

## Research on high-quality development of high schools in weak provinces in the Yangtze River Delta integration process

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### Abstract

State policies in China have created new opportunities for ordinary senior secondary education in 3 provinces and 1 city in the Yangtze River Delta (YRD) region. In this context, weaker areas of high school education in this region should benefit from these policies, use existing high-quality resources, and continue improving their overall quality. In this article we considering the actual implementation of relevant policies promulgated by the state and the statistical data on the development of ordinary high school education in 3 provinces and 1 city in the YRD region from 2013 to 2020. We adopted a combination of empirical and qualitative research to analyse the data. We combined corresponding theories to explore the actual development status and existing problems of high schools in weak regions compared to high-quality high schools in economically developed regions of the YRD. Based on these problems, we put forward the following suggestions to strengthen and promote weak high schools to enter the high-quality development process of the YRD integration. Firstly, the policy level should establish and improve the relevant linkage mechanism. Secondly, weak schools should actively innovate independently. Thirdly, a regular evaluation mechanism should be introduced in schools, and in the last instance, the training and construction of teachers should be optimised.

**Keywords:** education integration development; high-quality development; high-quality high school education; ordinary high school education; Yangtze River Delta integration

### Introduction

The integration of the Yangtze River Delta (YRD) refers to regional development and cooperation. The 2009 agreement on establishing a consultation mechanism for education collaboration in the YRD has become a symbol of integrated, standardised, and institutionalised education in the region (Cao, Derudder & Peng, 2018). The formation of integrated development in the Jiangsu, Zhejiang and Anhui provinces and Shanghai marks a national strategy upgrade in the YRD region. The outline emphasises the imperative of establishing a sense of integration, fostering comprehensive integration in key domains, enhancing the impetus for innovation, constructing a modernised economic system, and elevating the level of chains (Bin, 2022). The plan should progress forcefully, orderly, and effectively; reasonable efforts should be made in the coordination and implementation. The tasks outlined in the plan should be broken down and implemented and the primary parties responsible should be defined (Ojo & Adu, 2018). The YRD region, including the Jiangsu, Zhejiang, Anhui provinces and Shanghai city, should enhance integration, strengthen cooperation in various fields and promote integrated development.

At time of publication, the admission ratios of college entrance examinations in the YRD region were as follows: 98.2% (Jiangsu), 95.5% (Zhejiang), 83.9% (Anhui), and 92.8% (Shanghai). The popularisation of higher education has posed challenges to the development of secondary education. In fact, the high-quality development of general high school education serves as a fundamental basis for achieving overall success in higher education and represents a pivotal stage in national educational progress. The attainment of comprehensive excellence in higher education would be impossible without ensuring the high-quality advancement of general high school education (Sun, 2023). Therefore, the development of high school education requires continuous exploration of its advantages and leading the way in modernising education through regional exchanges, innovative reform coordination, and informatisation (McGinn, 2007). This is necessary because the modernisation of regional education serves as the foundation for national education modernisation. The Implementation Plan for Accelerating Education Modernisation, introduced at the beginning of 2019, designates the YRD region as one of the four strategic focal points for advancing education modernisation and effectively implementing coordinated regional development. The plan requires a systematic improvement of senior secondary education in general. Additionally, it emphasises the need to enhance both the education cooperation system and policy support system, explore innovative models of educational reform, and expedite national educational modernisation to ensure high-quality development of senior secondary education across all levels in the region (Shuai, 2020).

Against the backdrop of this national strategy, senior secondary education in the YRD region will embrace new development opportunities. The quality of senior secondary education should be comprehensive and tailored, focusing on national and societal perspectives as well as fostering students' holistic development. Therefore, to cultivate talent, senior secondary education should not be developed uniformly, and schools should not solely focus on quality or engage in competition (Wang, Y & Zhang, 2023). In the context of integration in the YRD, where numerous beneficiary groups and great development potential exist, weak provinces in the region face a new challenge of promoting high school education to keep pace with high-quality development. As a weaker

province, Anhui should proactively integrate into the YRD development, contributing to and driving coordinated development of high-quality general high schools across the entire region (Freeks, 2015).

#### Literature Review

The YRD region has a rich cultural history. On 11 May 2016, the State Council approved the Yangtze River Delta City Cluster Development Plan, integrating the Jiangsu, Zhejiang, Anhui provinces and Shanghai into the new YRD integration region. Currently, the YRD region has become one of China's most dynamic economic regions with high openness and strong innovation capabilities (Anub, 2020). The "Belt and Road" intersection between the Yangtze River Economic Belt is crucial. Education development in this region is a major concern, and the 3-year Action Plan for Integrated Development of the YRD Region (2018–2020) has been released. The plan includes cooperation at various levels of education, such as preschool, compulsory, high school, and higher education (Luo & Wendel, 1999).

The educated individuals who have completed senior secondary education must pass the college entrance examination before enrolling in higher education. Therefore, the quality of education at this stage is crucial (Liu, Y & Fang, 2022). This critical link plays a fundamental role in nurturing talent for higher education, occupying a key position in the national education system's next generation (Opoku-Asare & Siaw, 2016). The provision of excellent general senior secondary education is crucial for consolidating achievements in compulsory education, enhancing higher education development, and improving overall national quality (Gao & Cheng, 2013). The promotion of integrated development in the YRD region is a significant strategy for building a new pattern of coordinated regional development, as noted by some scholars (Li, Y 2023). Promoting regional integration in general high school education is an essential part of the integrated development strategy for the YRD, serving both national strategies and meeting local economic and social demands. Additionally, exploring how to continuously integrate general senior secondary education in the YRD into the regional integration and development process is urgently needed (YangYang & Xia, 2023). Chengjun Ji and other scholars analysed the primary state data of preschool, compulsory, senior high school, and higher education in three provinces and one city (hereafter referred to as the research sites) in the YRD region from a perspective of educational modernisation. The study reveals that while general high schools in Anhui lag behind in all indicators, there has been significant progress. However, efforts to improve quality and to catch up with high schools in other provinces are still needed (Ji & Zhang, 2019).

The Anhui province is an important part of the YRD's strategic development and national economic coordination zones, with historical and natural connections to the region's economy and culture. With a rich cultural heritage, Anhui has actively integrated into the YRD's high school education development in recent years (Liu, Z & We, 2022). According to the relevant data, the statistical data on education shows the following for 2020. In the Anhui province, 720,000 students were enrolled in high school education, which was an increase of 38,700 compared to the previous year, representing an increase of 5.7%. The total number of students was 1,925,000, which was 86,000 more than the previous year, representing an increase of 4.7%. There were a total of 607,000 graduates, showing a decrease of 24,000 compared to the previous year and a reduction of 3.8%. The gross high school enrolment rate was 92.3%. The number of general high schools in the province decreased by six from the previous year, totalling 661. The total number of people increased by 11,969 compared to the previous year, with an increase rate of 3.2%; the number of students enrolled was 1,133,579, an increase of 45,551 compared to the previous year, with an increase rate of 4.2%. Additionally, there were 351,280 graduates, which represented a decrease of 12,066, or 3.3%, over the previous year. Thus, the development of general high school education in the Anhui province in terms of the number of students, enrolment rate and graduates has increased. However, the increase in quantity does not indicate an improvement in quality (Yin & Yu, 2022). As a new province joining the integration of the YRD, there is a need to explore how progress can be made in general high schools in the Anhui province along with high schools in other regions of high-quality development (Ren, 2023).

In general, current research on the YRD focuses more on the economic aspects and the interaction and harmonious development of education and economy, while paying less attention to the educational dimension and how the quality of general high school education in the YRD region can jointly be improved (Nishizuka, 2022). In fact, the level of general high school education directly affects the integration and development of the YRD (Smith, Julie & Gierdien, 2020). Scholars have noted that for the construction of the new YRD region, educational development in each province and city should progress together to serve as a reference for other provinces' education. Therefore, we focus mainly on the Anhui province, where YRD general high school education is relatively weak. From the dimensions of government, schools, teachers and students, through relevant data analysis, combined with stakeholder theory and resource allocation theory, the specific development status and problems of the Anhui province, a weak province in the YRD integration, are discussed. The

aim was to provide valuable suggestions and guidance for strengthening its development (Quang & Tra, 2022).

### Research Questions

Within the general scope of the study, the following issues were explored.

By analysing the data, we learnt about the development gap between weak provincial high schools and high-quality provincial high schools in the YRD region. Four categories of participants were involved in the development of ordinary high schools in the YRD region (government, schools, teachers and students). An analysis of the deficiencies of ordinary high schools in the Anhui province sheds light on the development gap. Drawing on the development advantages of high-quality provinces and cities (Jiangsu, Zhejiang and Shanghai), and providing effective suggestions for the improvement of weak provinces in the process of moving towards the integration of the YRD can provide reference for other provinces to carry out assessment.

### Methodology

#### Research Design

##### *Data selection*

The data for this paper were selected from the National Statistics on Educational Programs (NSSEP) for general high schools in the research sites (Anhui, Jiangsu, Zhejiang and Shanghai). Data on the number of schools, classes, and students in general high schools in the research sites, as well as information about the academic and disaggregated data on the number of staff members from 2013 to 2020 (Tang, 2021) were included. During the process of data screening and organisation, only national-level data were officially released prior to 2013, with no detailed data available for provinces and cities. Consequently, some relevant data before 2013 is absent. Secondly, the Anhui province was fully incorporated into the planning system of the YRD in the outline of the Plan for Integrated

Development of the YRD Region, which was promulgated at the end of 2019. Therefore, a high-quality study on the development of general high schools in the Anhui province after its inclusion in the YRD, excluded relevant data prior to 2013. By integrating and analysing the existing data, we aimed to identify the challenges that general high schools in the Anhui province faced in their pursuit to catch up with the high-quality development of high schools in other provinces and municipalities. We also propose effective countermeasures and suggestions to accelerate the high-quality development of high schools in other provinces and achieve earlier integration within the YRD.

### *Ethics approval statement*

All methods were performed in accordance with the declaration of the journal. The study was approved by the Ethical Committee of the Anhui Normal University. All the participants provided written informed consent.

### Data Analysis

The independent variable in this research is the year of development, while the dependent variables include various aspects of high school education across three provinces and different years. These aspects include schools, classes, student enrolment, graduates, and academic qualifications of teachers (both full-time and part-time). The Statistical Package for the Social Sciences ([SPSS], Version 27.0; IBM Corp., 2020) software was mainly used for data statistics and analysis, and *t*-test, *F*-test and one-way ANOVA were used to analyse the number of schools, classes, students, education data of full-time teachers, number of teaching staff and other data of ordinary high schools. By using these statistical analysis methods, we explored the development differences between high-quality high schools and weak high schools in the YRD region. Basic information about the data are presented in Tables 1 to 3.

**Table 1** Introduction of sample

Province	Year	Number of schools	Number of classes	Number of students		
				Number of graduates	Enrolment	Student enrolment
Anhui province	2013	698	23,002	416,723	380,526	1,255,132
	2014	694	22,560	429,396	370,649	1,201,286
	2015	666	21,786	433,003	363,302	1,135,543
	2016	672	21,410	388,305	358,775	1,106,953
	2017	662	21,426	376,695	352,692	1,084,974
	2018	661	21,634	369,152	358,860	1,074,716
	2019	667	21,783	363,296	378,830	1,088,028
	2020	661	22,926	351,280	390,799	1,133,579
Jiangsu province	2013	578	23,586	425,924	341,417	1,109,899
	2014	567	22,600	396,668	319,780	1,034,205
	2015	569	21,786	368,844	319,487	977,955
	2016	571	21,680	338,683	318,236	951,525
	2017	564	21,109	317,594	314,573	943,365
	2018	578	21,386	312,440	352,082	980,758
	2019	580	22,261	313,885	387,603	1,050,290
	2020	585	24,463	311,320	423,390	1,155,411
Zhejiang province	2013	569	18,215	296,105	265,198	839,755
	2014	561	18,115	296,640	251,727	790,838

**Table 2** Number of staff (total) in the research sites

Province	Year	In total	Number of faculty members				Workers and staff of school-run enterprises	Substitute teachers	Doubles as teachers
			Full-time teachers	Teachers	Administrative staff	Teaching and auxiliary staffs			
Anhui province	2016	291,765	257,203	7,368	9,608	17,539	47	3,521	954
	2017	297,780	264,060	7,092	9,253	17,345	30	3,909	995
	2018	303,994	270,584	7,074	8,506	17,784	46	2,642	690
	2019	312,381	278,849	7,008	8,047	18,438	39	3,372	731
	2020	322,028	287,327	7,519	7,799	19,379	4	3,975	499
Jiangsu province	2016	348,313	306,185	7,597	17,257	17,098	176	2,322	155
	2017	353,638	313,611	7,185	16,194	16,439	209	2,622	148
	2018	366,213	326,782	6,700	15,662	16,799	270	2,788	340
	2019	384,087	344,304	6,585	15,476	17,566	156	3,530	405
	2020	404,454	364,809	6,460	15,403	17,539	243	3,984	492
Zhejiang province	2016	244,842	216,949	5,879	9,767	12,089	158	0	590
	2017	249,243	222,385	5,589	9,459	11,512	298	0	434
	2018	254,461	227,008	5,512	9,184	12,609	148	0	423
	2019	261,384	234,451	5,736	9,244	11,923	30	0	346
	2020	267,861	240,072	5,785	9,540	12,413	51	0	244
Shanghai	2016	81,131	65,738	5,798	6,374	3,177	44	294	436
	2017	84,172	67,833	5,891	6,257	4,156	35	322	283
	2018	87,124	71,072	5,490	6,466	4,092	4	299	293
	2019	89,952	74,450	5,035	6,568	3,898	1	335	209
	2020	93,519	77,613	5,009	6,795	4,101	1	334	150

**Table 3** Classification by educational background in the research sites

Province	Year	Graduate	Bachelor's degree	Junior college graduation	Graduation from high school	Graduate from high school or below
Anhui province	2013	698	23,002	416,723	380,526	1,255,132
	2014	694	22,560	429,396	370,649	1,201,286
	2015	666	21,786	433,003	363,302	1,135,543
	2016	4,849	71,037	1,435	9	0
	2017	5,339	71,357	1,295	7	0
	2018	5,758	71,666	1,166	5	0
	2019	6,150	73,044	1,157	16	0
	2020	6,802	74,333	912	7	0
Jiangsu province	2013	578	23,586	425,924	341,417	1,109,899
	2014	567	22,600	396,668	319,780	1,034,205
	2015	569	21,786	368,844	319,487	977,955
	2016	13,481	81,058	524	7	0
	2017	14,951	79,364	399	5	0
	2018	16,651	78,731	241	1	0
	2019	18,817	80,259	215	0	0
	2020	21,599	83,689	178	1	0
Zhejiang province	2013	569	18,215	296,105	265,198	839,755
	2014	561	18,115	296,640	251,727	790,838
	2015	563	18,171	270,956	259,850	773,359
	2016	5,912	61,655	403	6	0
	2017	6,698	62,570	337	3	0
	2018	7,866	62,227	267	5	0
	2019	8,958	62,767	225	2	0
	2020	10,260	63,217	185	0	0
Shanghai	2013	243	4,565	52,675	53,092	156,817
	2014	246	4,614	50,971	52,857	157,416
	2015	253	4,656	51,227	53,439	158,201
	2016	3,474	14,178	16	1	0
	2017	3,893	14,028	15	1	0
	2018	4,413	13,924	12	1	0
	2019	4,659	13,943	7	0	0
	2020	5,340	13,698	4	0	0

*Data analysis related to the number of schools, classes, and students***Table 4** Comparison of the differences in the number of general high schools in the research sites

Dependent variable	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Significance	95% confidence interval	
						Lower limit	Upper limit
Number of Tamhane schools	1	2	98.625*	5.873	0	79.52	117.73
		3	90.000*	9.1	0	61.69	118.31
		4	418.125*	5.794	0	399.1	437.15
	2	1	-98.625*	5.873	0	-117.73	-79.52
		3	-8.625	7.849	0.884	-35.19	17.94
		4	319.500*	3.515	0	308.74	330.26
	3	1	-90.000*	9.1	0	-118.31	-61.69
		2	8.625	7.849	0.884	-17.94	35.19
		4	328.125*	7.79	0	301.56	354.69
	4	1	-418.125*	5.794	0	-437.15	-399.1
		2	-319.500*	3.515	0	-330.26	-308.74
		3	-328.125*	7.79	0	-354.69	-301.56

Note. \*The significance level of mean difference was 0.05.

Table 4 shows that the mean difference between the number of general senior high schools in the Jiangsu and Anhui provinces was -98.62 ( $p < 0.05$ ), the mean difference between the number of general senior high schools in the Anhui and Zhejiang provinces was 90.00, ( $p < 0.05$ ) and the

mean difference between the number of general senior high schools in the Anhui province and Shanghai was 418.12 ( $p < 0.05$ ) – all significant differences. The mean difference between the number of general senior high schools in the Jiangsu and Zhejiang provinces was -8.62 ( $p > 0.05$ ); a

nonsignificant difference; and the mean difference between the number of general senior high schools in the Jiangsu province and Shanghai was 319.50 ( $p < 0.05$ ), which is significant. The mean difference between the number of general senior high schools in the Zhejiang province and the Shanghai municipality was 328.12 ( $p > 0.05$ ), which is significant.

ANOVA was used to analyse the number of schools in the research sites. The homogeneity of variance test was significant,  $ps < 0.01$ , and the Tamhane method was used for post-story comparisons. There was no significant difference between the number of schools in the Jiangsu and

Zhejiang provinces ( $p > 0.05$ ). The development trend of the number of schools in the two provinces was relatively smooth, as indicated by the estimated mean value. The number of general senior high schools in the Anhui province and Shanghai showed a significant difference ( $p < 0.05$ ). Despite the different population bases, it can be seen from the estimated marginal means that the Anhui province showed a declining trend in the development of the number of schools, which is directly related to the current situation of its large-scale population exodus to other provinces, as well as the large-scale population loss and the decline in the fertility rate.

**Table 5** Comparison of the differences in the number of classes in general high schools in the research sites

		(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Sig.	95% confidence interval	
Dependent variable							Lower limit	Upper limit
Number of classes	Tamhane	1	2	-293	469.487	0.991	-1789.62	1203.62
			3	4455.500*	921.478	0.008	1257.44	7653.56
			4	17395.250*	234.149	0	16552.61	18237.89
	2	1	2	293	469.487	0.991	-1203.62	1789.62
			3	4748.500*	980.203	0.004	1533.76	7963.24
			4	17688.250*	408.046	0	16214.06	19162.44
	3	1	2	-4455.500*	921.478	0.008	-7653.56	-1257.44
			2	-4748.500*	980.203	0.004	-7963.24	-1533.76
			4	12939.750*	891.743	0	9713.13	16166.37
	4	1	2	-17395.250*	234.149	0	-18237.89	-16552.61
			2	-17688.250*	408.046	0	-19162.44	-16214.06
			3	-12939.750*	891.743	0	-16166.37	-9713.13

Note. \* $p < 0.05$ ; Sig – significance.

The mean difference of the number of classes in general high schools in the Jiangsu and Anhui provinces was -293, ( $p > 0.05$ ), which is not a significant difference. The mean difference of the number of classes in general high schools in the Anhui and Zhejiang provinces was 4455.50, ( $p < 0.05$ ); a significant difference. The mean difference of the number of classes of students in general high schools in the Anhui province and Shanghai city was 17395.25 ( $p < 0.05$ ); a significant difference. The mean difference of the number of classes of general senior high school students in the Jiangsu and Zhejiang provinces was 4748.50 ( $p < 0.05$ ); a significant difference. The mean difference of the number of classes of general senior high school students in the Jiangsu province and the Shanghai municipality was 17688.25 ( $p < 0.05$ ); a significant difference. The mean difference of the number of classes of general senior high school

students in the Zhejiang province and the Shanghai municipality was 12939.75 ( $p < 0.05$ ).

The number of classes in general high schools was analysed using ANOVA in each region of the research sites. The homogeneity of variance test was significant,  $ps < 0.01$ , and the Tamhane method was used for post-story comparisons. The data show no significant difference between the relevant data from the Anhui and Jiangsu provinces ( $p > 0.05$ ). There was a significant difference between the number of classes in the Anhui and Zhejiang provinces and the Shanghai municipality ( $p < 0.05$ ), followed by a higher significant difference with the Zhejiang province and a flat significant difference with the Shanghai municipality. The development of the number of classes in the Anhui province after joining the YRD region was close to the estimated marginal mean of the Jiangsu province.

**Table 6** Comparison of the number of ordinary high school graduates in the research sites

Dependent variable	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Significance	95% confidence interval	
						Lower limit	Upper limit
Number of Tamhane graduates	1	2	42811.5	19177.117	0.238	-16845.44	102468.44
		3	124451.500*	13129.816	0	83046.45	165856.55
		4	339235.625*	11129.805	0	298957.3	379513.95
	2	1	-42811.5	19177.117	0.238	-102468.44	16845.44
		3	81640.000*	17102.332	0.005	25380.78	137899.22
		4	296424.125*	15619.547	0	239891.14	352957.11
	3	1	-124451.500*	13129.816	0	-165856.55	-83046.45
		2	-81640.000*	17102.332	0.005	-137899.22	-25380.78
		4	214784.125*	6971.406	0	189563.95	240004.3
	4	1	-339235.625*	11129.805	0	-379513.95	-298957.3
		2	-296424.125*	15619.547	0	-352957.11	-239891.14
		3	-214784.125*	6971.406	0	-240004.3	-189563.95

Note. \*The significance level of mean difference was 0.05.

Table 6 presents the mean difference in the number of general high school graduates in the Jiangsu and Anhui provinces as -42811.5 ( $p < 0.05$ ). The mean difference in the number of general high school graduates in the Anhui and Zhejiang provinces was 124451.50 ( $p < 0.05$ ). The mean difference in the number of general high school graduates in the Anhui province and the Shanghai municipality was 339235.62 ( $p < 0.05$ ). The mean difference in the number of general high school graduates in the Jiangsu and Zhejiang provinces was 81640.00 ( $p < 0.05$ ), and the mean difference in the number of general high school graduates in the Jiangsu province and the mean difference of the number of graduates of general high school students in Shanghai was 296424.12 ( $p < 0.05$ ). The mean difference in the number of graduates of general high schools in the Zhejiang province and Shanghai was 214784.12 ( $p > 0.05$ ).

ANOVA on the number of high school graduates of general high school teachers showed a significant homogeneity of variance test,  $ps < 0.0$ . After post-hoc comparisons, a Tamhane analysis showed that the number of graduates in Shanghai and the Zhejiang province was the most significant. The number of graduates in the Jiangsu province was more significant than that in the Anhui province, and the highest number of graduate values in 2013. Over the previous 5 years, the number of high school graduates was declining year-on-year, with the Anhui province showing the most pronounced decline from 2015 to 2016. The massive decline in graduate numbers is a common problem in all provinces and cities, except Shanghai. This is due to various reasons, such as the birth rate, the number of students studying abroad, and the employment situation of college students.

**Table 7** Comparison of enrolment difference of ordinary high schools in the research sites

		(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Significance	95% confidence interval	
Dependent variable							Lower limit	Upper limit
Enrolment	Tamhane	1	2	22233.125	14717.704	0.666	-27799.47	72265.72
			3	106012.250*	5926	0	87732.03	124292.47
			4	315302.000*	4728.066	0	298552.24	332051.76
	2		1	-22233.125	14717.704	0.666	-72265.72	27799.47
			3	83779.125*	14436.994	0.002	33691.92	133866.33
			4	293068.875*	13987.992	0	242563.93	343573.82
	3		1	-106012.250*	5926	0	-124292.47	-87732.03
			2	-83779.125*	14436.994	0.002	-133866.33	-33691.92
			4	209289.750*	3764.385	0	196108.98	222470.52
	4		1	-315302.000*	4728.066	0	-332051.76	-298552.24
			2	-293068.875*	13987.992	0	-343573.82	-242563.93
			3	-209289.750*	3764.385	0	-222470.52	-196108.98

Note. \*The significance level of mean difference was 0.05.

Table 7 shows that the difference between the means of enrolment in general senior high schools in the Jiangsu and Anhui provinces was negative 22233.125 ( $p > 0.05$ ), with no significant

relationship. The mean difference between the number of enrolments in general high schools in the Anhui and Zhejiang provinces was 106012.25 ( $p < 0.05$ ). The mean difference between the

enrolment of general senior high schools in the Anhui province and Shanghai was 315302.00 ( $p < 0.05$ ). The mean difference of enrolment in general high schools in the Jiangsu and Zhejiang provinces was 83779.12 ( $p < 0.05$ ), and the mean difference of enrolment in general high schools in the Jiangsu province and the Shanghai municipality was 293068.87 ( $p < 0.05$ ). The mean difference of enrolment in general high schools in the Zhejiang province and the Shanghai municipality was 209289.75 ( $p > 0.05$ ), which shows a significant relationship.

ANOVA showed a significant homogeneity test,  $ps < 0.01$ . It also showed that for high school enrolment of general high school teachers the

homogeneity of variance test was significant,  $ps < 0.01$ . After post-hoc comparisons, Tamhane showed that high school enrolment in the Jiangsu and Anhui provinces was the most significant, while the trend of enrolment in the Zhejiang province and Shanghai was relatively stable. Enrolment in the Anhui province in comparison with the other three provinces and the city from 2013 to 2017 showed a slight downward trend, while the enrolment in the Jiangsu province in 2017 had a slight downward trend. The Anhui province showed a small decline in enrolment from 2013 to 2017 compared to the others. The Jiangsu province showed a significant increase from 2017 to 2020 compared to the other provinces and cities.

**Table 8** Comparison of the number of ordinary high schools in the research sites

(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4							(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4		95% confidence interval	
Dependent variable				Mean difference (I-J)	SE	Significance	Lower limit	Upper limit		
Number of students	Tamhane	1	2	109600.375*	35134.632	0.046	1527.22	217673.53		
			3	346853.500*	24046.783	0	266650.2	427056.8		
			4	975876.750*	22369.663	0	895035.9	1056717.6		
	2	1	3	-109600.375*	35134.632	0.046	-217673.53	-1527.22		
			4	237253.125*	28534.265	0	140095.44	334410.81		
			3	866276.375*	27135.923	0	768159.39	964393.36		
	3	1	2	-346853.500*	24046.783	0	-427056.8	-266650.2		
			4	-237253.125*	28534.265	0	-334410.81	-140095.44		
			3	629023.250*	8953.42	0	596939.43	661107.07		
	4	1	2	-975876.750*	22369.663	0	-1056717.6	-895035.9		
			3	-866276.375*	27135.923	0	-964393.36	-768159.39		
			4	-629023.250*	8953.42	0	-661107.07	-596939.43		

Note. \*The significance level of mean difference was 0.05.

Table 8 shows that the mean difference in the number of students enrolled in general senior high schools in the Jiangsu and Anhui provinces was -109600.37, ( $p < 0.05$ ); a significant difference. The mean difference in the number of general senior high school students in the Anhui and Zhejiang provinces was 346853.50, ( $p < 0.05$ ); also a significant difference. The mean difference in the number of general senior high school students in the Anhui province and the Shanghai municipality was 975876.75 ( $p < 0.05$ ); a significant difference. The mean difference in the number of general senior high school students in the Jiangsu and Zhejiang provinces was 237253.12 ( $p < 0.05$ ); a significant difference. The difference in the number of students enrolled in general high schools in the Jiangsu province and Shanghai was 866276.37 ( $p < 0.05$ ); a significant difference. The mean difference of the number of students enrolled in general high schools in the Jiangsu and Zhejiang province was 237253.12 ( $p < 0.05$ ); a significant difference. The mean difference in the number of students enrolled in

general high schools in the Jiangsu province and the Shanghai municipality was 866276.37 ( $p < 0.05$ ) and the mean difference in the number of students enrolled in general high schools in the Zhejiang province and the Shanghai municipality was 629023.25 ( $p < 0.05$ ); both significant differences.

The number of students in general high schools was analysed using ANOVA, and the homogeneity of variance test was significant,  $ps < 0.01$ . After post-hoc comparisons, a Tamhane analysis showed that the Jiangsu province had the most significant difference in comparison with the other provinces and cities. Among the three provinces and cities, except for Shanghai, the trend of the number of students was relatively stable. The Anhui and Zhejiang provinces showed a downward trend. The Anhui province has shown a downward trend from 2013 to 2019. Among them, the downward trend was most pronounced from 2013 to 2017. Then, in 2019 and 2020, there was a regression-oriented trend in the marginal means.



*Data analysis of teachers' educational background***Table 9** Comparison of data difference of graduate education of ordinary high school teachers in the research sites

Dependent variable		(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4		Mean difference (I-J)	SE	Significance	95% confidence interval	
							Lower limit	Upper limit
Graduate	Tamhane	1	2	-9204.500*	1754.92	0.01	-15267.41	-3141.59
			3	-1738.00	912.83	0.40	-4631.05	1155.05
			4	1343.75	638.23	0.28	-610.16	3297.66
		2	1	9204.500*	1754.92	0.01	3141.59	15267.41
			3	7466.500*	1863.26	0.02	1365.29	13567.71
			4	10548.250*	1745.22	0.00	4481.24	16615.26
		3	1	1738.00	912.83	0.40	-1155.05	4631.05
			2	-7466.500*	1863.26	0.02	-13567.71	-1365.29
			4	3081.750*	894.04	0.03	218.95	5944.55
		4	1	-1343.75	638.23	0.28	-3297.66	610.16
			2	-10548.250*	1745.22	0.00	-16615.26	-4481.24
			3	-3081.750*	894.04	0.03	-5944.55	-218.95

Note. \* $p < 0.05$ .

Table 9 shows that the mean difference between the number of general high school teachers with postgraduate qualifications in the Jiangsu and Anhui provinces was 9204.50 ( $p < 0.05$ ); a significant difference. The mean difference between the number of general high school teachers with postgraduate qualifications in the Anhui and Zhejiang provinces was 1738.00 ( $p < 0.05$ ); a significant difference. The mean difference between the number of general high school teachers with postgraduate qualifications in the Anhui province and Shanghai was 1343.75 ( $p < 0.05$ ); a significant difference. The mean difference in the number of general high school teachers with postgraduate qualifications in the Jiangsu and Zhejiang provinces was 7466.50 ( $p < 0.05$ ); a significant difference. The mean difference in the number of general high school teachers with postgraduate qualifications in the Jiangsu province and the Shanghai municipality was 10548.25 ( $p < 0.05$ ); a significant difference. The mean difference in the number of general high school teachers with postgraduate qualifications in the Zhejiang province and the Shanghai municipality was 3081.75 ( $p < 0.05$ ); a significant

difference.

The number of teachers with postgraduate degrees in general high schools in the research sites was analysed using ANOVA. The homogeneity of variance test was significant,  $ps < 0.01$ . After post-hoc comparisons, a Tamhane analysis showed that the relevant data in the Jiangsu province were more significant than in Shanghai and the Zhejiang province, and that the number of teachers with postgraduate degrees was more significant than in the Anhui province. The number of teachers with postgraduate degrees was more significant ( $p < 0.05$ ) in the Zhejiang province than in the Shanghai municipality. After the Anhui province had joined the YRD region, the number of teachers with postgraduate qualifications in general high schools in the province compared with those in the other research sites was not significant. In contrast, the number of teachers with postgraduate qualifications in the Jiangsu province was insignificant.

After the Anhui province had joined the YRD region, the number of teachers with postgraduate qualifications in general high schools did not increase.

**Table 10** Comparison of data difference of undergraduate education of ordinary high school teachers in the research sites

Dependent variable		(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4		Mean difference (I-J)	SE	Significance	95% confidence interval	
							Lower limit	Upper limit
Undergraduate graduation	Tamhane	1	2	-11995.750*	1468.691	0	-16663.28	-7328.22
			3	9382.750*	876.357	0	6618.45	12147.05
			4	56849.750*	749.433	0	54168.11	59531.39
		2	1	11995.750*	1468.691	0	7328.22	16663.28
			3	21378.500*	1349.211	0	16836.98	25920.02
			4	68845.500*	1270.441	0	64265.45	73425.55
		3	1	-9382.750*	876.357	0	-12147.05	-6618.45
			2	-21378.500*	1349.211	0	-25920.02	-16836.98
			4	47467.000*	474.308	0	45797.47	49136.53
		4	1	-56849.750*	749.433	0	-59531.39	-54168.11
			2	-68845.500*	1270.441	0	-73425.55	-64265.45
			3	-47467.000*	474.308	0	-49136.53	-45797.47

Note. \* $p < 0.05$ .

Table 10 shows that the mean difference in the number of general high school teachers with undergraduate degrees in the Jiangsu and Anhui provinces was 11995.75 ( $p < 0.05$ ); a significant difference. The mean difference in the number of general high school teachers with undergraduate degrees in Anhui and Zhejiang provinces was 9382.75 ( $p < 0.05$ ); a significant difference. The mean difference in the number of general high school teachers with undergraduate degrees in the Anhui and Shanghai provinces was 56849.75 ( $p < 0.05$ ); a significant difference. The difference in the mean value of the number of general high school teachers with bachelor's degrees in the Jiangsu and Zhejiang provinces was 21378.50 ( $p < 0.05$ ); a significant difference. The difference in the mean value of the number of general high school teachers with bachelor's degrees in the Jiangsu province and the Shanghai municipality was 68845.50 ( $p < 0.05$ ); a significant difference. The difference in the mean value of the number of general high school teachers with bachelor's degrees in the Zhejiang province and

the Shanghai municipality was 47467.00 ( $p < 0.05$ ); a significant difference.

The number of general high school teachers with bachelor's degrees in the research sites was analysed using ANOVA, and the test for homogeneity of variance was significant,  $ps < 0.01$ . After post-hoc comparisons, a Tamhane analysis showed that the relevant data for the Jiangsu province were the most significant, and the number of teachers with bachelor's degrees in the Anhui province had increased year on year in recent years, showing a significant state in the Jiangsu province. However, the estimated marginal mean of the bachelor's degree was the highest. It showed a significant decline in the Jiangsu province and had the highest estimated marginal mean of undergraduate graduates, showing a significant downward trend from 2015 to 2016. In addition, the trend in the Zhejiang and Anhui provinces was less significant, but the overall trend was generally stable.

**Data analysis related to the number of teaching staff in the research sites****Table 11** Comparison of data difference of the total number of ordinary senior high school staff in the research sites

		(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Significance	95% confidence interval	
Dependent variable							Lower limit	Upper limit
Total staff	Tamhane	1	2	-66254.161*	8755.578	0	-94768.57	-37739.75
			3	47713.089*	6126.861	0	28689.35	66736.82
			4	211281.589*	4397.516	0	196705.68	225857.5
	2	1	3	66254.161*	8755.578	0	37739.75	94768.57
			4	113967.250*	9186.343	0	84883.05	143051.45
			4	277535.750*	8135.639	0	249350.46	305721.04
	3	1	2	-47713.089*	6126.861	0	-66736.82	-28689.35
			4	-113967.250*	9186.343	0	-143051.45	-84883.05
			4	163568.500*	5202.586	0	146437.08	180699.92
	4	1	2	-211281.589*	4397.516	0	-225857.5	-196705.68
			3	-277535.750*	8135.639	0	-305721.04	-249350.46
			3	-163568.500*	5202.586	0	-180699.92	-146437.08

Note. \*The significance level of mean difference was 0.05.

Table 11 shows that the mean difference between the overall number of teaching staff in the Jiangsu and Anhui provinces was 66254.16 ( $p < 0.05$ ), which is significant. The mean difference between the number of high school degree holders in the Anhui and Zhejiang provinces was 47,713.08, ( $p < 0.05$ ), which is significant. The mean difference between the number of high school degree holders in the Anhui province and the Shanghai municipality was 211281.58 ( $p < 0.05$ ), which is significant. The difference between the mean values of the number of people with high school education in the Jiangsu and Zhejiang provinces was 113967.25 ( $p < 0.05$ ), which is significant. The difference between the mean values of the number of people with high school education in the Jiangsu province and the Shanghai municipality was 277535.75 ( $p < 0.05$ ), which is significant, and the mean value of the

number of people with high school education in the general high schools in the Zhejiang province and the Shanghai municipality was 163568.50 ( $p > 0.05$ ), which is significant.

Analysis of variance showed that the number of general high school teachers in the research sites, analysis of variance, homogeneity of variance test was significant,  $ps < 0.01$ . After conducting post-hoc comparisons, a Tamhane analysis revealed significant differences in the number of staff among provinces and municipalities. Specifically, the number of staff in the Jiangsu province showed a significant upward trend compared to the Anhui province. This difference was also evident in the development trend of the estimated marginal means. Following other provinces and municipalities, the development of the number of faculty and staff in the Anhui province showed a stable upward trend.

**Table 12** Comparison of data difference of regular high school full-time teachers in the research sites

		(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Significance	95% confidence interval	
Dependent variable							Lower limit	Upper limit
Full-time teacher	Tamhane	1	2	-55051.000*	9892.106	0.001	-86657.39	-23444.61
			3	44447.125*	6894.108	0	23363.98	65530.27
			4	195984.250*	5258.56	0	178568.09	213400.41
	2	1	3	55051.000*	9892.106	0.001	23444.61	86657.39
			4	99498.125*	9921.773	0	67845.69	131150.56
			4	251035.250*	8863.707	0	220068.48	282002.02
	3	1	2	-44447.125*	6894.108	0	-65530.27	-23363.98
			4	-99498.125*	9921.773	0	-131150.56	-67845.69
			4	151537.125*	5314.158	0	133910.65	169163.6
	4	1	2	-195984.250*	5258.56	0	-213400.41	-178568.09
			3	-251035.250*	8863.707	0	-282002.02	-220068.48
			3	-151537.125*	5314.158	0	-169163.6	-133910.65

Note. \*The significance level of mean difference was 0.05.

Table 12 shows that the mean difference between the number of full-time teachers in the

Jiangsu and Anhui provinces was 55051.00, ( $p < 0.05$ ); a significant difference. The mean

difference between the number of full-time teachers in general high schools in the Anhui and Zhejiang provinces was 44447.12 ( $p < 0.05$ ); a significant difference. The mean difference between the number of full-time teachers in general high schools in the Anhui province and the Shanghai municipality was 195984.25 ( $p < 0.05$ ); a significant difference. The mean difference in the number of full-time teachers in general high schools of the Jiangsu and Zhejiang provinces was 99498.12 ( $p < 0.05$ ); a significant difference. The mean difference in the number of full-time teachers in general high schools in the Jiangsu province and the Shanghai municipality was 251035.25 ( $p < 0.05$ ); a significant difference. The

mean value of the number of full-time teachers in general high schools in the Zhejiang province and the Shanghai municipality was 151537.12 ( $p > 0.05$ ); not a significant difference.

The number of full-time teachers in general high schools in the research sites was analysed using ANOVA. The homogeneity of variance test was significant,  $ps < 0.01$ , and the post-hoc comparison of Tamhane showed that the development trend of full-time teachers in the Jiangsu province in general high schools was the most significant. The development of the number of full-time teachers in the Anhui province and the other research sites showed a stable development trend.

**Table 13** Comparison of data difference among teachers and administrators of ordinary high schools in the research sites

Dependent variable	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	(I) Provinces (Anhui = 1, Jiangsu = 2, Zhejiang = 3), Shanghai = 4	Mean difference (I-J)	SE	Significance	95% confidence interval	
						Lower limit	Upper limit
Administrative personnel	1	2	-40.714	376.291	1	-1248.29	1166.86
		3	1640.161*	201.238	0	954.91	2325.41
		4	2006.411*	217.269	0	1304.23	2708.59
	2	1	40.714	376.291	1	-1166.86	1248.29
		3	1680.875*	339.497	0.007	500.76	2860.99
		4	2047.125*	349.237	0.002	868.23	3226.02
	3	1	-1640.161*	201.238	0	-2325.41	-954.91
		2	-1680.875*	339.497	0.007	-2860.99	-500.76
		4	366.25	144.46	0.142	-82.9	815.4
	4	1	-2006.411*	217.269	0	-2708.59	-1304.23
		2	-2047.125*	349.237	0.002	-3226.02	-868.23
		3	-366.25	144.46	0.142	-815.4	82.9

Note. \*The significance level of mean difference was 0.05.

Table 13 presents the mean difference in the number of teachers and administrators in the Jiangsu and Anhui provinces as 40.71 ( $p > 0.05$ ); the difference is not significant. The mean difference between the number of administrators in the Anhui and Zhejiang provinces was 1640.161 ( $p < 0.05$ ); a significant difference. The mean difference in the number of administrative staff in the Anhui province and the Shanghai municipality was 2006.41 ( $p < 0.05$ ). The difference is significant. The mean difference in the number of administrative staff between the Jiangsu and Zhejiang provinces was 1680.87 ( $p < 0.05$ ); a significant difference. The mean difference in the number of administrative staff between the Jiangsu province and the Shanghai municipality was 2047.12 ( $p < 0.05$ ); a significant difference. The mean value of the number of administrators in general high schools in the Zhejiang province and the Shanghai municipality was 366.25 ( $p > 0.05$ ); a significant difference.

The results show that except for the Jiangsu province, where the difference between the number of teachers and administrative staff and the relevant number of teachers in the Anhui province was not significant, the difference between the relevant data of other research sites and the Anhui province was

significant, indicating that the number of administrative staff in the other research sites had a substantial positive impact on the composition of the number of teachers in general high schools.

The number of teachers and administrative staff in general high schools in the research sites were analysed using ANOVA. The homogeneity of variance test was significant,  $ps < 0.01$ , and the post-hoc Tamhane comparisons showed that, among them, the Jiangsu and the Anhui provinces did not show a significant difference. The other research sites showed a significant difference; the number of teachers and administrative staff in the research sites have shown a substantial downward trend in recent years. The downward trend in the Anhui province was slower than in the other research sites. Reducing the number of administrators to teachers may lead to the return of teachers to their jobs and thus improve the quality of teaching.

## Results

The development of ordinary high schools can reflect the country's emphasis on education equity. The data analysis set out above shows that in the process of the integration of the YRD, the development gap between high-quality high schools

and disadvantaged ordinary high schools is mainly reflected in four dimensions. Firstly, the government's positioning and resource allocation ability determine whether it can help the high schools in disadvantaged provinces to obtain further improvement and development. Secondly, the degree of integration in the development of a school determines the development of its integration ability. (See Tables 4–8 and the comparison of the differences in the number of general high schools, classes, ordinary high schools in the research sites). Thirdly, the development of teachers determines whether they are afforded high-quality development opportunities in the process of YRD integration. (See Tables 9–13 for a comparison of the data difference of ordinary senior high school staff, full-time teachers and administrators in the research sites). Fourthly, the quality of student training determines the future development potential of high schools, as shown in Tables 6–7 and related analysis. (Comparison of the number, enrolment difference of ordinary high school graduates at the research sites.)

#### Governmental Aspects

##### *Ambiguous positioning results in management dislocation in the process of integrated high-quality development*

The vague positioning of general senior secondary education by local governments and relevant education administrations has hindered progress and coordinated development in the YRD region. On the one hand, general senior secondary education plays a crucial role in nurturing talent for higher education, bridging the gap between different levels of education, and improving the nation's overall quality. However, during policy implementation, the relevant departments often fail to clearly define the position of senior secondary education. There have been instances where regular high school education was regarded as compulsory and preparatory for higher education, while overlooking the crucial linkage of senior high school education in integrating high-quality development in the YRD. Additionally, due to economic factors, economic development in the Anhui province is relatively weak compared to other YRD regions. To address this issue and to ensure nationwide completion of compulsory education, relevant departments have implemented measures to reduce financial investment in senior high school education (Arfani & Nakaya, 2019).

In contrast, the abolition of selective fees in senior high schools and the growing demand for modern educational technology have increased the financial investment in senior high school education. Additionally, the lack of uniform and clear guidance for provinces and cities has also contributed to the mismatch in management when promoting the linkage with the YRD in general senior high school education. The absence of guidance is one of the

factors contributing to the misalignment of management.

##### *Imbalance in educational resources leads to the loss of talent in the process of integrated high-quality development*

In February 2019, the state formulated and issued a plan for the modernisation of China's education. This plan determines the specific direction of education development. In the outline, it puts forward certain requirements, such as the high quality popularisation of education, a clear direction, reflection on the current basic situation of education, and essential measures to solve the imbalance and insufficiency in China's education development. Therefore, the prerequisite for ensuring high-quality education development is to address issues such as imbalanced educational resources. In the process of integrated development of the YRD, the imbalance of educational resources can be seen through comparison of the significance of teachers' academic qualifications as well as the ratio of the staff distribution at the research sites. This is currently identified as the most severe problem facing senior high school education development in the province. With the increasing national attention to education development, there has been a rapid expansion of general high schools in the province, resulting in an average student population reaching thousands. Based on urban, county and rural classification guidelines, as well as being in accordance with city development policies, urban general high schools can expand appropriately. However, there may be an uneven distribution of resources among the different high schools (Zhang & Sheng, 2022). The uneven distribution of educational resources has led to the intensification of the "student source war" in recent years, and increased school enrolment due to continuous expansion, further exacerbating resource disparities and imbalances in school size. For example, the increase in student numbers has led to a shortage of high-quality teachers in schools, which has caused a growing mismatch between the distribution of high-quality educational resources in general senior high schools and the degree of economic development in the Anhui province. In terms of teacher training, disadvantaged regions invest significant resources in training high-quality teachers following various approaches, such as the introduction of talent. These mature teachers may choose economically developed regions, further exacerbating the imbalance in educational resources in the Anhui province. Moreover, this is one of the reasons for the uneven development of educational resources in the Anhui province, which hinders implementation of senior high school regional integrated development policies. As an essential part of the YRD region, the level of the Anhui province's economic development is fundamentally lagging

behind that of the Jiangsu and Zhejiang provinces and Shanghai. As a result, a large number of categories of high-quality educational resources are increasingly depleted (Shuai, 2020).

#### Regarding School Aspects

##### *Insufficient integration in the process of integrated quality development*

Overall, the Anhui province needs to strengthen its general high school education for the initiative to take effect. The provincial education committee and relevant government departments have been working together to develop planning and action guidelines in a top-down approach (Li, W & Wang, 2019). Specific provincial party committee requirements have been integrated into the development of various stages of education. All levels of education, including higher education, secondary education (middle and primary), and vocational education, have struggled to keep up with the development of the YRD region. For example, the Anhui Provincial Department of Education issued a notice on the establishment of the Anhui Research Institute for the Integrated Development of Education in the YRD. The 12th Conference on the Integrated Development of Education in the YRD, and the Jiangsu, Zhejiang, Anhui provinces and Shanghai jointly formulated and signed the 3-year Action Plan for the Integrated Development of Education in the New Round. These efforts have significantly advanced collaborative innovation and service development capacity in promoting high-quality primary education, and accelerated the construction of a collaborative platform for vocational education. Additionally, projects aimed at accelerating the modernisation of education and improving the institutional mechanism for the collaborative development of education in the YRD have been strengthened. This will accelerate the integrated development and inject education kinetic energy. There has also been collaboration in developing resources for moral education, physical education, art, science and technology, labour, and other subjects in primary and secondary schools. Educational resources are shared, built, and promoted across the region in order to support the YRD education evaluation reform. This initiative aims to explore evaluation standards for schools, teachers, students, and other aspects of the YRD experiment. In the linkage development with other provinces and cities in the YRD, the Anhui province is actively integrating into the development of the YRD region. However, cooperation in the development of general high school education shows little linkage. In its own way, each is closely related to the development process of general high school education in the provinces. More attention will be paid to scores for the college entrance examination at school level (Lu, 2022). At this level, high schools in the Anhui province lack connections

with schools in neighbouring regions that have development advantages. This leads to a superficial integration and development of the YRD region as a whole in terms of general high school education, with insufficient initiatives to integrate with the catching-up process.

##### *Inadequate integration in the process of integrated quality development*

The education departments of the research sites have closely consulted on the reform of the secondary and higher education examinations and have shown linkages in the top-level design of policies. The education departments of various places have also formed a mechanism for consultation and exchanges on significant policies by taking advantage of the policy of regional integration. Through implementing activities such as the YRD Primary and Secondary School Headmasters Training Course and the Basic Skills Competition, they vigorously enhance principals' and teachers' professionalism. However, it is undeniable that due to the actual differences in regional development and the fierce competition among provinces regarding ratios, each province and city retains core training content during the collaborative stage of high school education development on how to improve the quality of education for learners and to optimise educational management mechanisms (Zhu, 2023). Therefore, in the process of integrating into the high-quality development of the YRD, some superficial linkage activities cannot solve the actual problems encountered by the disadvantaged regional high schools. Additionally, there is a lack of systematic construction for the follow-up feedback mechanism among all parties involved, which makes it difficult to fully participate in the process of regional integration of the development of high school education in the Anhui province. The degree of integration needs to be deeper to catch up with the high school development of other provinces and cities.

#### Regarding Student Aspects

##### *The quality of student training is relatively low in the process of high school integration and high-quality development in the Yangtze River Delta*

After analysing the data on the number of general high schools across the research sites, it is evident that there is no significant difference between the Anhui province and the other sites. However, when considering the estimated marginal mean shows a recent declining trend in the number of schools, specifically in the Anhui province. This decline was particularly notable during 2014 and 2015. The large-scale population migration from the province and the decline in the fertility rate are directly related. Regarding class numbers, there was no substantial difference between the Anhui and Jiangsu provinces. There was a significant difference compared to Shanghai but less significant

than with the Zhejiang province. The growth in the number of classes indicates that the problem has been considerably alleviated in recent years due to the efforts of education-related departments, and it is continuing to improve. The development of general high school education in the Anhui province has significantly increased in terms of the number of classes. Regarding high school graduates, there was a noticeable difference between the Anhui and Zhejiang provinces and the Shanghai municipality, with the Jiangsu province showing an even greater distinction. Moreover, the estimated marginal mean suggests a consistent number of high school graduates across different regions. In terms of the number of high school graduates, there was no significant difference between the Anhui and Zhejiang provinces or the Shanghai municipality, but there was a greater difference compared to the Jiangsu province. The number of high school graduates has been declining year on year due to the problematic employment situation and increasing trend of students choosing to study abroad, leading to a diversification in choices. In terms of high school enrolment, there were no significant difference between the Anhui, Jiangsu and Zhejiang provinces, and the Shanghai municipality. Additionally, the enrolment in the Anhui province showed a downward trend from 2013 to 2017 but started to rise thereafter. In terms of the actual number of high school students, there was little difference between the Anhui and Zhejiang provinces and the Shanghai municipality. However, the difference between the Anhui and the Jiangsu provinces was significant. The number of high school students in the Anhui province has declined substantially from 2013 to 2019, but showed a notable increase during 2019 and 2020.

In the past 2 years, the increase in enrolment and student population in general high schools has been closely linked to the rise of private high schools, changes in parents' school selection, and competition among schools for high-quality students. However, economically underdeveloped regions have faced challenges such as limited financial support from local governments and insufficient school expansion, resulting in a rapid but quantity-focused expansion with a decline in student intake quality.

#### Regarding Teacher Development

*The construction of teaching staff is not sufficiently refined to support the process of integrated high-quality development*

The analysis of general high school staff numbers shows little difference between the Anhui and the other provinces, indicating a balanced development of overall staff numbers, especially for general high schools (Sun, 2023). Concerning full-time teachers, there was a difference between the Anhui and Jiangsu provinces, although the gap was not large. The Jiangsu and Zhejiang provinces showed little

differences. The number of full-time teachers in the Jiangsu province had the highest significance and the trend was steadily increasing. The number of full-time teachers in the Anhui province lies between that of the Jiangsu and Zhejiang provinces, the significance was not apparent and the development was slower. Concerning the number of teacher administrators in various provinces and cities, there was no significant difference between the Anhui and Jiangsu provinces. The significance of the data on the Zhejiang province and the Shanghai municipality was equal. Regarding administrative personnel, in comparison with the other the research sites, the development trend in the Anhui province was in a minor catch-up stage (Liu, Y & Fang, 2022). Regarding high school teacher aids and assistants, the Anhui and Zhejiang provinces showed substantial differences. In the Jiangsu province and Shanghai, the significance was the same. Regarding the staff, the Anhui and Zhejiang provinces and the Shanghai municipality were not substantially different, but there was a larger difference compared to the Jiangsu province. In the dimension of the school office staff, the Anhui province differed significantly from the other two provinces, followed by a substantial difference with the data in the Jiangsu province and Shanghai. In the dimension of school-based enterprise teachers, the substantial difference between the Anhui province and the Shanghai municipality was the greatest, followed by the Zhejiang province, and a minor difference with the Jiangsu province. Regarding substitute teachers, there was no substantial difference between the Anhui and Zhejiang provinces and Shanghai, with an enormous difference compared to Jiangsu province. With regard to part-time teachers, there was a large, substantial difference between the Anhui and Zhejiang provinces, and there was no substantial difference compared to the Jiangsu province and Shanghai.

The student-teacher ratio is a key indicator for the need to improve the allocation of teaching staff. Although the Anhui province has a similar number of teaching staff compared to other provinces and cities, it lags behind in terms of full-time teachers, especially when compared to the YRD region. However, the development trend of teaching assistants, substitutes, and part-time teachers in the Anhui province aligns with that of other regions. This suggests a lack of optimised teacher structure design. While teacher resource coverage in the Anhui province is relatively extensive, its internal structure development needs refinement.

#### Discussion

**Governmental Aspects: Towards Integrated and High-quality Development in the Context of Establishing and Improving Relevant Linkage Mechanisms**

With the promulgation of guiding policies like the 3-year Action Plan for Integrated Education in the

YRD 2021–2023, the Anhui province must keep pace with the integrated and high-quality development of senior high schools in the YRD region. It should leverage policy advantages, foster regional collaboration, and implement top-level government design to ensure continuous progress towards balanced and high-quality senior high school education in the YRD region. The aim is to ensure the continued progress of high school education in the Anhui province towards balanced and high-quality development (Wang, H, Chen & Liu, 2023). Additionally, a corresponding platform for linkage and cooperation should be established due to the abundant and diverse educational resources in the YRD region. The establishment of interregional joint training courses and a collaborative platform for integrated general high school education can be achieved through long-term cooperation, regular feedback, and synergistic innovation among regions. The joint mechanism of teacher training and the sharing of high-quality resources will showcase the positive development of general high school education in the research sites in the new era (Smith et al., 2020). Furthermore, by establishing a standardised system, the development of high school education in each province and city can be evaluated within the existing quasi-system. An innovative system will be established to meet the characteristics of provincial development and interregional linkages. Currently, education cooperation in the YRD mainly consists of short-term study meetings and expert lectures. The learning mode is standardised and the continuity of the learning effect is short, so there is an urgent need to develop a new cooperation standard system to lead the high-quality development of general senior secondary education in the region and formulate corresponding mechanisms for learning evaluations, incentives, and supervision. The measures will promote the precise positioning and enhance the self-development ability of senior secondary schools. The programme will continuously carry out the plan. Additionally, through the linkage of senior high school education in the research sites led by local government and actively implemented by corresponding education departments in districts and counties, micromanagement needs to be tempered for optimised management (Wang, Y & Zhang, 2023). The government should aim to reduce excessive competition among provinces and cities in high school admissions through practical measures, while enhancing the concept of linkage development and high school rights. Additionally, relevant departments need to focus on developing high school education in the YRD Regional Integration and Linkage Programme, building bridges for the linkage development of high-quality schools with other regions.

**At the School Level: Towards an Integrated and High-quality Development Process through Autonomous Innovation and Proactive Integration**  
Ordinary high schools in the Anhui province should actively seize development opportunities, find their position, and participate in the YRD integration process with a clear understanding of their overall situation. Schools should have a clear understanding of their development situation. Regardless of the economic level in each high school's region, the primary purpose of high school education is to cultivate talent for higher education in the country. High schools, as an advanced stage of secondary education, need to actively coordinate with high-quality schools in developed regions to establish a model of linked development and enhance self-improvement. Additionally, it is necessary to establish and improve internal educational management mechanisms in general high schools (Komisarow, 2022).

There is a relatively mature model for high school development in various provinces and cities, but further exploration and optimisation are still needed. The following urgent problems need to be solved: balancing the number of full-time teachers and administrative staff, addressing the potential impact of irrational arrangements of part-time teachers on teaching quality and professional development of teachers. Additionally, the rapid expansion of senior secondary schools requires changes in management mechanisms, such as clarifying teacher categories and effectively enhancing motivation through a combination of common and individual approaches. The early development of the Anhui province should actively establish connections with high schools in other provinces and cities to identify weaknesses and shortcomings in the process of advancing towards high-quality development. Additionally, a strategic plan tailored to the characteristics of high school education in the province (Modiba & Sefotho, 2019) should be implemented. The Anhui province should learn and effectively adopt management models from other high schools as it integrates into the YRD region. It is also important to study and emulate the high-quality aspects of management models from other schools to promote the development of general secondary education.

**At the Student Level: Towards an Integrated and High-quality Development Process in Strengthening the Development of the Student Body**

When it comes to the training and the school population of ordinary high school students in the research sites, the first thing to consider is the student selection process. The rise of private high schools in various regions and the change in which schools parents choose have led to an increased



number of students in high schools in the Anhui province (Nishizuka, 2022).

Secondly, the constant expansion of high school student numbers dilutes both the ratio of student source and teaching, directly impacting the development of high-quality higher education (Cao et al., 2018). Therefore, in the process of developing and expanding enrolment modes, general high schools should focus on screening existing sources, establishing quality standards, and adhering to the principle of high-quality cultivation to catch up with other developed provinces and cities. Additionally, they should strengthen the linkage of high-level sources to cultivate exceptional students. The general high school stage represents an advanced level of secondary education, thus positioning recipients' educational attainment at a higher level. For instance, high schools in different provinces and cities can collaborate to establish a talent pool of high-quality students. The main focus should be on providing opportunities for exceptionally talented students in specific subjects to access diverse and excellent educational resources. This can be achieved by integrating existing summer programmes offered by prestigious colleges and universities. By doing so, top-notch educational resources can be provided, reducing the emphasis on comparing talent output quantitatively across regions. Instead, the advantages of collaborative management that contribute to the country's development can be highlighted (Ren, 2023). To cultivate young people to function in the new era and to provide a positive influence, a dual system development in secondary education can be established and advantageous projects developed in each region of the research sites. This will provide high school students with opportunities to experience vocational programmes that they are interested in and help them plan for their future studies (Anub, 2020). This will assist students in planning for their future majors or choosing a vocational education path that suits them, thereby addressing the declining graduation rate of general high school students year on year. Additionally, the province can establish a mechanism for the development and mobility of high school graduates and provide appropriate subsidies and incentives for those who have received a good education in the YRD region to return to their hometowns for employment. This will promote high-quality development of high school education in the Anhui province and facilitate the integration process within the YRD region.

**Regarding Teacher Development: Towards an Integrated and High-quality Development Process in Optimising Teacher Training and Construction**

Teachers in senior secondary schools are valuable educational resources that can adapt to different locations, generating new and high-quality ideas.

This positively contributes to interregional mobility and knowledge sharing among the underdeveloped YRD, promoting the development of related disciplines and enhancing quality services for the educated population, thus driving integrated and synergistic development in the YRD.

The current development of high school teachers in the Anhui province needs optimisation in two ways. One is the enhancement of their academic qualifications because qualification levels have an impact on education quality improvement, and by establishing a team of teachers with high moral integrity and cultural quality, teaching quality may be improved (Liu, Z & Kong, 2019).

Another way is to ensure systematic training and provide various channels for teachers' further education, helping them improve their academic qualifications, develop sustainable teaching abilities, and enhance the quality of teaching. For instance, collaborating with teachers in the leading stage of the YRD region can be beneficial by establishing connections with local colleges and universities affiliated with them to offer corresponding courses and establish a mechanism for joint training during summer and winter vacations (Anub, 2020). In addition, teachers in high-quality schools can establish mechanisms for talent mobility, effectively supporting the development of disadvantaged regions by integrating and implementing high-quality education in general high schools. Secondly, a more flexible system can be established for the timing of high-quality teacher employment. Additionally, a green channel can be opened for title appraisal of teachers in disadvantaged regions, promoting mobility and ensuring the availability of high-quality teachers (Yaqian & Yuqiang, 2022). Cooperation with high-quality high schools in other regions of the research sites should be deepened. This can be achieved by strengthening platforms for joint learning and establishing close connections with high-quality high schools in developed regions of the YRD. The gradient model of teacher training should be learned from, and opportunities for out-of-school rotations and exchanges should be expanded. Regular and special exchange programmes should also be created to enhance teachers' teaching practice, contributing significantly towards rapid development of their skills through regular exchange and feedback (Lu, 2022).

## Conclusion

The empirical analysis of the data shows that compared with the development of high-quality ordinary high schools in the developed provinces of the YRD region, the development trend of ordinary high schools in the weak Anhui province has serious imbalances, obvious gaps, relatively weak development and other problems. The primary

concerns include a lack of clarity in the system as well as insufficient proactive initiative towards advancement. Research indicates that weak provinces in the YRD can leverage their policy advantages to play a significant role at government level by establishing a cooperative platform for linkage. Furthermore, high schools in disadvantaged areas should actively collaborate with high-quality institutions in developed regions while enhancing internal education management mechanisms through strategic plans aligned with the characteristics and progress of underdeveloped senior high school education in the province. To improve student training, it is recommended to strengthen joint training programmes for high-achieving students from underprivileged provinces through rigorous selection processes. For teacher training, implementing well-planned professional development opportunities will be beneficial. Additionally, establishing an adaptable system would facilitate further academic pursuits.

In the long run, promoting the integration of ordinary high school education in the YRD requires a discussion on how integration should be done. This includes deep consideration on developing ordinary high school education in disadvantaged provinces during the integration process and determining its own development logic and orientation. Further research is needed to achieve quality and distinctive development. Countermeasures and suggestions are expected for how ordinary high schools in the Anhui province can catch up with those in high-quality development areas, aiming to provide reference for high school development in the YRD region and other provinces.

#### Data Availability

The datasets generated during and/or analysed in this study are available from the first author upon reasonable request.

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#### Authors' Contributions

MNZ conceived and designed the analysis, collected the data, performed the analysis, and wrote the manuscript. CWR supported the data collection, reviewed the studies, and assisted in data analysis. Both authors contributed to the article and approved the submitted version.

#### Conflict of Interest

The authors have no conflicts of interest to declare.

#### Notes

- i. The data in this study are taken from the time period after the country promulgated the policy on the integration process of the Yangtze River Delta, focusing on the Anhui province, a weak developing province in the development stage of the integration process, and exploring the development status quo of ordinary high schools in the Anhui province in the integration stage of the Yangtze River Delta.
- ii. Published under a Creative Commons Attribution Licence.
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