondents account for 44.5%. The majority (86.7%) belong to the Han ethnicity. Roughly half of the participants (48.3%) come from urban areas, while the remaining 51.7% originate from rural areas. The participants are fairly evenly distributed among different grade levels: first year (25.2%), second year (23.1%), third year (25.0%), and fourth year or above (26.7%). Just over one-third of the respondents are pursuing majors in social science (35.2%), followed by natural science (32.6%) and human culture (32.2%). Hence, except for ethnicity, the sample exhibits a relatively balanced distribution in terms of these demographic characteristics.

Table 4. Respondents' demographic statistics.

Variable		Number	%
Gender			
	Male	346	55.5%
	Female	277	44.5%
Ethnicity			
	Han	540	86.7%
	Minorities	83	13.3%
Region			
	Urban	301	48.3%
	Rural	322	51.7%
Grade			
	First year	157	25.2%
	Second year	144	23.1%
	Third year	156	25.0%
	Fourth year or above	166	26.7%
Major			
	Natural science	203	32.6%
	Social science	219	35.2%
	Human culture	201	32.2%

Note: n = 623. Extracted by authors.

4.2. Mapping of SES Diversity

To address RQ1 concerning the SES diversity among RC students, a frequency analysis was undertaken. In this study, various indicators of parental education, occupation, and income were amalgamated into an overarching SES metric using regression analysis [60]. To distinctly characterize the backgrounds of RC students, SES backgrounds were categorized into three levels: high, middle, and low. Among the RC respondents, 27.8% hailed from high SES backgrounds, while 39.1% and 33.1% were from middle and low SES backgrounds, respectively (Figure 2). This highlights that RCs in China attract students from diverse social classes.

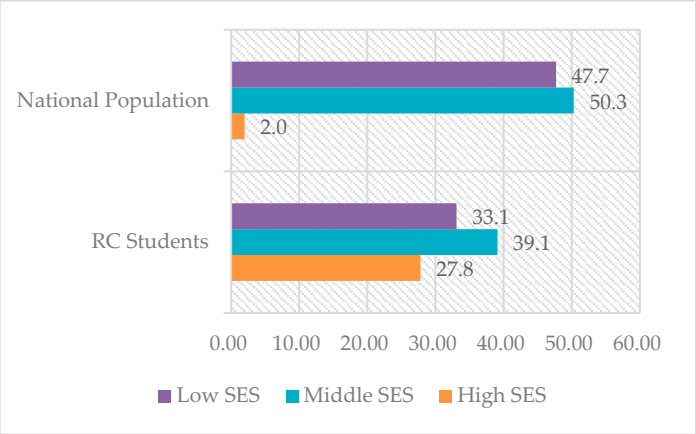

Figure 2. Comparison of SES diversity between national population and RC students. Extracted by authors.

To delve deeper into the SES diversity among RC students and its implications for equitable access to RCs, a comparison was made between the representation of RC students from different SES groups and the distribution of the population across various social classes in China. According to research, the current Chinese social classes are divided into ten clusters divided into three levels: high, middle, and low strata [61,62]. Based on the data on individual income and population distribution across different socioeconomic groups released by the National Bureau of Statistics of China in 2022 [63], individuals from a high social class constituted the smallest group, accounting for approximately 2.0%. The majority fell into the middle (50.3%) and low social classes (47.7%) (Figure 2).

Figure 2 reveals significant disparities in the distribution of SES categories between RC students and the national population. While the share of high SES individuals in the national population was the lowest, the proportion of RC students from the same SES level climbed by 25.8%. Conversely, the proportion of RC students from middle SES level decreased by 11.2% compared to the national data, and students from low SES backgrounds decreased by 14.6%.

The results strongly suggest that among the RC student population in China, individuals from diverse SES backgrounds are represented; however, students from more affluent SES backgrounds constitute a relatively larger proportion. SES does matter in accessing RCs. This implies that opportunities for higher education are not uniformly accessible to students from different socioeconomic backgrounds. SES is widely acknowledged as a crucial background variable in education research [64]. A series of empirical studies have found that SES significantly impacts educational opportunities and academic outcomes [10–12]. These findings align with prior research indicating that SES can have an impact on equal access to tertiary education, even in the Chinese context [65–67]. They also furnish empirical evidence for the unbalanced distribution of educational opportunities in RCs among Chinese students from various SES backgrounds.

4.3. Relationship between SES and RC

To address RQ2, a grouped regression method was applied for inferential analysis. It was imperative to examine the statistical relationship between RCs and academic performance, followed by an evaluation of RCs' role in reducing the SES achievement gap. RQ2 comprised two hypotheses, denoted as H1 and H2.

H1 posited that RCs positively impact academic performance. The grouped regression analysis in Table 5 reveals a significant positive correlation between RCs and academic performance among students from diverse SES backgrounds ($\beta = 0.302$, $p < 0.01$). Specifically, RCs make a positive contribution to the academic performance of students in low SES ($\beta = 0.245$, $p < 0.01$), middle SES ($\beta = 0.147$, $p < 0.01$), and high SES ($\beta = 0.199$, $p < 0.01$) groups. Here, β represents the regression coefficient, and the p-value indicates the level of significance within a statistical hypothesis test. Consequently, the first hypothesis (H1) finds support.

Table 5. Grouped linear regression analysis.

	Overall SES	Low SES	Middle SES	High SES
Constant	2.838 **	2.774 **	3.102 **	3.226 **
	(33.026)	(20.854)	(22.430)	(24.351)
Gender	−0.030	−0.023	−0.016	−0.035
	(−1.613)	(−0.899)	(−0.554)	(−1.232)
Ethnicity	0.007	0.015	−0.001	−0.009
	(0.376)	(0.558)	(−0.038)	(−0.333)
Region	−0.153 **	−0.095 **	−0.061 *	−0.120 **
	(−7.424)	(−2.820)	(−2.058)	(−3.228)
Grade	0.008	0.003	0.010	0.012
	(0.998)	(0.232)	(0.789)	(0.977)
Major	−0.007	−0.017	0.004	0.017
	(−0.600)	(−1.061)	(0.218)	(0.941)
RC	0.302 **	0.245 **	0.147 **	0.199 **
	(16.715)	(8.081)	(4.104)	(7.859)
n	623	206	244	173
R^2	0.479	0.346	0.099	0.407
ΔR^2	0.474	0.326	0.076	0.385
F	94.264	17.538	4.327	18.950

Note: DV = academic achievement (CGPA), RC = residential college, n = sample size. * $p < 0.05$, ** $p < 0.01$. Extracted by authors.

Following the identification of the relationship between RCs and academic performance across different SES groups, the difference in regression coefficients was examined to test H2, asserting that SES differences do not impact RCs in promoting academic performance. Table 6 displays the coefficient differences in group regression. Specifically, comparing the low SES and middle SES groups, RC had a positive impact on performance, and there was no significant difference in the magnitude of it ($t = -0.116$, $p = 0.908 > 0.05$). The results are the same between low and high SES groups ($t = -0.528$, $p = 0.597 > 0.05$) and middle and high SES groups ($t = -1.258$, $p = 0.209 > 0.05$). Hence, no significant differences are apparent in the role of RCs in academic performance among low, middle, and high SES groups. This indicates that there are no noteworthy variations in the impact of RCs on different SES groups. Subsequently, the second hypothesis (H2) receives support. Indicated here is that RC mitigates academic achievement discrepancies, which exist be-tween different SES groups.

Table 6. Results of regression coefficient difference.

Variable	Group		b_1	b_2	Divergence	t	p
Residential College	Low SES	Middle SES	0.245	0.147	0.098	−0.116	0.908
	Low SES	High SES	0.245	0.199	0.046	−0.528	0.597
	Middle SES	High SES	0.147	0.199	−0.052	−1.258	0.209

Note: DV = academic achievement (CGPA). b1, b2 = regression coefficients. Extracted by authors.

In conclusion, the findings affirm a statistical correlation between RCs and academic performance, suggesting that the RC system has the potential to positively influence student learning outcomes by fostering inclusive and supportive environments [19–22]. Furthermore, the results unequivocally demonstrate that there is no significant difference in the magnitude of RC impact among different SES levels, affirming that SES does not hinder the role of RCs in academic performance.

The education system is often regarded as a means to promote equality [9,25,68]. Students attending education institutions with superior residential and extracurricular facilities often perform better academically compared to their counterparts in institutions without such amenities [41]. Family SES background influences students' development through parental involvement in the education system and the provision of various learning opportunities and resources [65]. High SES families are more likely to have financial, intellectual, and professional resources, which support students' access to high-quality education and good grades [11,12]. The findings offer empirical evidence that SES does not impede the influence of RCs on academic performance, indicating that RCs contribute to enhancing students' academic achievements irrespective of SES barriers. This implies that RCs mitigate the academic achievement gap among all SES groups, potentially improving the current educational landscape. As a result, RCs represent a constructive initiative in China for ensuring equal access to high-quality education.

4.4. Influence of RC on Sustainable Education

Building upon the previously discussed results, RQ3 was explored. It is evident that RCs contribute to academic achievement across various socioeconomic backgrounds, aligning with the goal of universal education regardless of students' SES. However, it is crucial to acknowledge that RCs alone cannot entirely eliminate enrolment disparities based on SES in China. Despite the broadening of higher education opportunities, students from privileged SES backgrounds continue to enjoy superior access to enhanced educational environments, including RCs.

The concept of sustainable education extends beyond the pursuit of educational quality; it is a multifaceted instrument. Sustainable education encompasses diverse programs, strategies, and institutional frameworks aimed at contributing to national progress equitably [8]. The issue of education disparities has a long history [69,70]. Despite numerous efforts to address these inequalities, it remains a fundamental challenge in achieving sustainable development in education [8]. In the Chinese context, RCs represent an innovative approach to nurturing talent among students from diverse SES backgrounds. Although RCs may not fully resolve the issue of enrolment disparities, they play a significant role in advancing sustainable education.

5. Concluding Remarks

This section discusses the implications, followed by an exploration of limitations and suggestions for future research with reference to this subject. Finally, the conclusion is explained.

5.1. Theoretical and Practical Implications

The findings from this study lead to significant implications for both theoretical and practical considerations in the realm of education. Initially, the study extends its theoretical

reach to encompass broader educational theories, including the student involvement theory [71] and engagement theory [72]. By investigating the effects of residential colleges, this research sheds light on the influence of this educational model on supporting the involvement and engagement of students from diverse socioeconomic backgrounds in school learning. This expansion underscores the interconnectedness of various educational constructs and emphasizes the multifaceted nature of RCs' influence on students' academic experiences.

Moreover, educational inequality remains a critical global challenge, spanning issues such as disparities in access to schooling, dropout rates, and notably, variations in learning outcomes, each carrying unique consequences [73]. Although RCs in China admit students from diverse socioeconomic backgrounds, the enrolment disparities persist, with SES remaining a crucial indicator for accessing educational institutions, including RCs [10,15]. However, it is noteworthy that RCs can serve as a valuable tool for enhancing academic achievement among students from both advantaged and disadvantaged socioeconomic backgrounds [19–22], aligning with the specific objectives of sustainable education. Consequently, this study contributes to a deeper theoretical understanding of the interplay between social inequality and educational disparities, advancing discussions on educational equity and social justice.

Nevertheless, it is critical to recognize that the RC system cannot adequately address the broader cultural and structural variables influencing education results, including those linked with family situations and external pressures. Combining measures such as financial aid, resource allocation, and curriculum enhancements with the RC system may be required to properly address the complex issue of equity in the education system. In addition, the development of RCs should consider the role and influence of local contexts. Exploring localized RC models is crucial to maximizing how they can influence the role of SES in accessing education resources and producing the desired outcomes. This research provides practical suggestions on how to overcome the challenges associated with the role of RCs in sustainable education. It is recommended that further studies explore additional scenarios in this field, as outlined below.

5.2. Limitations and Future Directions

While this study offers valuable insights, it is essential to recognize and address the various limitations. Future research efforts aimed at overcoming these limitations will contribute to a deeper understanding of the intricate dynamics involved in fostering sustainable educational equity within the framework of RCs.

Initially, this study is constrained to the context of China, potentially limiting the applicability of its findings to other education systems with distinct cultural, social, and economic contexts. To achieve a more comprehensive understanding of the influence of RCs on educational equity, future research endeavors could extend the investigation to diverse countries. Furthermore, academic performance is an important indicator for assessing educational quality and equity among nations [74]. Academic achievement is influenced by a number of elements, including intrinsic factors, such as personal traits, and extrinsic factors, such as teachers, family, and school-related issues [75]. This study does not take into account a number of relevant characteristics, such as study habits, personal motivation, and parental engagement [76,77], which could influence the research outcomes. Future studies could include a greater range of variables, resulting in more thorough and meaningful research findings. Moreover, this study adopted a quantitative method, wherein participants attending RCs were selected. This approach may introduce biases, which, to some extent, influence the objectivity and scientific rigor of the findings. Therefore, future research should consider employing equally important research designs, including experimental methodologies or qualitative methods, which may yield more comprehensive findings.

In conclusion, the role of residential colleges in China and what they mean for the UN's SDGs are crucial. The reality is that students' socioeconomic status in RCs has created

an unequal learning environment, in that there is a lot of varied access to the education system and the resources it has. This situation has posed further obstacles to sustainable development in education, which is a prerequisite for national economic development. Having said that, residential colleges can contribute to improving education quality by narrowing, or ideally, removing academic discrepancies among students from a range of SES backgrounds. Consequently, it remains very challenging to ensure that equal access to quality education for all students is attained, regardless of socioeconomic status, and there is a need for sufficient training to address the challenges related to education inequality.

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