The limited difference in students has no effect on the quality of teaching under homogeneous education resources

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Abstract

Background

Very limited studies have emphasized whether different admission scores have an impact on the quality of high education teaching.

Methods

In this work, 2016 undergraduates were included, who majored in clinical medicine at the School of Medicine (Shenzhen Campus, SZC) and the Zhongshan School of Medicine (Guangzhou North Campus, GZNC) at Sun Yat-sen University. There was a 13-point difference in the average admission scores in Guangdong Province. The limited different students were educated under exactly the same resources during the 5 years of undergraduate period. The grades, graduation, and postgraduate enrollment rates of the students were compared between the two campuses.

Results

After 5 years of homogeneous education, comparing the GZNC students with the SZC students, there were no significant differences in the average total score (80.2 ± 4.6 vs 80.0 ± 5.6, P = 0.691), the average compulsory course (78.9 ± 3.4 vs 78.4 ± 6.1, P = 0.438), the average core course score (78.8 ± 7.4 vs 78.7 ± 5.0, P = 0.860) and the average clerkship score (85.1 ± 7.2 vs 84.6 ± 2.7, P = 0.275). Only a significant difference in the average score of the 48-week internship could be observed (78.3 ± 4.2 vs 82.1 ± 4.0, P < 0.001) and it was a subjective grade. When students were classified and compared, those who ranked in the top 25% were considered outstanding students, there is no difference in the outstanding rate of total scores between students from the two campuses (33/165, 20% vs 90/415, 21.4%, P = 0.652). Furthermore, there are no statistical differences in postgraduate enrollment between the two campuses (P = 0.758).

Conclusions

After 5 years of homogeneous education, students with limited different admission grades showed similar educational quality, including similar academic scores, as well as similar postgraduate admission rate, which strongly suggesting that the key to improving medical educational quality is optimizing educational resources, not just enrolling high-scoring students.

Key messages

1. Undergraduates from two medical schools with different average admission scores were educated with exactly the same resources during the 5-year undergraduate period. After 5 years of homogeneous
education, the students showed similar educational quality, including similar academic scores, as well as a similar rate of postgraduate admission.

2. The key to improving educational quality is to optimize educational resources, not just to recruit high-scoring students.

Introduction

Education is the basic construction for cultivating talents and promoting the continuous progress of society[1]. Education is the basic construction to cultivate talents and promote the continuous progress of society. How to promote conformant development of higher education, that is, adhere to the stable scale, optimize the structure, strengthen the characteristics, improve the guarantee and take quality improvement as the core of the development model, is an important issue that higher education workers need to solve. Since the quality of students is closely related to educational resources, high-quality educational resources always attract high-quality students. In China, a difference of 10–20 points in the results of the college entrance examination will lead to the admission of students to universities with significant differences in educational resources. Therefore, the difference in education quality is often difficult to define as the difference in student quality or the difference in educational resources.[2][3]. Compared to the means to improve the overall quality of teachers and increase the administrative support of education, attracting high-quality students has become the most convenient means for Chinese universities and colleges to improve the quality of education[4, 5]. But do higher admission scores actually lead to better educational outcomes? Especially in medical education, it is more difficult to evaluate the quality of the teaching due to the sociality of medicine, the complexity of the learning content, and the particularity of the organization and management of the teaching. Previous studies on the impact of student source quality on education quality are based on subjective views or analogical analysis, and few studies are based on objective data[6]. During the establishment of the Sun Yat-sen University School of Medicine (Shenzhen Campus, SZC), students from the SZC and the Sun Yat-sen University School of Medicine(Guangzhou North Campus,GZNC) were taught in the same class, completely eliminating the possible aggregation effect of the difference of educational resources on the quality of students and allowed us to objectively analyze the impact of the limited quality difference of students on the quality of teaching. This study aims to compare the overall teaching quality of students in the two colleges and universities, clarify the impact of the difference of limited student sources on teaching quality, and then explore feasible methods for colleges and universities to improve the connotation of education.

Methods

In this work, undergraduates in grade 2016, who majored in clinical medicine in SZC and GZNC, were included. There is a limited difference in the average admission score in Guangdong province (which represents about 50% of admissions in 2016) between them. The average admission scores for SZC
students are 13 points lower than those of GZNC (613 points vs. 626 points). Since the construction of SZC has not been completed, students were set to study in GZNC after admission, so it could be considered that there are no differences in teachers and curricula. Currently, students from both campuses have completed their undergraduate studies. Students’ curricular grades during the five-year undergraduate period were all collected. The curriculum consists of public courses, basic specialized courses, core courses, internship courses, and clinical internship. Public courses include Medical Mathematics, Health Law, Medical Statistics, Preventive Medicine, Epidemiology, and Evidence-Based Medicine, College English, Medical Physics, Fundamentals of Computer Science, Physical Education, etc. The specialized basic courses include biology and cell biology, Basic Anatomy, Histology and Embryology, Physiology, Biochemistry and molecular biology, Medical Immunology, Medical Microbiology, Medical English, Pathology, Pharmacology, Pathophysiology, Clinical Anatomy, Medical Genetics, Human Parasitology, Molecular Medicine Skills, Experimental Physiology, Basic Chemistry, Medical Ethics, Diagnostics, etc. Core courses include Internal Medicine Theory, Traditional Chinese Medicine, Pediatrics Theory, Medical Imaging, Clinical Nuclear Medicine, Medical Psychology, Surgery Theory, Obstetrics and Gynecology Theory, Neurology Theory, Infectious Disease Theory, Psychiatry Theory, Oncology Theory, Otorhinolaryngology Theory, Ophthalmology Theory, Dermatology and Venereology Theory, Clinical Skill Training, etc. The clerkship courses include clerkships in internal medicine, surgery, pediatrics, obstetrics and gynecology, infectious diseases, psychiatry, oncology, otolaryngology, ophthalmology, dermatology and venereology, and neurology. The 48-week Clinical Internship is set up to rotate in internal medicine, surgery, pediatrics, obstetrics and gynecology, dermatology, neurology, otolaryngology, infectious diseases, etc. All of these curricular grades were collected to perform statistical analysis.

Among them, the average score of the total score is the average score of all the courses; the average score of compulsory courses is the average score of public courses, basic courses and core courses; the average score of core courses is the average score of the above-mentioned core courses. The average score of the clerkship courses is the average score of all the clerkship courses; the average score of the internships is the average score of all the internship departments. The internship score is made up of a 30% rotation score, a 28% comprehensive examination score, and 42% comprehensive operation scores. In addition, clerkship courses and internships are uniformly classified as practical courses.

In order to compare the distribution of students’ grades, according to the average score, students’ grades were divided based on quartiles and classified into three groups.

1. Excellent: ranking in the top 0–25% of the average total score;
2. Good: ranking in the top 25–75% of the average total score;
3. Qualified: ranking in the top 75–100% of the average total score.

Continuous variables are expressed as mean ± standard deviation. Categorical variables are expressed as numbers and percentages. The objective academic performance of students in the two campuses is compared using the student t test and the rank sum test. A P < 0.05 was considered statistically different. All statistical methods were analyzed with SPSS 13.0.
Results

Differences in average scores of undergraduate theoretical and practical courses between students from SZC and GZNC under same educational resources

A total of 165 students came from SZC and 415 from GZNC. The statistical results are presented in Table 1 and Fig. 1. Compared to the GZNC students, there was no significant difference in the average total score (80.2 ± 4.6 vs 80.0 ± 5.6, P = 0.691), average compulsory course score (78.9 ± 3.4 vs 78.4 ± 6.1, P = 0.438), average core course score (78.8 ± 7.4 vs 78.7 ± 5.0, P = 0.860) and the average internship score (85.1 ± 7.2 vs 84.6 ± 2.7, P = 0.275). The only significant difference that could be observed was the average score for the 48-week placement (78.3 ± 4.2 vs 82.1 ± 4.0, P < 0.001), which was primarily a subjective grade. The grading habits of teachers in different hospitals in practice may influence the scores.

Table 1. Average scores of the five-year undergraduate courses in students of SZC and GZNC, Class of 2016

<table>
<thead>
<tr>
<th></th>
<th>SZC n=165</th>
<th>GZNC n=415</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores of total courses</td>
<td>80.2±4.6</td>
<td>80.0±5.6</td>
<td>0.691</td>
</tr>
<tr>
<td>Scores of specialized basic courses</td>
<td>78.9±3.4</td>
<td>78.4±6.1</td>
<td>0.438</td>
</tr>
<tr>
<td>Scores of core courses</td>
<td>78.8±7.4</td>
<td>78.7±5.0</td>
<td>0.860</td>
</tr>
<tr>
<td>Scores of clerkship courses</td>
<td>85.1±7.2</td>
<td>84.6±2.7</td>
<td>0.275</td>
</tr>
<tr>
<td>Scores of clinical internships</td>
<td>78.3±4.2</td>
<td>82.1±4.0</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*The results are expressed as means ± standard deviation.

Abbreviations: SZC, Zhongshan University School of Medicine of Shenzhen Campus; GZNC, Zhongshan School of Medicine (Guangzhou North Campus).

Differences in the proportion of excellent students in theoretical and practical courses between students from SZC and GZNC under the same educational resources

In order to compare excellent students, the performance of students from the two campuses was categorised and compared using the top 25% of scores. The results showed (Table 2) that there was no difference in the excellent overall score rate between students from the two campuses (33/165, 20%) vs 90/415, 21.4%, P = 0.652). However, the excellent rate of compulsory courses (113/26.8% vs. 29 /17.6%, P < 0.001) and placement grades (136/32.3% vs. 18/10.9%, P < 0.001) was higher in students in GZNC, while the excellent rate of placement grades was higher in SZC (73/44.2% vs. 130/30.9%, P = 0.008).
<table>
<thead>
<tr>
<th></th>
<th>SZC (n = 165)</th>
<th>GZNC (n = 415)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores of total courses</td>
<td></td>
<td></td>
<td>0.652</td>
</tr>
<tr>
<td>Excellent (n, %)</td>
<td>33 (20%)</td>
<td>90 (21.4%)</td>
<td></td>
</tr>
<tr>
<td>Good (n, %)</td>
<td>96 (58.2%)</td>
<td>224 (53.2%)</td>
<td></td>
</tr>
<tr>
<td>Qualified (n, %)</td>
<td>36 (21.8%)</td>
<td>101 (24%)</td>
<td></td>
</tr>
<tr>
<td>Scores of specialized basic courses</td>
<td></td>
<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Excellent (n, %)</td>
<td>29 (17.6%)</td>
<td>113 (26.8%)</td>
<td></td>
</tr>
<tr>
<td>Good (n, %)</td>
<td>108 (65.4%)</td>
<td>171 (40.6%)</td>
<td></td>
</tr>
<tr>
<td>Qualified (n, %)</td>
<td>28 (17.0%)</td>
<td>131 (31.1%)</td>
<td></td>
</tr>
<tr>
<td>Scores of core courses</td>
<td></td>
<td></td>
<td>0.404</td>
</tr>
<tr>
<td>Excellent (n, %)</td>
<td>45 (27.3%)</td>
<td>94 (22.3%)</td>
<td></td>
</tr>
<tr>
<td>Good (n, %)</td>
<td>83 (50.3%)</td>
<td>207 (49.2%)</td>
<td></td>
</tr>
<tr>
<td>Qualified (n, %)</td>
<td>37 (22.4%)</td>
<td>110 (26.1%)</td>
<td></td>
</tr>
<tr>
<td>Scores of clerkship courses</td>
<td></td>
<td></td>
<td>0.008</td>
</tr>
<tr>
<td>Excellent (n, %)</td>
<td>73 (44.2%)</td>
<td>130 (30.9%)</td>
<td></td>
</tr>
<tr>
<td>Good (n, %)</td>
<td>62 (37.6%)</td>
<td>171 (40.6%)</td>
<td></td>
</tr>
<tr>
<td>Qualified (n, %)</td>
<td>29 (17.6%)</td>
<td>108 (25.6%)</td>
<td></td>
</tr>
<tr>
<td>Scores of clinical internships</td>
<td></td>
<td></td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Excellent (n, %)</td>
<td>18 (10.9%)</td>
<td>136 (32.3%)</td>
<td></td>
</tr>
<tr>
<td>Good (n, %)</td>
<td>97 (58.8%)</td>
<td>198 (47.0%)</td>
<td></td>
</tr>
<tr>
<td>Qualified (n, %)</td>
<td>49 (29.7%)</td>
<td>32 (7.6%)</td>
<td></td>
</tr>
</tbody>
</table>

* Excellent, defined as ranking in the top 0–25%; good, ranking in the top 25–75%; qualified, ranking in the top 75–100%.

Abbreviations: SZC, Zhongshan University School of Medicine of Shenzhen Campus; GZNC, Zhongshan School of Medicine (Guangzhou North Campus).

Comparison of SZC and GZNC graduation and post-graduate enrollment rates
The graduation and post-graduate enrollment rates of the two campuses are shown in Fig. 2. The SCZ graduation rate was higher than that of GZNC (93.94% vs. 86.27%, \( P = 0.009 \)). The postgraduate enrollment rates for SZC and GZNC were 69.70% (115/165) and 70.84% (294/415), respectively. There are no statistical differences in postgraduate enrollment between the two campuses (\( P = 0.758 \)).

**Relation between practical and theoretical marks**

Practical courses, which included clerkships and internships, were an important part of medical education. Pearson's correlation analysis was performed on the relationship between the scores of practical courses and theoretical courses. The results showed (Table 3) that the practical courses were positively correlated with the average scores of the total score, the compulsory courses, and the core courses, either in the general students or in the students of SZC or GZNC. It was suggested that students with excellent scores in the theoretical courses also performed better in the practical courses.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>The correlation between practical course grades and theoretical course grades</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scores of clinical internships</strong></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>SZC</td>
</tr>
<tr>
<td>( \beta )</td>
<td>( P )</td>
</tr>
<tr>
<td>Scores of total courses</td>
<td>0.534</td>
</tr>
<tr>
<td>Scores of specialized basic courses</td>
<td>0.480</td>
</tr>
<tr>
<td>Scores of core courses</td>
<td>0.534</td>
</tr>
<tr>
<td><strong>Scores of clerkship courses</strong></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>SZC</td>
</tr>
<tr>
<td>( \beta )</td>
<td>( P )</td>
</tr>
<tr>
<td>Scores of total courses</td>
<td>0.801</td>
</tr>
<tr>
<td>Scores of specialized basic courses</td>
<td>0.754</td>
</tr>
<tr>
<td>Scores of core courses</td>
<td>0.891</td>
</tr>
</tbody>
</table>

* Practical courses included clerkship and internships.

Abbreviations: SZC, Zhongshan University School of Medicine of Shenzhen Campus; GZNC, Zhongshan School of Medicine (Guangzhou North Campus).

**Discussion**
As mentioned above, although there was a significant difference of more than 10 points in the college admission scores of students from the two campuses, they had similar average grades in school, as well as a similar rate of admission to post-graduate school under the same educational resources for 5 years. Our results suggest that optimizing educational resources is the core content of improving educational quality, rather than recruiting high-scoring students.

Regarding theoretical courses, there was no statistical difference in the overall average score between the two campuses and the respective average scores of the compulsory and professional courses that make up the overall average score, but the GZNC scores have a greater dispersion, which means that there were more students who did not pass the exams and were not admitted to subsequent practical courses. Regarding the graduation rate of the campuses, the number of students in the GZNC is significantly lower than the number of students in the SZC. As higher admission scores and lower graduation rates were observed in GZNC, this phenomenon deserves further consideration.

The reasons why students with higher entrance grades appear to diverge significantly during college are complicated. Combined with the current high-intensity study in domestic high school and the high pressure of examinations, it is suggested that the high-intensity study in high school has exhausted some students' enthusiasm for learning, leading to the study-weary phenomenon when they enter college[7, 8]. Meanwhile, it is also possible that students are adapted to the passive learning style in high school, but cannot change to the active learning style in college, or they cannot adapt to the environment of college life, or they cannot continue their studies due to various psychological problems[9, 10]. However, the reasons for finding a higher percentage of dropouts among students with higher entrance scores are unclear. However, the current results suggest that persistence in learning, rather than higher entrance scores, is the guarantee of better academic performance in future studies.

The students in the two campuses have the same educational teaching resources and the evaluations are also carried out using the same tests and scoring system. Students from two campuses showed similar academic performance except that GZNC students had better grades in clinical internships. To explore the underlying reason, we traced the specific process of this part of the examination and found that clinical performance evaluation, which accounts for a large proportion of internship results, was carried out separately in two hospitals. Since the evaluation of clinical performance was mainly a subjective evaluation by teachers, the possibility of systematic deviation between hospitals cannot be ruled out.

Student quality, faculty diplomas, academic characteristics, and administrative support were all believed to be the core components of high-quality higher education[5, 11]. Consistent with our study, there were studies that believed that the core contents of high-quality educational resources were more dependent on faculty competence and experience, which determine the height and depth of disciplinary and professional programs[12, 13]. Since the comprehensive quality of medicine integrates with teaching and research in medical school teachers, medical schools having higher requirements for faculties and high-quality resources are more difficult to obtain than general higher education[13, 14]. For medical education,
improving teaching quality lies not only in the ability and level of individual teachers, but also in the support and training of teaching staff by schools and hospitals\textsuperscript{[15]}. 

Currently, the goal of our medical education has changed from cultivating applied medical professionals who will engage in medical services to cultivating research-oriented physicians with innovative ability, discovering problems in clinical work and obtaining the ability to solve problems\textsuperscript{[16, 17]}. Higher medical education is not only the instillation of professional knowledge, but also the ability and spirit of innovation in scientific research\textsuperscript{[18, 19]}. Students who are good at memorizing are more likely to get good grades on exams, but in practice, especially clinical practice and scientific research, these students may not perform as well as expected. Therefore, our study is not necessarily the most appropriate for using test scores during school, as well as the acceptance rate of graduate students, as a standard of educational quality. It may be more convincing to follow these students over a longer period of time, looking at their achievements 10 and 20 years later.

In addition, the evaluation of the quality of education is a very complicated process, it includes not only the academic performance of students, but also the evaluation of moral development such as the ideals and beliefs of the students, social responsibilities and behavior habits, as well as aesthetic literacy, labor practices, etc. It is difficult to quantify in the short term \textsuperscript{[17, 18]}. However, the qualitative differences defined in our study were based solely on admissions performance; the conclusion of this study is limited to academic performance.

**Declarations**

a. Ethics approval and consent to participate

The Ethics Committee of the First Affiliated Hospital of Sun Yat-sen University waived the requirement for informed consent for the study because the study did not involve any personal information. All methods were carried out in accordance with relevant guidelines and regulations for the present study and this study and it’s protocol was approved by the Guangdong Provincial Education Science Planning Office.

b. Consent for publication

All authors gave their consent for publication.

c. Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request and it’s not publicly available.

d. Competing interests

All authors declared no conflict of interest.
e. Funding

1. 2021 Guangdong Province Education planning project (Higher education special project 2021GXJK339)

2. 2023 University level teaching quality and teaching reform project (80000-12220011)

g. Acknowledgements

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h. Author information (optional)

References


19. Research Trends from a Decade (2011-2020) for Information Literacy in Higher Education: Content and Bibliometric Mapping Analysis[J].

**Figures**
Figure 1

Average scores of the five-year undergraduate courses in students of SZC and GZNC

Abbreviations: SZC, Zhongshan University School of Medicine of Shenzhen Campus; GZNC, Zhongshan School of Medicine (Guangzhou North Campus).
Figure 2