

Chapter 4

Secondary Education (High School) in China



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Abstract Secondary education (high school) is an important link between compulsory education and higher education. This chapter demonstrates education data obtained from OECD, UNESCO, the official website of the Ministry of Education of China (MOE), and other data sources, and conduct analysis based on these data. The results show that due to a large population, China has a certain disadvantage when compared with developed countries in terms of total expenditure per full-time equivalent student. Despite this added hurdle, China has reached or surpassed the global average in multiple measures, including student–teacher ratio and teacher attrition rate. This chapter also preliminarily constructs three dimensions of indicators (input, output, and college preparation) to examine excellent high schools in international context. Additionally, this chapter analyzes the development trends of China’s high school education from the perspectives of latest research and national policies, and presents aspirational stories and best practices. The chapter provides readers with a unique lens to understand the current and future development of China’s high school education in the international context.

Keywords High School education · Curriculum reform · College entrance exam reform · Core competency · Moral education · Well-rounded education · Student development

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1 Introduction

High school education is an important part of the national education system. High school education, which is between basic education and post-secondary education, has a significant impact on student development (*rencai peiyang*). Not only does high school education influence higher education, but it also directly impacts social capital. According to OECD (2021a), a high school education “has become a minimum requirement for navigating the modern economy and society”. The popularity and quality of high school education directly impacts social capital which further affects national development. Chinese government places a high value on the cause of high school education and has integrated high school education development into the national strategic development system. With strong national support, China’s high schools continue to improve teaching conditions, develop educational resources, and improve education quality aiming to cultivate talents with overall quality and excellence. It is worth noting that 2022 marks the 10th anniversary of high school education reform, which began from the 18th National Congress of the Communist Party of China (CPC) in 2012. In the past decade, China’s high school education has made important progress and remarkable achievements (see Table 1).

The data above show that China’s high school education has improved significantly in popularity, financial investment, teaching conditions, and teacher resources.

However, scholars across the globe may not be aware of the latest changes in high school education in China. Some scholars may still hold onto outdated perceptions and past criticisms of China’s education. For instance, Xu Guanlin, the honorary president of Nanyang Technological University in Singapore, has criticized China’s

Table 1 Achievements of high school education reform in China over the past decade

Aspects	Indicators	Data (2012)	Data (2021)	Changes
Universal access to education	Number of high schools	13,509	14,600	↑8%
	Gross enrollment ratio	85%	91.4%	↑6.4%
Financial investment	Fiscal expenditure of education (RMB100 million)	2,317	4,666	↑101%
Teaching conditions	Instrument and equipment value per student (RMB)	2,127	4,968	↑134%
	Area of school buildings (km ²)	420	644	↑52.35%
	Proportion of large classes	47.76%	4.81%	↓42.95%
Teacher resources	Number of full-time teachers	1,595,000	2,028,300	↑27.17%
	Student–teacher ratio	15.47:1	12.84:1	↓20.48%
	Percentage of teachers with a bachelor’s degree or higher	96.44%	98.82%	↑2.38%
	Percentage of teachers with a master’s degree or higher	5%	12.4%	↑148%

Source MOE (2022)

high school education for placing too much emphasis on examinations and test scores (Zhang, 2012). Education scholars from different countries have condemned China's exam-oriented culture for impeding creative education (Mullen, 2017). However, with the advancement of education reforms in China, China's high school education is not what it used to be.

This chapter aims to introduce the new developments of China's high school education systematically, and from an international perspective. This chapter intends to help international researchers better understand China's high school education, and thus promote educational communications between China and other countries. Furthermore, successful experiences of China's education will be highlighted, promoting the common development of educational causes across the globe.

2 Highlighting Data

This section analyzes the resources invested in education in China and other countries, including human resources (e.g., teachers), financial resources, and physical resources (e.g., facilities). The resources to be compared are shown in Table 2. The data are mainly drawn from OECD's annual *Education at a Glance* report and UNESCO databases. While indicators for China are not directly available in the datasets of OECD and UNESCO, this chapter calculates comparable indicators using data from China's Ministry of Education (MOE), National Bureau of Statistics and other authorities.

2.1 Student–Teacher Ratio

The ratio of students per teacher is calculated by comparing the number of full-time equivalent students at a specific education level to the number of full-time equivalent teachers directly involved in teaching at the same level of education (OECD, 2022a).

Table 2 An overview of the indicators in highlighting data

Type of resources	Indicators
Human resources	Student–teacher ratio
	Percentage of teachers qualified according to national standards
	Percentage of teachers with a bachelor's degree or higher
	Teacher attrition rate
Financial resources	Total expenditure per full-time equivalent student (PPPs for GDP)
	Total expenditure on educational institutions as a percentage of GDP
Physical resources	Proportion of schools with access to internet

As a measure of teaching resource allocation, the student–teacher ratio is considered to be a determining factor of learning outcomes and a significant indicator of educational quality (OECD, 2013; UNESCO, 2022a). Studies find that the lower the student–teacher ratio is, the more support and attention students are likely to receive (Biddle & Berliner, 2002) and the higher academic performance students may achieve. An empirical study based on PISA 2009 finds that poor academic performance may result from a high student–teacher ratio (Hou & Shen, 2014).

According to OECD, in 2019, among the OECD countries with available data, the ratio of students to teaching staff at high school level in general programs varies from 9:1 in Latvia and Lithuania to 28:1 in Mexico, with an average of 13:1. In China, the average student–teacher ratio in regular senior secondary schools is 12.99:1, which is roughly equal to the average in OECD countries (Fig. 1).

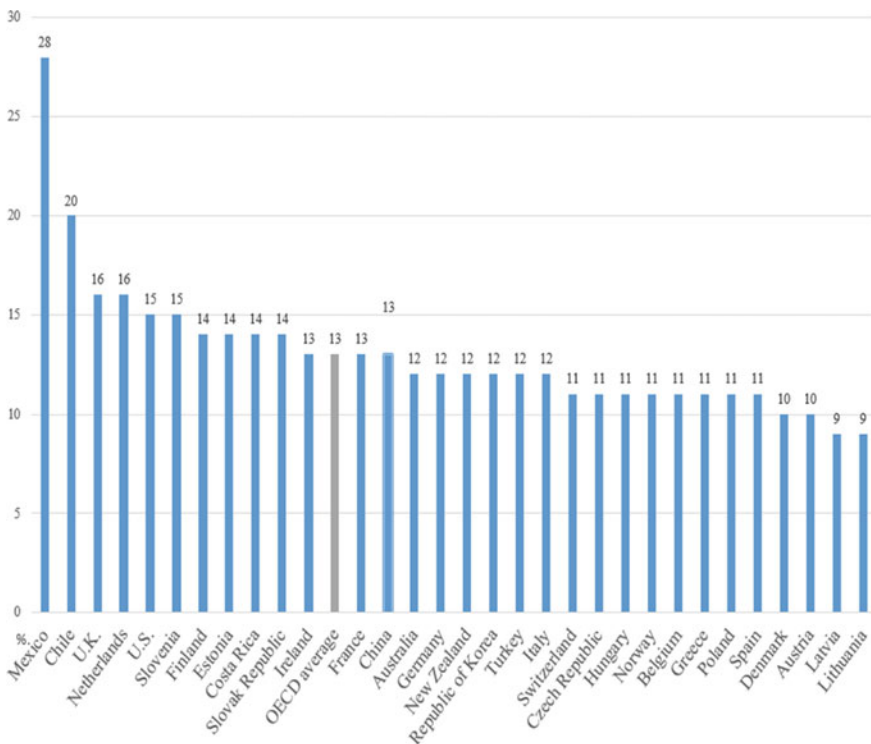


Fig. 1 Ratio of students to teaching staff in high school general programs (2019) (%). Source OECD (2021b), National Bureau of Statistics (2020a)

2.2 Percentage of Teachers Qualified According to National Standards

Percentage of teachers qualified according to national standards refers to the proportion of teachers possessing the minimum national academic qualifications required to teach a given subject at a certain level (UNESCO, 2022b).

It is necessary to measure and monitor the certification of teaching workforce. In 2008, Australia Education Alliance reported that 58% of public-school teachers were not eligible to teach their subjects, which negatively affected education quality (Zhang, 2009). The percentage of qualified teachers is predictive of the quality of education.

According to UNESCO, in UNESCO Institute for Statistics (UIS) regions, the average percentage of qualified teachers in high school education is 91.93% in 2020. The percentage varies sharply across the countries, from 19.91% in Ethiopia to 100% in 18 countries including Monaco, Jordan, and Thailand. China's percentage of qualified teachers at high school level is 90.04% with 1.89% percentage points lower than the average level in UIS regions (Fig. 2).

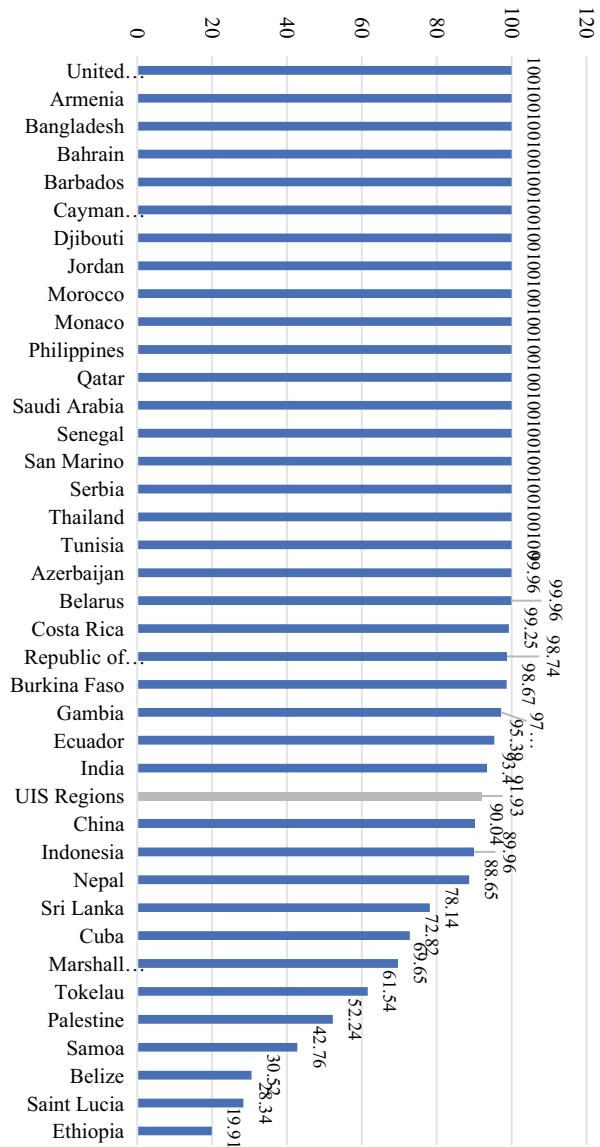
However, the national qualification requirements for teachers vary widely among different countries, and there are limitations on the international comparability at a fixed point in time. This chapter also examines the trend in China's percentage of qualified teachers. According to the UNESCO, between 2015 and 2020, the percentage of qualified teachers in China rose from 82.80% to 92.04%, while the average percentage of qualified teachers in UIS regions fell by 2.60% (Fig. 3). It can be seen from the comparison of the change trend that China's percentage of qualified teachers is likely to exceed the average level in UIS regions in the future.

2.3 Percentage of Teachers with a Bachelor's Degree or Higher

Studies indicate that educational quality is significantly associated with teachers' educational attainment (Rivkin et al., 2005). Despite the debates about the impact of teacher education level (Betts et al., 2003; Henry et al., 2014), many studies find that teacher education level is positively related to students' academic performance (Cooper & Cohn, 1997; Lee & Lee, 2020).

Since teachers' academic level could influence the quality of education, many countries have set minimum requirements on educational attainment for teachers. In China, high school teachers must have a degree of Bachelor's or above (MOE, 2021a). According to MOE, the percentage of teachers with a bachelor's degree or higher reached 98.62% in 2020. In accordance with OECD, in 2020, the average across the reporting OECD countries was approximately 97.89%, with the minimum of 83.00% in Iceland and maximum of 100% in Australia, Denmark, Finland, Germany, Hungary, the Republic of Korea (ROK), Netherlands, Poland, Portugal,

Fig. 2 Percentage of qualified teachers in high school education (2020) (%).
 Source UIS (2022a)



Spain, Turkey, and Scotland (the United Kingdom [U.K.]) (Fig. 4). It is important to note that the original data offered by OECD include the distribution of high school teachers by education levels according to the International Standard Classification of Education (ISCED). In the framework of ISCED, the 6th and above level correspond to a bachelor's degree or higher (Federal Ministry of Education and Research, n.d.). The data of this indicator were self-calculated based on the original data from OECD and the classification framework of ISCED.

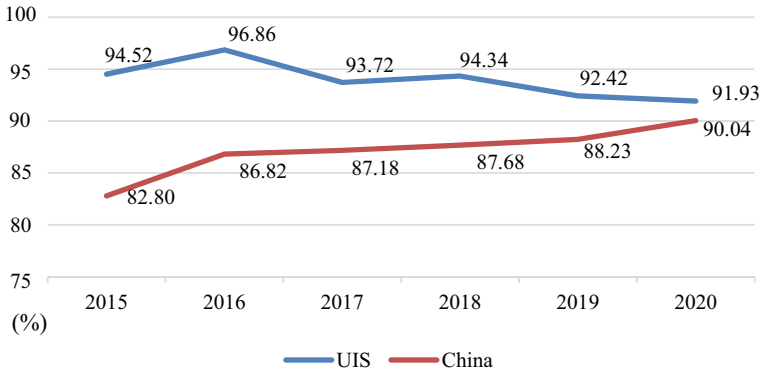


Fig. 3 Percentage of qualified teachers in high school education: 2015 to 2020 (%). *Source* UIS (2022a)

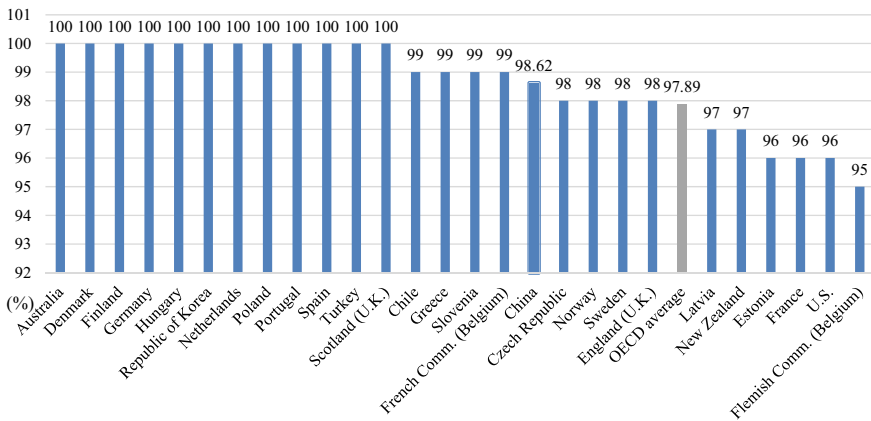


Fig. 4 Proportion of high school teachers with a Bachelor's degree or higher (percent) (2020) (%). *Source* MOE (2020a), OECD (2021c). *Notes* The OECD average is calculated by using the data of OECD countries presented above

From the data above, China's percentage of high school teachers with a bachelor's degree or above is higher than the average of OCED countries. Furthermore, from 2009 to 2020, the percentage of teachers with a bachelor's degree or higher in China continued to rise, from 93.60% in 2009 to 98.62% in 2020 (Fig. 5). The statistics demonstrate both a slight international advantage and a steady increase in the academic level of China's high school teachers, indicating a great increase in the investment in teachers' human capital.

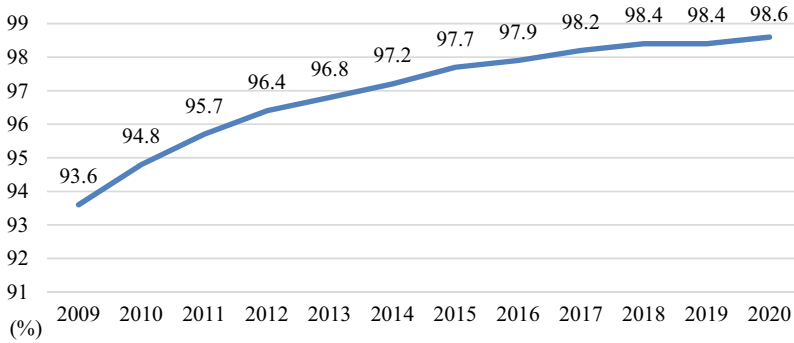


Fig. 5 Percentage of Chinese high school teachers with a bachelor's degree or above (%). *Source* Chen and Zhi (2019), MOE (2019a, 2020a)

2.4 Teacher Attrition Rate

The teacher attrition rate is the percentage of teachers who leave the profession. This indicator is calculated by dividing the number of leavers in a given year by that year's total teaching workforce, including new entrants (UNESCO, 2022c). A large value indicates that the teacher supply is unstable and insufficient, which could negatively affect students' learning and hinder the development of education.

According to UNESCO (Fig. 6), in upper-middle-income countries, the average attrition rate of high school teachers was about 4.60% in 2020. China's high school teacher attrition rate was 4.30%, lower than the average level of upper-middle-income countries, demonstrating a relatively more stable teacher population.

2.5 Total Expenditure Per Full-Time Equivalent Student, PPPs for GDP

Total expenditure per full-time equivalent student is an indicator that shows the amount of financial resources devoted to a single student on average, reflecting the degree of financial investment and support for education. It is calculated by dividing the total expenditure on educational institutions at a given level of education by the corresponding full-time equivalent enrollment (OECD, 2021d). To ensure the comparability across countries, expenditures in different national currencies are converted into equivalent U.S. dollars (US\$) using Purchasing Power Parties for GDP (PPPs for GDP).

In 2018, OECD countries spent on average around US\$10,581 per student in general programs at high school level. There were large variations among the reporting countries, ranging from less than US\$6,000 per student in Chile, Greece, Mexico, and Turkey to more than US\$14,000 per student in Luxembourg, Norway,

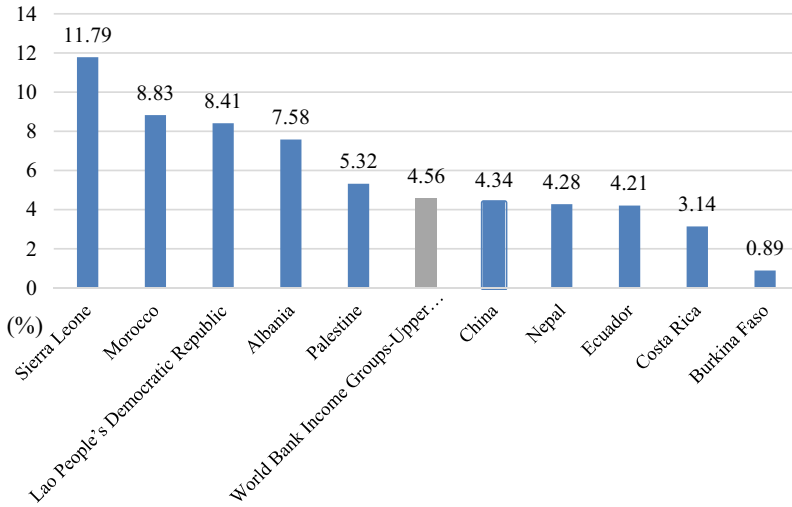


Fig. 6 Teacher attrition rate from high school education (2020) (%). *Source* UIS (2022b)

Belgium, Austria, Australia, France, and U.K. According to MOE, the 2018 total education expenditures per student in general high school education was RMB20,441 (around US\$4,833). The PPPs for GDP of China was 4.228704, according to OECD. Figure 7 shows that China’s level of expenditure per high school student was much lower than that of the majority OECD countries.

However, a lower level of average education expenditure does not necessarily represent a lower degree of financial investment in education. The level of spending per student can be affected by many factors, such as the number of students enrolled, the length of schooling, and teachers’ salaries (OECD, 2021a), which vary significantly from country to country.

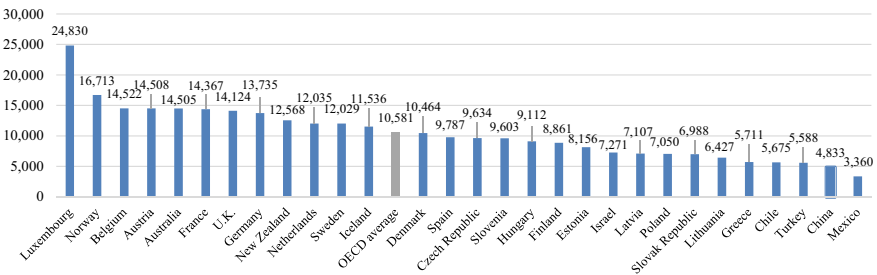


Fig. 7 Total expenditure per full-time equivalent student in general programs at high school level, PPPs for GDP (2018). *Source* OECD (2021d, 2022b), MOE (2019b)

2.6 Total Expenditure on Educational Institutions as a Percentage of GDP

National investment in education can also be evaluated by total expenditure on educational institutions as a percentage of GDP. It shows the share of a country's wealth produced in a period that has been spent on educational institutions. Not only can this measure indicate the priority placed on education, but it also demonstrates the degree of adaptability between the development of education and the economy. This indicator is also helpful to avoid some comparability issues, giving a more accurate picture of national investment in education.

In 2018, OECD countries spent an average of 0.6% of their GDP in general high school programs. The percentage ranged from lows of 0.2% in the Czech Republic and the Slovak Republic to highs of 1% in Chile and New Zealand and 1.4% in Israel. In 2018, China spent RMB472,100 million on general high school education (MOE, 2019b), while China's GDP reached RMB900,309 billion (National Bureau of Statistics, 2019). It is estimated that the total 2018 expenditure on general high school in China accounted for 0.52% of GDP. The data are presented in Fig. 8.

Although China's total expenditure on general high school education relative to GDP is lower than the average level of OECD countries, the gap is not large. Moreover, the total expenditure on general high school education as a percentage of GDP in China has risen from 0.52% in 2018 to 0.55% in 2020 (Fig. 9).

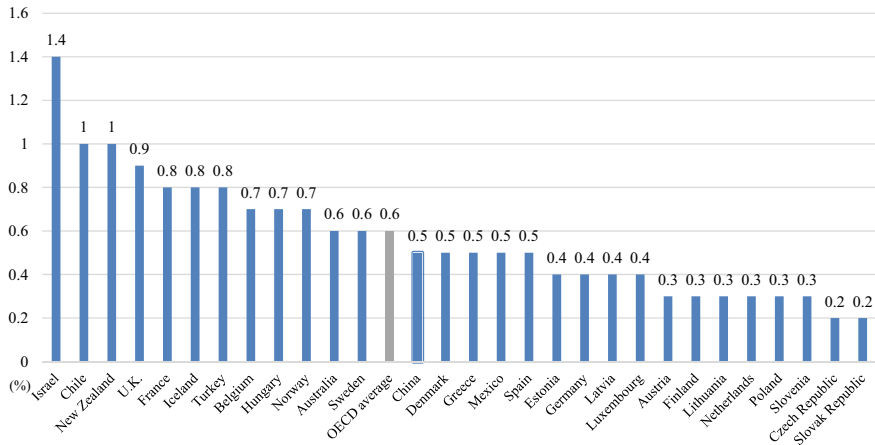


Fig. 8 Total expenditure on high school education as a percentage of GDP (2018) (%). *Source* OECD (2021e), MOE (2019b), National Bureau of Statistics (2019)

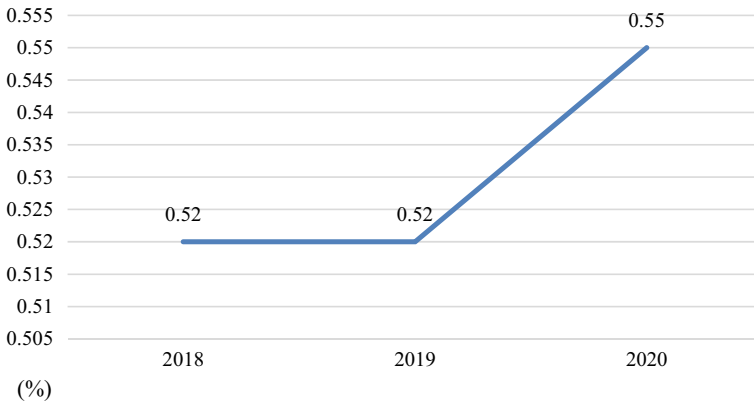


Fig. 9 China's total expenditure on high school education as a percentage of GDP (%). *Source* MOE (2019b, 2020b, 2021b), National Bureau of Statistics (2019, 2020b, 2021)

2.7 Proportion of Schools with Access to Internet

Effective instruction and learning environments require adequate school resources, including both human and physical resources. One of the necessary physical resources is internet access. Schools with internet access can use digital resources in education, which make teaching more effective. The proportion of schools with access to Internet could indicate the level of information facility investment.

According to UNESCO, the 2020 average proportion of high schools with internet access in UIS regions was approximately 65.5%. There is a significant variation across countries, with values ranging from lows of 1.09% in Burkina Faso and 6.72% in Sierra Leone to highs of 100% in nearly 30 countries such as Seychelles, Thailand, and Vietnam (Table 3). The proportion for China was 97.06%, above the average level.

Based on the overall indicators, several conclusions can be drawn. First, in terms of human resources investment in high school education (teacher investment in particular), China ranks high in international comparisons. The teacher workforce of high school education in China is above average in terms of adequacy, qualification level, and stability. Second, China's financial investment in high school education does not seem to keep pace with other countries. However, China is increasing its financial investment in high school education, and China is narrowing the gap gradually. Last but not least, with the advancement of the economy, science, and technology, investment in information technology (IT) is becoming increasingly important for the advancement of education. China's investment in IT equipment (e.g., cyber infrastructure) has performed well in international comparisons, providing a favorable condition for the modernization of China's high school education.

Table 3 Proportion of high school schools with access to Internet (2020)

Country	Proportion (%)	Country	Proportion (%)
Seychelles	100	China	97.06
Thailand	100	Malaysia	96.40
Vietnam	100	Tunisia	96.35
Cayman Islands	100	Lebanon	95.94
Cuba	100	Morocco	89.19
Dominica	100	Tonga	88.46
Grenada	100	British Virgin Islands	87.50
Saint Lucia	100	Kyrgyzstan	85.63
Albania	100	Turks and Caicos Islands	83.33
Andorra	100	Costa Rica	82.80
Gibraltar	100	Palestine	80.54
Monaco	100	Ecuador	78.41
San Marino	100	Colombia	77.60
Spain	100	Peru	75.27
Ukraine	100	Kiribati	75.00
Cook Islands	100	Algeria	73.37
Niue	100	Azerbaijan	72.81
Palau	100	Marshall Islands	72.22
Samoa	100	Zimbabwe	70.71
Tuvalu	100	UIS Regions	65.50
Armenia	100	Nepal	63.47
Bahrain	100	Senegal	60.77
Georgia	100	India	58.52
Jordan	100	Ivory Coast	54.35
Kuwait	100	Panama	53.11
Oman	100	Bangladesh	41.51
Qatar	100	Turkmenistan	31.10
Saudi Arabia	100	Cameroon	25.31
United Arab Emirates	100	Ethiopia	20.58
Belarus	99.52	Togo	14.06
Republic of Moldova	97.96	Sierra Leone	6.72
Bhutan	97.56	Burkina Faso	1.09

Source UIS (2022c)

3 Excellence Indicators

In recent years, educational scholars in China have actively promoted the development and evaluation of high-quality high schools. These scholars have explored a variety of indicators for evaluating and identifying excellent schools. However, merely focusing on China's excellent high schools is not enough; it is critical to examine top-performing high schools in an international context, which provides the foundation to understand and compare the strengths and weaknesses of excellent high schools across the globe. Given the challenges of data collection and ensuring international comparability, analysis in this chapter is limited to specific districts in China and the U.S.: Shanghai and California. These two regions have been selected due to their economic strengths and robust populations.

However, it needs to be noted that much of the school-level data are not publicly available for California's and Shanghai's high schools. As such, this chapter uses Shanghai and California as the contexts for the comparison mainly for illustrative purpose, and focuses on presenting definitions and possible sources for the indicators. In future studies, the research team will collect comprehensive individual-school data from Shanghai's and California's high schools, so as to conduct a full-scale comparison between Shanghai's high schools and California's high schools. Additionally, the research team would like to further understand if it is possible to examine high schools in other regions and districts from a global context using the indicators we established in this chapter.

3.1 Design

Three sets of indicators are chosen for examining high school excellence at the global level: input indicators, output indicators, and college readiness indicators (Fig. 10). Notably, the selection of indicators is constrained by two factors: data comparability and data availability.

3.1.1 Data Comparability

There are distinct disparities between the Chinese and U.S. national education systems, which renders the current comparison somewhat challenging. As such, quantifiable indicators that generally have comparable definitions in the global context are selected. To further strengthen the comparability, when the definitions and calculations are different between these two countries, the analysis will apply one country's definition and formula as the reference and adjust the other's indicator outcomes using raw data wherever possible.

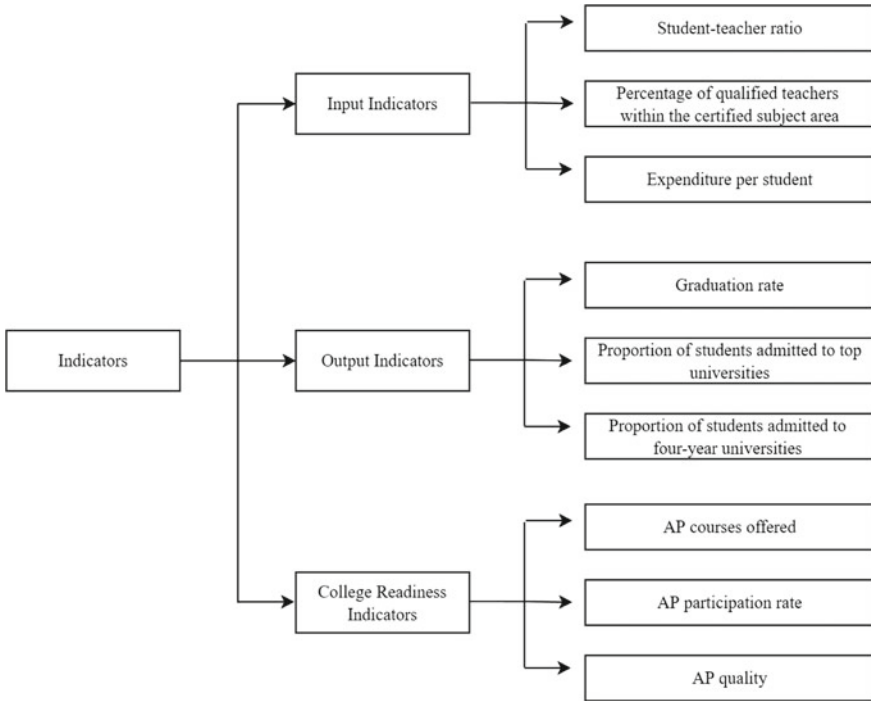


Fig. 10 Organizing framework of indicators

3.1.2 Data Availability

Preferably, data should be obtained from public sources to ensure transparency and validity. However, a great amount of data for China’s and U.S. high schools are not publicly available. Fortunately, educational agencies and third-party organizations (e.g., U.S. News & World Report) provide school-level data on their official websites, along with definitions and calculation methods, offering a solid foundation for investigations. In other cases, information will be required from high schools and educational agencies directly for future investigations.

As a result, the indicators in this study draw upon operational definitions, data sets, and formulas from various sources, including National Center for Education Statistics (NCES), U.S. Department of Education, California Department of Education (CDE), Ed-Data (a partnership of the CDE), U.S. News & World Report, and Niche.

3.2 Definitions and Sources

The set of indicators for evaluating excellent high schools in Shanghai and California are listed in Fig. 10.

3.2.1 Input Indicators

There are three indicators under the input branch: student–teacher ratio, the percentage of qualified teachers within the certified subject area, and expenditure per student. Table 4 contains the brief definitions of these indicators with the subsequent paragraphs providing additional details.

Student–Teacher Ratio. The student–teacher ratio in a high school reflects the level of teaching resources available to students. The lower the ratio, the more personalized support a student may receive from the teachers. Prior studies find that student–teacher ratios are significantly related to student outcomes, including test scores and graduation rates (e.g., Brozak, 2017).

The student–teacher ratio is calculated by dividing the number of students enrolled in a given school year by the number of full-time equivalent teachers in the same year. Full-time equivalent teachers comprise any teaching personnel who are directly involved in the instruction of pupils, regardless of their employment status. The total number of full-time teachers should be added to the equivalency of part-time instructional staff converted to the statutory working hours of a full-time teacher to calculate the number of full-time equivalent teachers. However, the information regarding part-time instructional staff for Shanghai’s high schools is not readily available, and we can only use total number of students and total number of teachers to calculate an approximate value. Thus, the student–teacher-ratio results between Shanghai’s and California’s schools are not strictly comparable, and are mainly presented for illustrative purpose.

For high schools in California, student–teacher ratios can be directly retrieved from the Common Core of Data (CCD) at NCES (RTI International, 2021). The ratios can also be verified from multiple sources, including U.S. News & World

Table 4 Operational definitions of the input indicators

Input indicators	Definitions
Student–teacher ratio	The ratio of total student enrollment to the full-time equivalent teachers
Percentage of qualified teachers within the certified subject area	The proportion of teachers that possess a full credential and teach the subjects within their certification area
Expenditure per student	The funding per pupil, allocated for the specific benefit of the school or the benefit of all schools in the Local Education Authority (LEA) equally

Report and Niche official websites. For high schools in Shanghai, data regarding the number of students and teachers can be obtained from school official websites and Baidu encyclopedia for most schools. As discussed previously, detailed part-time instructional staff information is not available for high schools in Shanghai, and may need to be collected from the schools directly in future investigations.

Percentage of Qualified Teachers within the Certified Subject Area. This indicator reflects the specialization level of teachers, which directly influences education quality. There is mounting evidence of the negative relationship between unqualified/mis-assigned teachers and student learning (Clotfelter et al., 2010; National Education Union, 2022; Van Overschelde, 2022).

The percentage of qualified teachers within the certified subject area is calculated by dividing the number of qualified teachers within the certified subject area by the total number of the teachers employed by the school (including the teachers without full credentials, such as internships, emergency, and waivers). The following formula shows the specific way this percentage is calculated:

$$\frac{(\text{Number of credentialed teachers} - \text{Number of credentialed teachers assigned out} - \text{of} - \text{field})}{(\text{Number of teachers with full credentials} + \text{Number of teachers without full credentials})} \quad (1)$$

For high schools in California, this percentage is obtained based on the information about teacher credentials and misassignment in the School Accountability Report Card (SARC) provided by CDE. For high schools in Shanghai, data are not readily available, and may need to be collected from the schools directly in future investigations.

Expenditure per Student. Expenditure per student indicates the estimated absolute amount of financial support for education on a per-student basis. A large body of evidence suggests that financial resources play a significant role in determining education quality (Baker, 2018). Prior studies have reported associations between increased educational spending and better student outcomes, including test scores and graduation rates (Jackson et al., 2015; Ted, 2014).

This indicator is calculated by dividing the total government funding allocated for a school in a given year by the school's annual Average Daily Attendance (ADA) figure. ADA is the pupil count used for funding allocation, obtained by dividing the total number of days of student attendance by the total number of days in a regular school year (Ed-Data, 2020). The reason for utilizing ADA rather than enrollment count is that ADA provides a more accurate student population statistic by accounting for transience, dropouts, and illness. In addition, given the different national currencies, this indicator will be converted into PPP\$ to ensure international comparability.

Data regarding expenditures per student at high schools in the U.S. are obtained from SARC (California Department of Education, 2020). The matching data on PPP conversion factor can be retrieved from OECD Data. For high schools in Shanghai,

data are not readily available, and may need to be collected from the schools directly in future investigations.

3.2.2 Output Indicators

There are three indicators under the input indicators branch: graduation rate, proportion of students admitted to top universities, and proportion of students admitted to four-year universities (see Table 5).

Graduation Rate. Graduation rate is one of the most important indicators for evaluating high schools. It is a well-accepted standard used by many education agencies, including U.S. News & World Report and Niche to measure high school success. Graduation rates also reflect school accountabilitythe level of education quality that a school can provide to its students to prepare them for further development. Furthermore, graduation rates may be related to other aspects of high school quality, including financial strengths, management capacities, curriculum resources, and teacher qualifications.

To ensure accuracy of the graduation rate indicator, the indicator is adjusted by Adjusted Cohort Graduation Rate (ACGR) (California Department Education, 2022). ACGR is calculated by dividing the number of students who graduate in the standard number of years or less by the number of students in the adjusted cohort for that graduating class (U.S. Department of Education, 2017). The adjusted cohort is based upon the number of the first-time 9th-graders in a particular academic year, and then subsequently adjusted by “adding any student transferring into the cohort and by subtracting any student who, during the years covered by the rate, transferred out, emigrated to another country, transferred to a prison or juvenile facility, or died” (U.S. Department of Education, 2017). For example, for a high school in Shanghai, its ACGR in school year 2021–2022 should be calculated as follows. Note that high schools in China typically cover Grades 10 to 12, while those in the U.S. typically cover Grades 9 to 12, which may render graduation rate slightly different due to grade coverage.

Table 5 Operational definitions of the output indicators

Output indicators	Definitions
Graduation rate	The percentage of first-time 9th grade students enrolled in the same school year that earn a regular high school diploma within the stipulated period
Proportion of students admitted to top universities	The percentage of students admitted to elite universities in China or the U.S
Proportion of students admitted to four-year universities	The percentage of students admitted to the government-approved four-year universities in China and the U.S

Number of cohort numbers who earned a regular high school diploma
by the end of the 2021 – 2022 school year

Number of first – time Grade 9 students in fall 2019 (starting cohort)+ students who transferred
in – students who left during school years 2019 – 2022

(2)

For high schools in California, graduation rates are available from the SARC provided by the local educational agencies (LEAs). The data can also be retrieved from “state education agency public websites or received directly from state education agencies” (RTI International, 2021). For high schools in Shanghai, data are not readily available, and may need to be collected from the schools directly in future investigations.

Proportion of Students Admitted to Top Universities. This indicator reflects talent training quality. Top universities can provide outstanding learning opportunities and educational resources. Admission to top universities is highly competitive and demands outstanding abilities. The proportion of students admitted to top universities reflects how successful a high school is in student development.

For U.S. institutions, the top 4 universities are defined based upon Times Higher Education (THE) World University Rankings, and THE Ranking is generally considered one of the leading rankings for world universities (Times Higher Education, 2021). Based upon THE ranking, for U.S. institutions, the top 4 universities are: Harvard University, Stanford University, Massachusetts Institute of Technology, and California Institute of Technology. For China’s institutions, the top 4 universities are: Tsinghua University, Peking University, Fudan University, and Shanghai Jiao Tong University. These eight universities have been recognized as the leading universities in these two countries.

For high schools in California, data are not readily available, and may need to be collected from the schools directly in the future. For high schools in China, data are obtained from official school websites, Xibao (a bulletin of glad news), university admission office, and other websites (e.g., WeChat official accounts). In particular, information obtained from official school websites, Xibao, and university admission office is considered to be of high accuracy, and we prioritize these sources for calculation. The information obtained from other websites may vary, and we only use these websites when information from official sources is not available. Additionally, we use multiple sources to crosscheck the accuracy of the data wherever possible.

Proportion of Students Admitted to Four-Year Universities. It refers to the percentage of students admitted to the government-approved four-year universities in both countries.

For high schools in Shanghai, data are obtained from official school websites and other websites (e.g., WeChat official accounts). For high schools in California, data are not readily available, and may need to be collected from the schools directly in the future.

3.2.3 College Readiness Indicators

There are three indicators under the input indicators branch: AP courses offered, AP participation rate, AP quality (see Table 6).

One of the goals of high school education is to prepare students for post-secondary education. Therefore, this chapter took college readiness into consideration while evaluating excellent high schools. College readiness refers to a set of skills, knowledge and behaviors a high school student should have before enrollment in their first-year college. These may include subject-specific knowledge, creativity, the capacity for independent learning, and other aspects. Advanced Placement (AP) courses are designed to improve college readiness.

Not until recent years, China's high school education has started to attach great importance to college readiness. A group of educators are actively exploring how to set up China's AP courses (also known as CAP). For instance, Peking University's Advanced Courses (AC), Tsinghua University's MOOCAP, and Chinese Advanced Placement created by the Chinese Society of Education (CSE) are three typical examples (Liu, 2016; Shao, 2021; Si, 2016; Yang, 2016). These programs have established a complete course system, including teacher training, AP designation, AP enrollment, course assessments, and credit certification methods. There are many similarities between the programs and the American AP courses, allowing for cross-national comparisons. However, it is worth noting that the AP programs in China are still at the preliminary stage of development and are only available at a few selected Chinese post-secondary institutions. As such, the values of the three college readiness indicators in China's high schools may not be parallel to those in the U.S.

AP Courses Offered. AP courses offered indicates the abundance of AP course resources. It is calculated by counting the authorized courses with at least one student enrolled. Specifically, the courses should meet the following two criteria. First, the courses must be authorized by the organizations that provide the AP courses. Second, at least one student should register for the course.

For high schools in California, the number of AP courses offered are available from SARC. For high schools in Shanghai, data are not readily available and may need to be collected from the schools directly in the future.

Table 6 Operational definitions of the college readiness indicators

College readiness indicators	Definitions
AP courses offered	The number of authorized AP courses with at least one student enrolled
AP participation rate	The percentage of students enrolled in all AP courses at the school for a given school year
AP quality	The percentage of AP tests on which a student obtained a passing score or higher

AP Participation Rate. AP Participation Rate can be used to measure access to college-level material (RTI International, 2021). It is computed by using the total number of unduplicated students enrolled in AP classes divided by the total number of unduplicated students enrolled in the same year.

For high schools in California, the number of AP courses offered are available from SARC. For high schools in Shanghai, data are not readily available and may need to be collected from the schools directly in the future.

AP Quality. AP quality refers to the AP test outcomes. This indicator measures students' readiness for college-level work (*ibid*). It is calculated by dividing the number of AP exams on which a student obtained a passing score or higher (e.g., a score of 3 or higher on AP exams in the U.S.) by the total number of AP exams taken in a school year. If a student took multiple AP exams, all of them will be counted.

For high schools in California, the values of this indicator can be obtained based on the AP test results offered by ED-data. For high schools in Shanghai, data are not readily available and may need to be collected from the schools directly in the future.

3.2.4 Sample

In order to demonstrate the operationality of the definitions and formulas, we selected 12 leading high schools from California. Specifically, we used the 2022 Best U.S. High Schools Rankings from U.S. News & World Report (2022) for the selection of leading U.S. high schools because this ranking also strives to examine high schools using publicly available data. These schools are Gretchen Whitney High School, California Academy of Mathematics and Science, Preuss School UCSD, Lowell High School, University High School (Fresno), Mission San Jose High School, Lynbrook High School, Eunice Sato Academy of Math & Science, Monta Vista High, Western Center Academy, Canyon Crest Academy, and Dougherty Valley High School.

For high schools in Shanghai, although there is no official ranking available, there are twelve schools that are generally considered leading institutions in Shanghai (Gong, 2020). These schools are Shanghai High School, No. 2 High School of East China Normal University, High School Affiliated to Fudan University, High School Affiliated to Shanghai Jiao Tong University, Shanghai Qibao High School, Shanghai Nanyang Model High School, Shanghai Kong Jiang Senior High School, Shanghai Jianping High School, Shanghai Yan'an School, Shanghai Fuxing Senior High School, Shanghai Datong High School, and Shanghai Gezhi High School.

3.3 Findings

The results of the averages of the indicators for excellent U.S. high schools are presented in Table 7.

Table 7 Indicator averages for excellent California's and Shanghai's high schools

Region	STR	PQT	EPS	GR	PSTU	PS4U	APC	APPR	APQ
California	25/1	94%	10,275	98%	N/A	N/A	53	58%	77%
Shanghai	10/1	N/A	N/A	N/A	26%	99%	N/A	N/A	N/A

Notes STR refers to student–teacher ratio; PQT refers to percentage of qualified teachers within the certified subject area; EPS refers to expenditure per student; GR refers to graduation rate; PSTU refers to proportion of students admitted to top universities (e.g., High School Affiliated to Shanghai Jiao Tong University, 2022; Shanghai High School, 2022a); PS4U refers to proportion of students admitted to four-year universities (e.g., Shanghai High School, 2022b); APC refers to AP courses offered; APPR refers to AP participation rate; APQ refers to AP quality. Not all data from all high schools are available for each indicator; only the averages are reported

3.4 Discussion

There are notable differences between California's and Shanghai's high schools. For instance, there was a substantial difference for student–teacher ratio: the STR is 25/1 for top California's public schools, and the STR is 10/1 for top Shanghai's high schools. However, we shall not overinterpret the differences, as: (1) The total number of full-time teachers was added to the equivalency of part-time instructional staff converted to the statutory working hours of a full-time teacher to calculate the number of full-time equivalent teachers for California's high schools; while we only used the total number of teachers and students to calculate STR for Shanghai's high schools, as the detailed part-time instructional staff information was not available. (2) There are significant enrollment differences between top public and private high schools, and we only focus on public high schools for both countries for this round of analysis.

Again, the AP programs in China are still at the preliminary stage of development and are only available at a few selected Chinese post-secondary institutions. The values of the three college readiness indicators in Chinese high schools collected in the future may not be parallel to those in the U.S. Additionally, dual enrollment programs are becoming an increasingly popular option in the U.S. which is a direct challenger to AP course offerings and enrollments.

Additionally, not all data are publicly available for U.S. high schools, such as proportion of students admitted to top universities and proportion of students admitted to four-year universities. Preliminary results show that 26% of students from the 12 leading high schools enrolled in top-4 universities in China, and 99% students attended 4-year universities. Future investigations should collect data from individual schools or districts for U.S. high schools.

Finally, although the comparative analysis is limited given the lack of publicly available data for Shanghai's and California's high schools, individual-school data will be collected from Shanghai's and California's high schools, so as to conduct a full-scale comparison between Shanghai's high schools and California's high schools. Specifically, detailed data may be collected from school officials and government agencies. Additionally, the research team would like to further understand if

it is possible to examine high schools in other regions and districts from a global context using the selected indicators in this chapter.

4 Best Practices

4.1 *Cultivation of Innovative Talents in Chinese High Schools*

The competition of comprehensive national strength lies in the competition among innovative talents. Countries across the globe have realized the significance of innovative talents, and thus are actively developing their abilities to research and improve the practice of innovative student development.

China has attached great importance to the cultivation of innovative talent (*chuangxin rencai peiyang*). *Outline of the National Plan for Medium- and Long-Term Education Reform and Development (2010–2020)* issued in 2010 clearly puts forth the necessity to reform talent training mechanisms and modernize the talent training mode. It also emphasizes that the high school is a critical period for the formation of students' personality, which is of great significance to the cultivation of innovative talents (the State Council, 2010).

Many high schools in China have explored their own effective and distinctive training systems for innovative talent. In this section, two schools as talent-innovation representatives are presented. One is Shanghai High School, which has been taking the lead in carrying out the experimental project of cultivating high school students' innovative literacy in China (Feng & Liu, 2019), and the other is No. 2 High School of East China Normal University (NHSECNU), one of the first "top-10 schools in science and technology innovation education" (NHSECNU, 2022a). In the following paragraphs, details are told regarding their talent-innovation cultivation approaches.

4.1.1 Moral Education (*Daode Jiaoyu*) Comes First

Moral education refers to activities that purposefully exert moral influence on students. The contents include improving moral consciousness and understanding, cultivating moral emotion, exercising moral will, establishing moral faith, and forming moral habits.

The cultivation of innovative talent needs to put moral education first. The NHSECNU features "Moral Education Leading Innovation" in its cultivation of innovative talent (Sheng, 2010). Moral education is highly valued at the school. It initiates a mode for talent cultivation named "100% x N", which calls for all students (100% students) to complete N tasks (NHSECNU, 2022b). One of the tasks, 100-h volunteer work, is designed to develop students' moral character (NHSECNU, 2021). Similarly, Shanghai High School also emphasizes the significance of moral

education. When the school created its original course groups for innovative talent cultivation, one of the first approaches they came up with was to create a moral education curricula group (Feng, 2016). Survey results from Shanghai High School showed that 96.3% students agreed that moral character would greatly influence the future student development (Feng, 2015).

4.1.2 Providing Sufficient Space for Students to Explore Their Potential

Individual development is necessary for students with varying potential. This requires schools to provide students with sufficient space to explore their potential. The NHSECNU initiated a program named “College of Excellence” in 2013. This program offered a wide range of courses and provided personalized cultivation in accordance with students’ innovation potential and subject specialties, aiming at promoting each student to fully explore their own potential (NHSECNU, 2022c).

Shanghai High School has creatively built a highly selective curriculum system with its own characteristics based on the idea of “subject cluster” from International Baccalaureate (IB) courses. The curriculum system is divided into three categories: a course group regarding learning (nearly 500 courses), a course group regarding moral education (nearly 40 subjects and 150 modules), and a course group regarding potential development (involving finance, law, energy-saving cars, medicine, software engineering, brain science and artificial intelligence [AI], geographic information systems and other discipline areas) (Feng, 2016). Students can freely choose the courses and develop their advantageous potential according to their learning bases and research interests.

4.1.3 Collaborating with Top Universities and Scientific Research Institutions

The cultivation of innovative talent needs support of good teachers, while teachers in ordinary high schools are inadequate when cultivating innovative talents in terms of knowledge, teaching methods, and time. Many high schools collaborate with universities or scientific research institutions to cultivate innovative talents.

Since 2014, Fudan University (FDU) and Shanghai High School have jointly promoted the “FDU-Shanghai High School mentoring plan”, including “office hours” (academic seminars with the professors from FDU), cross-disciplinary lectures, micro-courses with difficulty equivalent to a college course, summer courses offered by FDU, online guidance, and MOOC learning (Feng, 2021). Additionally, Shanghai High School has also worked with prestigious universities and research institutions such as Shanghai Jiao Tong University, Tongji University, and the Institute of Neuroscience of the Chinese Academy of Sciences (CAS) to cultivate innovative talent (Feng & Liu, 2019). NHSECNU has incorporated the “Talent Program” (a training program for youth science and technology innovation talent) organized by the Chinese Association for Science and Technology and MOE into its cultivation

system (NHSECNU, 2022d). Through the “Talent Program”, students can conduct research under the guidance of top scientists in China and develop their pioneering spirit and innovative ability.

Thanks to the assistance of universities and research institutions, students can make great achievements and access resources that they would not have had otherwise. For instance, through the training of the “Talent Program”, four students from the NHSECNU are qualified to have an asteroid named after them because of their exceptional performance in Intel International Science & Engineering Fair (ISEF) (NHSECNU, 2022b), demonstrating to the world the innovative potential of Chinese youth.

4.2 The Exploration of Liberal Education (Boya Jiaoyu) in Chinese High Schools

Liberal education is a long-established educational philosophy that emphasizes the cultivation of a “harmoniously developed” person with a wide range of knowledge and a noble moral character through the accumulation of extensive knowledge and the cultivation of refined humanistic spirits (Su, 2013). Studies have shown that liberal education has a positive effect on both individual development and socio-economic development (Axelord & Anisef, 2001; Wang, 2015). Thus, many scholars are exploring how to put liberal education into practice. However, practicing liberal education in high school settings, especially in China, is quite challenging (Wang, 2015). This is mainly because China’s high school students are under a lot of pressure to prepare for college entrance exams (*gaokao*) and have little time to pursue liberal education. However, the High School Affiliated to Fudan University has explored an effective way to practice liberal education from which much can be learned.

4.2.1 Shaping a School-Based Philosophy of Liberal Education

It is critical to think carefully about two questions for a school to practice liberal education: What is liberal education? What kind of people does the school want to cultivate through liberal education? Jian Wu, Principal of High School Affiliated to Fudan University, gives a clear answer to these questions (Wang, 2021). Liberal education pursues students’ holistic development (*quanmian fazhan*), diversified growth, and sustainable progress. Students should be trained to “*Bo er Tong, Ya er Zheng* (have a complete knowledge system and good conduct)”. Wu highlights the importance of developing moral character in the age of intelligence and highly recommends that teachers develop students’ spiritual beliefs in accordance with the Chinese culture. Chinese teachers in this school have developed a course group named “Chinese People” (*zhong guo ren*), including “the Chinese Characters”, “Chinese Ancient Poetry Appreciation”, and “Chinese Root Culture” (Zhou,

2019). It is designed to help students internalize good virtues of Chinese culture while learning literary knowledge.

4.2.2 Constructing a Curriculum System to Meet Students' Various Needs

The school has established a curriculum system consisting of eight sections, which are Humanities and Classics, Language and Culture, Society and Development, Teaching and Logic, Science and Experiment, Technology and Design, Sports and Health, Art and Appreciation. Under each section, a certain number of courses are offered for students to choose. For instance, Sports and Health has up to 74 courses for students to choose (Wang, 2021). The school has also set up a “four-step” progressive curriculum system. The “four steps” are: level A—basic courses to ensure basic learning abilities, level B—expanding courses to meet students' individual needs, level C—research courses to cultivate scientific research abilities, and level D—selective courses to develop potentials. Students have autonomy in deciding whether to take courses above level A. In this curriculum system, students can learn a wide range of knowledge at their own pace.

This school encourages students not only to learn a wide array of subjects, but also to conduct cross-disciplinary research. During the World Expo, the school gathered nearly 10 teachers from different disciplines, including Chinese, Geography, Physics, and Politics to co-edit a book titled the “World Expo Tour” (Fu & Li, 2011). Inspired by this book, many students found inter-disciplinary topics fascinating to study, and developed their abilities to apply cross-disciplinary knowledge.

4.2.3 Constructing a Multiple Evaluation System to Encourage Diversified Development

Principal Wu believes that while assessment scores are important, they are not the purpose of learning (Xu, 2021). Students need to be evaluated thoroughly. Therefore, the High School Affiliated to Fudan University established a multiple evaluation system for students (Yu, 2016).

First, in order to lessen the tendency to evaluate students by scores, each student's test scores are converted into corresponding grades. Furthermore, there are variations in the methods used to evaluate students for courses at various levels. Basic course evaluations include daily performance, midterm grades, and final grades. Research courses are evaluated by P (pass/qualified) and NP (not pass/unqualified). In selective courses, students will not receive grades; instead, their performance in these courses will be presented in terms of overall quality (*zonghe suzhi*) reports.

Overall quality reports are used to assess students' holistic development. Apart from academic performance, these reports record the students' performance in various extracurricular activities such as volunteer service, awards and honors they have received, and semester comments from their teachers. The information

presented in the reports will be used as an important basis for student awards. The school has set up different kinds of honorary awards, including “star of volunteer work”, “star of arts and sports”, “star of science and technology” (Wang, 2021). These different types of “stars” form a multi-symbiotic model group, which increases students’ awareness of multi-dimensional development.

4.3 China’s High School-Centered Education Groups for Educational Balance

In 2019, Chinese government issued several documents to promote the balanced development of education (*jiaoyu junheng fazhan*), for example, *The Implementation Plan for Accelerating the Modernization of Education (2018–2022)* (the State Council, 2019a) and *China Education Modernization 2035* (the State Council, 2019b).

To realize the balanced distribution of educational resources, the government put forward an excellent school-led development strategy, which encourages high-performing high schools to open branch schools and establish education groups. A number of education groups have been established, such as High School Affiliated to Shanghai Jiao Tong University Education Group, Hangzhou Qiushi Education Group, and Beijing Fengtai No. 1 Primary School Group, etc.

As early as 1996, Shanghai Jianping High School started to open branch schools and formed Jianping Education Group, the first education group in Shanghai (Huang & Luo, 2016). It is one of the representatives of group-schooling in China and the experience of this education group can be learnt from.

4.3.1 School Culture Comes First

Educational philosophy is vital to running a school. Shanghai Jianping High School attaches great importance to the creation, transmission, and growth of school culture in the process of opening branch schools.

In 1994, the former Meiyuan Middle School was renamed Shanghai West Jianping Middle School and joined Jianping Education Group (Chen & Xue, 2016). Shanghai Jianping High School sent a cadre of teachers and experienced education administrators to the West Jianping Middle School. These teachers were instrumental in the development of the middle school. Furthermore, the educational philosophy of Shanghai Jianping High School, “qualification + specialization; norm + choice”, has also greatly influenced the development of Shanghai West Jianping Middle School. It established a credit system based on this educational philosophy (Jiangsu Education Newspaper, 2021a). The credit is calculated by adding “basic credit” and “specialty credit”. To allow students to explore more about their specialties, Shanghai West

Jianping Middle School has developed more than 90 selective courses for students to choose (Jiangsu Education Newspaper, 2021b).

It is worth mentioning that Shanghai West Jianping Middle School has also creatively developed its own school culture based on the educational philosophy of Shanghai Jianping High School. This middle school nurtures its idea of “realizing the vigorous growth of each student” based on the two words “specialty” and “choice” (*ibid*). This new idea not only adds humanistic charm to Shanghai West Jianping Middle School, but also enriches the educational philosophy of Jianping Education Group.

4.3.2 Realizing Resource Balance Through Resource Sharing

Educational resources, especially teachers, are extremely important to school development. Pudong Middle School, before being a member of the Jianping Education Group, had inadequate instructional resources. After Pudong Middle School joined the Jianping Education Group, Shanghai Jianping High School assigned a math teacher and an English teacher to Pudong Middle School (Huang & Luo, 2016). The two teachers were experienced in teaching graduates at Shanghai Jianping High School. They introduced many efficient techniques for class management and lesson preparation to the middle school. After a semester, students’ scores significantly improved. Additionally, the teaching abilities of the teachers in Pudong Middle School also progressed.

It is clear that Jianping Education Group may raise the standards of both students and teachers in underprivileged schools through internal resource reallocations. This further supports the balanced development of fundamental education.

4.3.3 Ripple Effect Within the Education Group

With the development of Jianping Education Group, many schools in this group have gradually grown/evolved from “recipients” to “helpers”, and started to help promote the development of other schools within the education group, which is called a ripple effect.

Take Jianping South Middle School as an example. There was a severe staff shortage when Jianping South Middle School joined the Jianping Education Group. It only had the principal in its management team, which seriously hampered its development. Facing this huge problem, other schools in the education group all came to help (*ibid*). Three excellent teachers from Shanghai West Jianping Middle School—a special-grade physics teacher, a senior math teacher, and an experienced teacher from the Subject Center—went to Jianping South Middle School to train the teachers. Meanwhile, a gold-medal coach specializing in designing fire-fighting robots was sent to train the students in the robot team of Jianping South Middle School. Jianping Yuanxiang School also sent four experienced teachers to Jianping South Middle School. With the joint support of several schools Jianping South Middle

School was transformed from an ordinary school to a school with high teaching quality and great social recognition in a short period of time.

5 Inspiring Stories

5.1 *Zhang Guimei: Female Education in Rural China*

Huaping High School for Girls in Southwestern China's Yunnan province is a small but well-known local school in a rural area. It is the first free all-girls public high school in China. Since its founding in 2008, it has helped nearly 2,000 girls enter the universities and have a chance to change their lives (China Daily, 2021). This could not have happened without the principal, Zhang Guimei, who has spent most of her life fighting against the educational inequalities girls face in rural areas.

5.1.1 **Determined to Build the First Free-of-Charge High School for Girls in China**

Many years ago, as a teacher in Huaping County, Zhang noticed that girls were less likely to further their education after finishing middle school. One of the reasons is that families do not expect girls to have high-level education. As a result, many families are not willing to pay the tuition fees for female students for the high school. While working as a part-time president of a local welfare center for children, Zhang learned from many cases that K-12 is a key period of growth, regardless of gender. Furthermore, female students will grow to be children's mothers, who play significant roles in students' lives, and thus should receive good education to be able to educate their children (CGTN, 2021). Zhang decided to find a tuition-free school just for girls from the mountainous areas for poor families.

5.1.2 **Dauntless Efforts and Selfless Dedication**

There was nothing easy about setting up a school like this. One of the toughest challenges was fund-raising. To raise enough money for the school, Zhang spent all her holidays on the streets, handing out leaflets and asking for donations. Many people thought her a fraud and refused to contribute. Some people even set dogs on her. After five years, she had collected only RMB10,000 (around US\$1,500), far from enough to open a school (China Central Television, 2020).

Zhang's situation changed in 2007, when she was elected to attend the 17th Communist Party of China National Congress. At the meeting, a journalist noticed her and reported on her story. Soon after, her dream was known by the public. In

a short time, she received a large number of donations sufficient for founding the all-girl high school.

In September 2008, the Huaping High School for Girls began its operation (MOE, 2020c); however, new challenges emerged. Although people knew the school was free, they hesitated to send their girls to the school. Some of the families were less confident about the new school, but more were worried that even if the girls could pass the college entrance exam, their families would still not be able or willing to pay for college. To persuade these parents, Zhang visited families, door to door, and told them that “knowledge could change lives; sending the girls to schools or college may change both the girls’ and the next generations’ lives” (CGTN, 2021).

Gradually, more and more students started to come to the school. However, Zhang found that most girls had poor learning foundation because they did not receive adequate education before, which was worrisome. To encourage the students to study hard, she walked around the school with a loudspeaker every day, reminding students to make the best use of every moment. Sharing the same faith with Zhang, the entire teaching staff in the school also worked hard to support every single student.

Under the efforts of everyone involved, the Huaping High School for Girls became better and better; however, her health condition worsened. Years of overwork had caused great damage to her health. She was diagnosed with more than 20 diseases, including osteoma, hemangioma, and emphysema (Teller Report, 2021). Instead of receiving medical treatment in the hospital, she continued working for the students and taking multiple medications to alleviate her pain. One day in 2018, she could not even bear the pain and fainted. After a series of surgeries, she was finally out of danger. When she woke up, she said, “Can I have an advance on my funeral expenses? I want to spend the money on school construction,” which moved everyone present to tears (People’s Daily, 2020). In spite of her terrible health condition, she went back to work the next day.

As Zhang said, she contributed almost everything she had. During the past years, she worked year-round, despite suffering from various diseases. Intending not to let any girl fall behind in schooling, she insisted on home visits for 11 years, and visited more than 1,300 families, traveling more than 100,000 km (MOE, 2021c). She has given most her money to the school, her students, and their families. She always thinks of others but never of herself.

5.1.3 Yeas of Dedication in Return for Good News

Since the founding of the school, nearly 2,000 students have graduated and received higher education at universities, including prestigious ones such as Wuhan University and Xiamen University (China Daily, 2020). As Zhang hoped, the girls went out of the mountains and thrived in various fields. It is worth mentioning that some of the girls returned to the mountainous areas and became teachers, continuing the fight against educational inequality.

Thanks to Zhang’s endeavors to improve female education in the poor areas in China, more and more girls can change their lives and their children’s destinies. She

not only awakens the life goals of rural girls, but also encourages more educators to follow their educational dreams.

5.2 Yu Yi: Making Education a Life-Long Mission

On September 29, 2019, Yu Yi, the honorary president of Shanghai Yangpu Senior High School, received the award of People's Educator, a national honorary title, in recognition of her outstanding contributions to primary and secondary education in China (MOE, 2021d).

Yu has spent more than six decades teaching Chinese language and literature. During her teaching career, she has taught nearly 2,000 high-quality exemplary classes (China Daily, 2019). Based on her teaching experience, she formed an original teaching philosophy. Many of her viewpoints were accepted by MOE, producing a profound effect on national education reform (Yangpu News, 2019). Moreover, she also made outstanding advances in school governance and teacher education.

5.2.1 A Chinese Language Teacher: Constantly Striving for Excellence

At first, Yu was not a Chinese language teacher, but a history teacher. She switched to Chinese language teaching because her school had a lack of Chinese language teachers. It was a significant challenge for her, since she knew little about the Chinese language and literature. To ensure teaching quality, she made efforts to learn professional knowledge. Every day after finishing work, she would stay up late to study. Within two years, she equipped herself with the kind of knowledge that a Chinese language teacher should have. Yu also worked hard on lesson preparation. Each time she prepared a lesson, she pushed herself to study on her own rather than following teachers' guidebooks. To make her class as attractive as possible, she wrote down what to say in class, modified the words iteratively, and practiced a lot. She treated every class as a work of art, endeavoring to perform better. In 1978, Yu became one of the first group of supreme teachers in China (MOE, 2019c). However, she was not satisfied. She always reflected on her craft, trying to find deficiencies and learn from others' strengths to overcome her shortcomings. Through constant reflection, she kept making progress in teaching. As a result, 50 of her exemplar courses are recognized as milestones in Chinese Education Reform (China Daily, 2019).

5.2.2 An Education Reformer: Sharply Criticizing Malpractices

In the 1980s, many people tended to take Chinese education as a language tool. However, Yu put forward a different point of view that Chinese is a subject that combines instrumentality with humanity: the language of each nation is not only a symbolic system for communication but also a system containing cultural and

emotional values (Yu, 1995). She emphasized that Chinese teaching should not only focus on language knowledge but also on cultivating students' humanistic spirit. Her viewpoint aroused heated discussion and gradually gained acceptance from more and more people. In 2001, as part of reforms in the Chinese curriculum, MOE accepted Yu's suggestion and added "humanity" to the Chinese Curriculum Standard (MOE, 2021d). Based on the "humanity theory", Yu further expressed her opposition to the utilitarianism in education and emphasized well-rounded development for students. She pointed out that the priority of education is to help students realize their full potential and enrich their spiritual lives (Yu & Tang, 1999). It is important to note that the issues Yu criticized many years ago are still relevant today. Many of her ideas have a significant impact on the development of elementary education in China.

5.2.3 An Educational Administrator: Contributing to School Development

In the mid-1980s, Yu was appointed principal of Shanghai No. 2 Normal School, where the school climate was poor. The teachers were often late to work, and many students put focus on things other than their studies. Even worse, gambling and excessive drinking activities were frequently found in school. Yu was keenly aware of the needs to prioritize school spirit. She took several measures, including setting up an office-hour system and regulating school uniform. A few years later, the school had changed beyond recognition. It became well-known for its excellent school spirit and received a national commendation (People's Daily, 2021). She summed up the practical experiences and formed a theoretical system for managing schools, providing many valuable suggestions for school development.

5.2.4 An Educational Administrator: Contributing to Teacher Development

To accelerate young teachers' growth, Yu initiated a cultivation program, where a novice teacher received guidance from three aspects (People's Daily, 2021). Every novice teacher would have a mentor and join a teaching group, receiving individual instruction from the mentor and collective training from the teaching group. An additional accountability system was prepared to ensure the quality of teacher training. Many novice teachers have benefited from this kind of cultivation model. Additionally, Yu has cultivated three generations of top-class teachers (Xinhua, 2019). Furthermore, Yu found a lack of systematic research on teacher development in China and decided to fill the gap. Based upon her continual efforts, the first work on contemporary teacher education in China—*Xiandai Jiaoshixue Gailun (Introduction to Modern Pedagogy on Teacher)* was published in 2001 (China Education Daily, 2018).

5.2.5 A Life-Long Educator

Over the past decades, Yu has devoted herself to China's education with a strong sense of mission and made remarkable contributions. Now, she is more than 90 years old, but still pays close attention to the education reform in China. She says that the imperative of educational reform is to establish a pedagogy with Chinese characteristics (*ibid*). Despite her age, she is still looking forward to it and continues to work. Her motto is: to be a life-long educator (*ibid*). For her, education is a life-long mission.

5.3 *Bian Yuexia: Educator Fighting Against COVID-19*

"If not for COVID-19, I should have retired." Bian Yuexia, a high school teacher in Shandong Jinan Tibetan High School, said to a reporter (China Education Daily, 2020a).

Bian is a teacher in charge of the daily lives of the students at the only boarding school in Shandong Province that accepts Tibetan students. There are a total of 794 students in the school (*ibid*). Students typically do not return home for the entire school year, including the spring festival.

5.3.1 Volunteering to Stay at School to Watch Over Her Students

To take care of her students, Bian stays at school every spring festival, spending time with her lovely students. However, in 2020, she planned to go home to spend Chinese New Year with her parents, as she would reach retirement age before the Chinese New Year came that year.

Unfortunately, COVID-19 broke out in Shandong Province in early 2020. Although Bian really wanted to go home, as the teacher in charge of students' daily lives, she could not bring herself to leave her students in such a situation. She decided to put off her retirement and stay in school to ensure the well-being of her students. Bian returned her plane tickets and told her parents that she would not return to be with them until the pandemic was over. Despite feeling upset, Bian soon prepared herself for a fight against COVID-19 and for her students.

5.3.2 Ensuring Students' Physical and Mental Health

To reduce the spread of the virus, Bian proposed that mealtime should be arranged according to grades and classes, and the school hospital should implement a 24-h duty system. She also checked students' daily health conditions and recorded each students' information carefully, including temperature changes, symptoms of physical discomfort, medications, and the details of medical consultations. When students

had suspected symptoms or other serious health problems, she would immediately contact the hospital for treatment and report to the leaders in the city for consultation. She would also accompany the sick students to the hospital and care for them until they recovered. Bian treated her students so much like children, that they began calling her “Mom Bian”.

Furthermore, Bian, together with school doctors, conducted a variety of activities such as campus broadcasting to assist students in correctly treating the epidemic and managing negative emotions. Thanks to the efforts made by teacher Bian and other teachers, the students’ physical and mental health were well-protected.

5.3.3 Allowing Students to Eat Well, not just Eat Enough

Food supplies were short during the COVID-19 pandemic. To guarantee the nutrition of students and boost their immune resistance, Bian managed to obtain sufficient nutritious ingredients, including meat and vegetables. Due to the epidemic control, the vehicles transporting vegetables were not allowed to drive into the school, which was troublesome. To solve the problem, Bian decided to receive and count the supplies at the school gate, bring them to a storage area, perform a quarantine inspection, and then carry the safe ingredients to the food processing room. There were more than 500 people in the school at that time. It was extremely hard to transport and inspect the ingredients needed by so many people. In addition, Bian wanted her students to eat well, not just enough. To do so, she organized canteen staff meetings many times to emphasize the significance of food safe and often asked her students what they wanted to eat. A student at the school named Bai said, “every time we told teacher Bian what we wanted to eat, we could eat the food the next day!” (*ibid*).

5.3.4 Enriching Students’ Learning Life

In addition to taking care of the students’ health and nutritional needs, Bian assumed the role of classroom teacher and subject tutor. She insisted on offering a variety of interesting physical education lessons for the students despite the fact that she was very busy. She hoped to strengthen students and improve their quality of life during this special period by offering physical education lessons.

5.3.5 The Most Beautiful Educator Combating COVID-19

Since the outbreak of the COVID-19, Bian has worked conscientiously, with little rest. It is her hard work that brings safety and happiness to the students. Nobody can count how many times she has patrolled the school, how many questions she has answered for students, and how many calls she has received.

“I often felt tired, both physically and mentally. At that time, I rarely got more than 6 h of sleep per day. Sometimes, I really wanted to go back to my room and

just lie in the bed for a while. However, every time I looked at the students and their smiling faces, I would feel energized, and everything was worthwhile.” (*ibid*).

Later, China Education Daily commented on Bian’s deeds, and she was awarded “zhanyi zuimei jiaoyu ren (the most beautiful educator combating COVID-19)” (*ibid*). Her selfless spirit and sincere dedication to her students were highly praised. Importantly, like her, many other educators in China also helped safeguard and support students during the COVID-19 pandemic.

6 Latest Research

6.1 General Overview

High school education plays an important part in the national education system. The purpose of this section is to investigate research trends at the high-school level in China through the analysis of journal articles on China National Knowledge Infrastructure (CNKI), which is the world’s largest Chinese journal database. Publication dates are restricted from January 01, 2012 to June 20, 2022. An electronic search is carried out using the keyword “high school”. Finally, 70,106 articles are identified. Figure 11 presents the distribution of the major research topics.

It can be seen from the Fig. 11 that the most researched subjects are high school math, followed by high school Chinese, high school English, and high school physics. In addition to course subjects, the first topic that was researched in general is core competency, followed by teaching strategy.

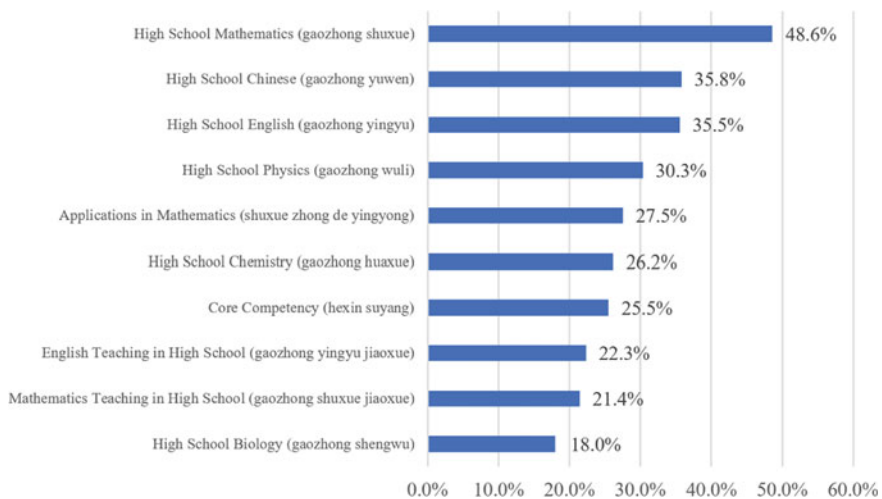


Fig. 11 Major research topics in CNKI from 2012 to 2022. *Source* Compiled from search result from CNKI

6.2 Research Topics

6.2.1 Core Competency

The term core competency (*hexin suyang*) first appeared in *Core Competencies for a Successful Life and a Well-Functioning Society* proposed by OECD in 2003. The research on core competencies in China began in 2013 when Xin et al. (2013) published an article about the model construction on core competencies of students in compulsory period. This research topic was soon extended to high school level in 2015, and the number of relevant research studies increased significantly in following years. One important factor behind the phenomenon is that MOE (2014) asked for opinions on comprehensively deepening curriculum reform (*kecheng gaige*) and emphasized the urgent need to propose a system of core competencies for student at all levels of school.

In 2016, China specified the key abilities that students should possess to meet the challenges in the twenty-first century. The implementation of core competencies requires the systematic transformation of teaching beliefs, practices, and behaviors. In response to the national education policy, researchers begin to develop policy-oriented evaluations on system of core competencies in specific subjects. Li et al. (2021) proposed an evaluation framework of Chinese core competencies in high school. It consists of four constructs, including language construction and use, thought development and enhancement, aesthetic appreciation and creativity, cultural heritage and understanding. Rather than focusing on subject knowledge, the framework emphasized student's deeper understanding of the nature of Chinese subjects.

The teaching community is also dedicated to developing new teaching strategies aligned with the concept of core competencies in practical teaching (Liu & Huang, 2022; Zhang, 2017). Take science courses as an example: Guo and Yao (2016) designed a model of science instructional design based on learning progression. It includes five stages of teaching targeted at the cultivation of big scientific concepts: analysis, design, development, implementation, and evaluation (ADDIE). The instructional design model is shown to be effective through comparing the experimental group's and control group's knowledge understanding and ability to explain scientific phenomena.

6.2.2 Curriculum Reform

Curriculum reform is always one of the leading themes in high school education. Many districts in China have long been criticized for the problem of exam-oriented education for high school students. With the rapid development of the global education ecosystem, there is a consensus on the importance of reconsidering the traditional method of teaching. Given the negative impact of exam-oriented education on students' long-term development, Chinese government has put great efforts on

transforming the objectives of teaching and learning, the standards of the curriculum, the structure of the curriculum, the management of teaching evaluation, and the development of teaching materials.

Researchers utilize the opportunity to reflect on the progress which China has made on curriculum reform throughout the years (Bai & Ma, 2019). Other researchers compare curriculum reform practices across countries, such as comparisons with the U.S. (Lu & Qian, 2013) and the U.K. (Qian & Wang, 2014), to highlight current calls for improving high school curriculum reform and to suggest what further research is needed. Key needs include increasing the academic curriculum and integrating vocational education into the ordinal high school curriculum.

The transformation of teachers' roles in classroom is another key issue. The shift from teacher-centered instruction towards student-centered instruction is highly appreciated (Yu, 2014; Zhang, 2014). Teachers used to be the sole authority holders in the classroom, but now they are seeking to play multiple roles as lecturers, coaches, and facilitators for ongoing improvement of teaching quality. Teachers do not just implement the teaching content as it is. Instead, they are the planners and developers of the curriculum. The responsibility of organizing lesson plans, finding classroom resources, facilitating team collaboration, and evaluating the learning outcome largely falls upon teachers. Researchers are investigating teachers' transformation and helping them change in effective ways.

6.2.3 Well-Rounded Education (*Suzhi Jiaoyu*)

The term “qualities” (*suzhi*) is a core concept in Chinese education and remains difficult to define in English. In short, it refers to the consistent quality structure that results from knowledge internalization, innate abilities, and physiology (Pang et al., 2020). Well-rounded education is the educational ideal behind curriculum reform. Instead of the one-sided pursuit of test scores and higher promotion rates, the goal of well-rounded education is to cultivate people who have a well-rounded development of ethics, intellect, physique, aesthetics, and labor for the society and country. While government views education as an investment to promote global competitiveness, the implementation of well-rounded education has been seen as a national strategy for sustainable education. Chinese authorities issued the first official document on well-rounded education back to 1999 and numerous reform directives have been published since then. As a result, high school student's qualities in arts (Wang, 2017), information (Wu et al., 2012), and labor (Zhang, 2020) are increasingly valued by researchers. Physical education (P.E.), music, and labor education are considered as important as other subjects such as Chinese language arts, math and English language.

Qualities is strongly influenced by one's educational background and social environment. However, many high schools remained committed to the original examination-oriented education because university admissions largely depend upon test scores. The reform of higher education enrollment policy is another hot topic under the background of well-rounded education. To be better in tune with education reform, the evaluation of students should highlight the concept of quality orientation.

Dong et al. (2019) highlighted the current practice of the talent selection function in Shanghai is the first to pilot the new college entrance examination reform. Students are admitted to college based on their overall qualities, which include moral development, academic performance, physical and mental health, artistic abilities, and innovative literacy (Shanghai Municipal Commission of Education, 2018). Although there is controversy about how to quantify student qualities, how to ensure the authenticity of the information, and whether it will cause new unfair educational opportunities, it is still a step towards helping schools change their practices and achieve well-rounded education.

6.2.4 Innovative Literacy

Innovative literacy refers to the ability of a person to utilize different forms of materials to draw accurate conclusions and scientific deductions with the aim of creating a novel and original product (Erdogan et al., 2013). Since innovative literacy is an essential quality in college admissions as mentioned before, high school education should equip students with the innovative knowledge and skills to deal with real-life challenges.

To encourage students' innovative literacy, maker education has become a popular topic in science, technology, engineering, and math (STEM) fields. The trend of maker education first emerged in the U.S. In maker education, students are encouraged to design, make, create, and modify objects towards a specific goal outside the formal classrooms (Tofel-Grehl et al., 2021). Open-access environments called "makerspaces" refer to spaces for creation and knowledge exchange among members (Saorín et al., 2017). In 2015, China's former Premier Li Keqiang toured Shenzhen's Chaihuo makerspace and praised makers as the driving force behind China's economic growth. The cultivation of innovative talents has become an important mission and the ideal of maker education has been spread around 2017. Current researches are focusing on how maker education should be designed to create student-centered learning that maximizes students' interest and engagement (Liu, 2017; Mi & Wang, 2019; Yang & Ruan, 2021). With advanced technology such as wireless technology and virtual reality (VR), teachers are able to create an innovation makerspace and fully stimulate students' interests in learning. However, efforts to bring maker education into high schools are still not enough. More research on its efficacy is needed.

Project-based learning (PBL) and team-based learning (TBL) are also applied with the aim of developing students' innovative literacy in all subjects. PBL is a pedagogical approach that engages students in various subjects through a project. Interdisciplinary teaching allows students to gain a more systematic understanding of various subjects. PBL and TBL have been demonstrated to be effective for increasing students' engagement and scaffolding learning to meet the unique needs of all students (Quan et al., 2019). Involving students in projects improves their collaboration and communication skills (Yu, 2018), which are highly sought-after in innovative literacy.

6.2.5 AI-Enhanced Education

Various research in the field of education and psychology has suggested that learning outcomes are associated with learner's personality, preferences, motivation, and other characteristics. Educators are thus encouraged to provide personalized instruction adapted to students' learning styles, but the shift from "one-size-fits-all" towards a student-centered instructional mode is not easy (Zhang et al., 2020). Institutions are turning to new technologies to address this urgent need. With the rapid development of technology, adaptive learning, learning analytics, and virtual assistance are increasingly viable as an alternative to traditional static instruction in hope of addressing students' variation (Wauters et al., 2010).

Take adaptive learning as an example. It can track student progress and make changes to the curriculum at any time (Becker et al., 2018), empowering students with more control over their learning content and pace (Dagger et al., 2005). Adaptive learning has proven its great potential to improve learning performance and engagement worldwide. It has received wide attention in China since 2015. Since then, online learning has encountered several problems including low retention rate and poor self-regulation. While adaptive learning is based on the idea that technologies are able to learn and modify the materials in response to student performance, it possesses the capacity to solve existing problems of online learning. As one form of personalized learning, adaptive learning is still at its infancy in China. However, even at the early stage, adaptive learning still offers educational institutions new opportunity to change classroom routines. In many cases, the results of adaptive learning systems are positive. For example, Yixue Squirrel AI is one of the first adaptive learning systems in China. Since its establishment in 2016, Yixue has collaborated with 200 public schools across China for math, English language, physics, Chinese language arts, and chemistry serving more than 100,000 users (Yixue, n.d.). It uses diagnostic pre-assessments, differentiated instruction, high-quality learning content and immediate feedback (Li et al., 2018). Students gain greater success with Yixue Squirrel AI than traditional instruction (Cui et al., 2018; Li et al., 2018). Wang et al. (2020) also showed its usefulness compared to small-group classroom instruction.

Generally speaking, AI-enhanced education appears to be on its way to serve the broader educational practice for personalized learning. MOE (2012) demonstrated that "personalized learning information and environment should be provided for each student". They further announced the list of experimental zones to explore new instructional mode with IT (MOE, 2020d). However, technology alone does not yield improved learning outcomes. The effective implementation of adaptive learning calls for more attention and effort from institutions, educators, and other stakeholders to figure out the best educational practices.

7 National Policies

7.1 Basic Policies

In 2011, China achieved universal access to compulsory education. The strategic importance of high school education was further emphasized, and the high school education in China has entered a period of accelerated development. Over the past decade, the Chinese government has issued a number of policies to promote the development of high school education in China. The basic education policies are as follows (see Table 8).

7.2 Key Policies

7.2.1 Enrollment Reform (*Zhaosheng Gaige*)

MOE (2016) issued *Guidelines on Further Promoting the Reform of School Examination and Enrollment System in High Schools*, pointing out that there are problems with the enrollment of high school students in China, including the over-emphasis on exam scores, the narrow range of scoring subjects, and the unequal access to high-quality high schools. To solve the problems, MOE has promoted the reform of enrollment system in high schools. The key points are as follows:

Reforming High School Academic-level Examination. To encourage students to learn every subject carefully, MOE (2016) advocated that all subjects (Chinese language arts, math, foreign languages arts, politics, history, geography, physics, chemistry, biology, P.E. and health, music, art, information technology, etc.) specified *the Experimental Program of Compulsory Education Curriculum* should be included in the scope of the junior high school academic level examinations.

MOE (2016) also stressed the need to reform scoring methods. In addition to Chinese language arts, math and foreign languages, other subjects should also be considered as scoring subjects and the scoring methods should consider various factors including study stress, the balance between subjects, and students' selectivity. Furthermore, it is suggested to adopt grading system instead of raw scores to avoid excessive competition.

Improving Overall Quality Evaluation System. To further promote students' well-rounded development and healthy growth, the education departments and high schools have continuously improved the overall quality evaluation system and actively explored the enrollment mode based on it. According to MOE (2016), local governments should improve the systems according to the following points (see Table 9).

Improving Quota Allocation Implementation in High-Quality High Schools. To promote the balanced development of compulsory education, the reform of high

Table 8 Key contents of the basic policies

Aspects	Policies [year]	Main contents
Universal access to education	<i>Action Plan for Universal Access to Upper Second Education (2017–2020)</i> [2017]	By 2020, the gross enrollment rate of high schools in all provinces should reach more than 90%, and special groups such as students from poverty-stricken areas in the central and western regions, students with financial difficulties, disabled students, and relocated children of migrant workers should receive more attention ^a
Safeguard mechanism	<i>Action Plan for Universal Access to Upper Second Education (2017–2020)</i> [2017]	Local governments should improve the allocation system of educational expenditure per student
		Tuition fees can be waived for students with financial difficulties
Teaching conditions	<i>Action Plan for Universal Access to Upper Second Education (2017–2020)</i> [2017]	Eliminate large classes and reduce super large schools
		Strengthen the reconstruction of school buildings, libraries, and sports facilities in schools in impoverished areas, to help these schools meet the basic needs of teaching
	<i>Guidelines on Promoting the Reform of Educational Methods in High Schools in the New Era</i> [2019]	Schools are encouraged to construct innovation laboratories and activity rooms, and provide information equipment and other advanced facilities
Teacher building	<i>Action Plan for Universal Access to Upper Second Education (2017–2020)</i> [2017]	Schools should establish inter-school teacher shifting systems to ensure teacher sufficiency
	<i>Guidelines on Promoting the Reform of Educational Methods in High Schools in the New Era</i> [2019]	Innovate teacher training methods; focus on improving teachers' ability to implement course reform; guide students' career development; implement classified class teaching
	<i>Action Plan for the Development and Improvement of County High Schools in the "14th Five-Year Plan"</i> [2021]	Establish training programs for excellent teachers in underdeveloped regions
Talent cultivation	<i>Action Plan for Universal Access to Upper Second Education (2017–2020)</i> [2017]	High schools are encouraged to develop their own characteristics
	<i>Curriculum Plan of High School and Curriculum Standards of Chinese and Other Disciplines</i> (2017) [2018]	High school curriculum reform (This policy will be introduced in the ensuing paragraphs.)

(continued)

Table 8 (continued)

Aspects	Policies [year]	Main contents
	<i>Guidelines on Promoting the Reform of Educational Methods in High Schools in the New Era [2019]</i>	Strengthen overall quality training and improve overall quality evaluation systems Schools should attach importance to students' career development guidance
Examination and enrollment	<i>Implementation Guidelines on Deepening the Reform of Examination and Enrollment System [2014]</i>	Improve the distribution of enrollment plans to increase the college entrance examination admission rate in underdeveloped regions and populous provinces Reform examination content, improve academic-level examinations, and standardize the overall quality evaluation of high school students 2014 marks the beginning of the college entrance exam reform

Source MOE et al. (2017), MOE (2018, 2021e), the State Council (2014, 2019c)

^aIn some regions across the globe, high school education is publicly funded. Although China's high school education is not free in general, the country has been working on decreasing the fees for high school students

Table 9 Key points in establishing an overall quality evaluation system

Aspects	Main contents
Evaluation contents	The evaluation contents should include students' moral characters, academic performance, physical and mental health, artistic quality, and social practice. Clarify approaches should be developed to evaluate students
Evaluation materials	The materials used in the comprehensive evaluation should be put into an electronic system. The materials include objective data (for example, grades, and physical test results) and subjective statements (including self-introduction, representative experiences and research study reports). Schools and other institutions should enter the data into the electronic system on time. Students should sort out their materials on a regular basis, write statements on time, and be responsible for the authenticity of their submissions
Evaluation procedures	High schools should specify the methods for using materials in the electronic system and the process for overall quality evaluation, and publish them in advance
Supervisory measures	Except for personal private information, all information stored in the electronic system should be made available to the public for supervision. It is necessary to establish mechanisms (e.g., an accountability system) to ensure the objectivity and authenticity of the evaluation system

Source MOE (2016)

Table 10 A glance at the local policies on quota allocation

Provinces/ Cities	Policies
Shaanxi province	At least 50% of the enrollment quota of provincial model high schools will be allocated to junior high schools in the region, and appropriate preference will be given to rural junior high schools
Fujian province	No less than 50% of the enrollment quota of the high-quality high schools will be allocated to each middle school, and the targeted enrollment quota is tilted to rural middle schools
Shanghai	The number of students enrolled through quota allocation will account for 50–65% of the total enrollment plan of Shanghai high-quality schools
Hebei province	The enrollment ratio of “quota to school” of high-quality high schools should reach 80%

school enrollment system attaches great importance to implementing the quota allocation of high-quality high schools. According to MOE (2016), junior middle schools in the region should get a reasonable allocation of enrollment quota from high-quality high schools. Besides, the high schools in urban areas should allocate some enrollment quota to the junior middle schools in rural areas.

Several local governments have released the policies on quota allocation. Table 10 displays the policies in a number of provinces and cities (Fujian Provincial Department of Education, 2018; Hebei Provincial Department of Education, 2018; Shaanxi Provincial Department of Education, 2017; Shanghai Municipal Commission of Education, 2021).

Many other provinces and cities are also actively working on improving the enrollment ratio of quota allocation. It is expected that several provinces will achieve 100% enrollment through quota allocation in high-quality high schools by 2023, which will affect more students and parents.

7.2.2 College Entrance Examination Reform (*Gaokao Gaige*)

In 2014, the State Council issued *Implementation Guidelines on Deepening the Reform of the Examination and Enrollment System*. Since then, the most comprehensive, systematic, and profound round of college entrance examination reform in China has begun, in response to long-standing problems of over-emphasizing scores in China's college entrance examination.

According to MOE (2021f), Shanghai and Zhejiang, as pilots, launched the college entrance examination reform in 2014. Three years later, the reform's first batch of high school students sat for the college entrance examination. In the same year, Beijing, Tianjin, Shandong and Hainan announced to join the reform. In 2018, eight provinces (Hebei, Liaoning, Jiangsu, Fujian, Hubei, Hunan, Guangdong and Chongqing) kept up with the pace of reform, which also means that the college entrance examination reform, starting from the Eastern regions, has expanded to the Central and Western

regions of China, representing a new stage. After 2019, 16 provinces and cities including Anhui, Sichuan, Henan, Shanxi, Heilongjiang, Jilin and Inner Mongolia followed the reform. With the continuous advancement of the reform, the new college entrance examination reform has been gradually implemented nationwide. The three major measures of the college entrance examination reform will be introduced below.

Adjusting Examination Subjects. Chinese language arts, math, and English language are required subjects of college entrance examination. In addition to them, students must select other subjects as scoring subjects in the exam. Before the reform, students had only two options: politics, history, and geography or physics, chemistry, and biology. Students were thus divided into “science students” and “arts students”. This subject selection system is also known as the “Division of Arts and Science”.

The college entrance examination reform abolished this subject selection system, giving students more autonomy and flexibility in subject selection. Students can choose freely from politics, history, geography, physics, chemistry, biology, and technology. There are mainly two types of policies for selecting subjects, “3 + 3” and “3 + 1 + 2” (Table 11).

Reforming Scoring Methods. The scores for Chinese language arts, math, and English language will be added to the total scores directly, while the results for the other subjects will be processed as converted scores. Exams for the selected subjects are broken down into “passing exam (pass/fail)” and “grading exam (A/B/C/D/E)”. The “grading exam” is only open to the students who have successfully completed the “passing exam”. Scores for the selected subjects will be generated based on students’ ranks. In order to make it easier to understand, the method used in Beijing is presented as an example (see Table 12).

Implementing College Admission with “two base + one reference”. To reverse the value orientation of “score-only”, China’s college entrance examination reform adopts the “two base + one reference” mode in the enrollment process. The “two base” refers to college entrance examination score and the score of academic proficiency test (the “passing exam” and the “grade exam” mentioned above). “One reference” refers to overall quality evaluation. The State Council (2014) clearly points out that it is necessary to improve the overall quality evaluation system for high school

Table 11 Two types of policies for selecting subjects

Modes	Examination subjects	Target regions
“3 + 3”	3: Chinese, math and English	Zhejiang, Shanghai, Beijing, Tianjin, Shandong, Hainan
	3: Any three of the following subjects: politics, history, geography, physics, chemistry, biology, technology	
“3 + 1 + 2”	3: Chinese, math and English	Hebei, Liaoning, Jiangsu, Fujian, Guangdong and other 15 provinces/cities
	1: physics or history	
	2: Any two of the following subjects: chemistry, biology, politics, geography	

Table 12 Scoring method for selected subjects in Beijing

Grades		Ranking ranges	Corresponding scores
A (15%)	A1	1%	100
	A2	2%–3%	97
	A3	4%–6%	94
	A4	7%–10%	91
	A5	11%–15%	88
B (35%)	B1	16%–21%	85
	B2	22%–28%	82
	B3	29%–36%	79
	B4	37%–43%	76
	B5	44%–50%	73
C (34%)	C1	51%–57%	70
	C2	58%–64%	67
	C3	65%–71%	64
	C4	72%–78%	61
	C5	79%–84%	58
D (15%)	D1	85%–89%	55
	D2	90%–93%	52
	D3	94%–96%	49
	D4	97%–98%	46
	D5	99%	43
E	E	Last 1%	40

Source Beijing Municipal Education Commission (2018)

students and apply overall quality evaluation into college admission. The overall quality evaluation system for high school students is quite similar to the one for junior high school students, which has been introduced in the previous chapter. One significant difference is that high school students' evaluations highlight students' performance of social responsibility, innovation spirit, and problem-solving skills, in addition to moral character, academic success, physical and mental health, artistic excellence, and social practice.

7.2.3 Curriculum Reform

Basic courses play a key role in education. In 2003, MOE issued *Experimental Draft of the Curriculum Plan and Curriculum Standards for High Schools*, which has guided the curriculum reform in high schools for more than 10 years, and has established a high school curriculum system suitable for China's national conditions, making a positive contribution to the improvement of the education quality in China.

However, with the development of economy, science and technology, new requirements for talent cultivation have been constantly put forth. The original curriculum system needs to be improved.

In 2013, MOE launched the plan for high school curriculum revision, with a view to revising the current curriculum plan and curriculum standards into programmatic teaching documents that not only conform to China's actual situation, but also have an international perspective, so as to build a high school curriculum system with Chinese characteristics.

In 2018, MOE issued *Curriculum Plan of High School and Curriculum Standards of Chinese and Other Disciplines (2017)*. Compared with the curriculum plan and curriculum standard issued in 2003, the revised plan and standard mainly have the following changes.

Changes of Course Plan. The three major changes in course plan will be introduced below.

- Clarify the orientation of high school education in China. This revision aims to change the tendency of over-emphasizing scores, and re-affirms the goal of China's high school education is raising students' overall quality by emphasizing the development of core competencies and the sense of social responsibility, as well as the capacity for lifelong learning and self-motivated development.
- Optimize course structure. This revision adjusts the courses to mandatory courses, optional mandatory courses, and optional courses. It aims to ensure an academic foundation for all students while giving students more chances for personal growth. In addition, the new curriculum plan also adapts the credit system in high school to the change in the course structure.
- Strengthen the supporting system for curriculum implementation. To adapt to the changes brought by the college entrance examination reform, the revision further defines the responsible parties in curriculum implementation and their responsibility requirements.

Changes in Curriculum Standards. The three major changes in curriculum standards will be introduced below.

- Specify the core competencies for each discipline. MOE (2014) proposed to refine the requirements for talent training and raised two questions: What kind of students do China need? How to cultivate the students? In this context, the core competency system came into being. It defines the necessary characteristics and skills for students to adapt to the development of society, and has become the core guidance for high school instruction. In order to better cultivate students' core competencies, the new curriculum standard has specified core competencies for each discipline. Take English as an example (Table 13).
- Update teaching contents. Traditional Chinese culture should be integrated into teaching and learning, in order to strengthen the ideological nature of the courses; present new achievements in economic, political, cultural, scientific, technological, social and ecological development, so as to cultivate students' spirit of

Table 13 Core competencies for English

Core competencies	Descriptions
Language proficiency	The ability to understand others and express oneself in social situations by listening, speaking, reading, watching, and writing
Culture character	The ability to understand both Chinese and foreign cultures
Thinking quality	The ability to think logically, critically, and creatively
Learning ability	The ability to improve English learning efficiency by adjusting strategies and broadening learning channels

Source MOE (2018)

keeping pace with the times; pay attention to the internal connection between knowledge, as well as the interdisciplinary connection among disciplines, so as to strengthen the integrity of teaching contents.

- Develop academic quality standards. Academic quality standards define students' specific performance at different core competency levels. With the help of the standards, students can conduct self-tests and achieve self-improvement. Teachers can better understand students' performance and cultivate students' core competencies. Academic quality standards can also strengthen the relationships between teaching, learning, and evaluation by serving as a crucial foundation for formative assessment, academic level exams, and admission exams.

7.2.4 The Latest Changes in Curriculum Reform

MOE has published a new version of curriculum plan and curriculum standards in 2022. The fundamental difference between the new and the old is a stronger emphasis on the necessity to merge the primary and junior high school curricula and to increase the connections among different learning stages, so as to establish a solid basis for high school education.

8 Summary

This chapter shows the development and achievements of China's high school education in recent years through data analysis, indicators building, case studies, storytelling, research reviews and policies combing. After years of reform, China's high school education has taken on a new look. It mainly has three characteristics.

These reforms have profoundly changed the ways of cultivating talents. Over the past 10 years, China's high school education has implemented many reforms including the curriculum reform, the enrollment reform, and the college entrance examination reform. The textbooks, curriculum structure, teaching contents, teaching

methods, and evaluation systems have all been updated as part of the reform process, which have significantly changed how high school education is delivered in China. In addition, high schools in China have actively explored how to utilize IT to optimize teaching methods. Some, for example, have begun to adopt AI-powered educational systems to make teaching more effective and intelligent.

These reforms have brought more attention to the breadth of student development. Many high schools in China (e.g., the High School affiliated to Fudan University) have developed new curriculum systems to guide students in acquiring extensive knowledge in various fields. Furthermore, the establishment of overall quality evaluation systems encourage students to develop holistically rather than only focusing on examination scores.

Increasing emphasis has been laid on promoting equitable and balanced education. Principal Zhang Guimei founded the first all-girl free-education public high school in China in order to reduce the educational inequity caused by gender differences and regional differences. The quota allocation policy in high school enrollment is designed to improve the entrance opportunities for disadvantaged groups (e.g., students from the middle schools in rural areas). The high school-centered education groups (e.g., Jianping Education Group) have effectively promoted a more balanced distribution of high-quality educational resources. Other measures are also used to promote education equity in China, with the goal of eliminating educational injustice caused by gender differences, inter-school differences, urban–rural differences, and regional differences.

In recent years, the development of high school education in China has made many breakthroughs and entered a new stage of development. However, there are still some inadequacies. For example, China's fiscal expenditure on high school education has nearly doubled in the past decade, but the total expenditure per student is still lower than the international average. The recent press conference held by MOE (2022) also shows that more attention will be paid to the development of high school education in the future, to meet the challenges brought by the unprecedented changes in the world.

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