Research on Reducing the Extremes of Special Enrollment in the College Entrance Examination (High-level Sports Team) Under the Bilateral Matching Model

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ABSTRACT
As the number of college entrance examinations continues to increase, competition is becoming more and more fierce. Among them, the special type is also the multitude of troops crossing the single-plank bridge. As one of the high-level sports teams, the number of participants each year is also increasing, but among them there is no shortage of schools and students who have missed the ideal university due to various reasons, or the school cannot recruit the students they want. Therefore, this article examines the existing mechanism through the bilateral matching theoretical model, and the result cannot prevent schools in extreme situations from recruiting a single student, and there are still many aspects that need to be improved. Schools can adjust the existing mechanism according to their own needs.

Keywords: *Bilateral matching theory, High-level sports team, Special type admissions for college entrance examination.*

1. INTRODUCTION

In recent years, the number of applicants for the college entrance examination has continued to increase, even breaking through 10 million in the past two to three years. Among them, the number of special types of enrollment is also increasing. The enrollment of high-level sports teams once exceeded 8,000. At the same time, there are also a group of people who are unable to attend their ideal university due to various reasons. They may choose to repeat one year and take the exam again in the coming year, but this undoubtedly greatly increases the cost of study, so some people can only choose to go to a relatively poor school. Even worse, they may choose not to go to school.

As an important part of the college entrance examination, high level shares the same system and process with the college entrance examination enrollment. It is a school admission mechanism problem, and it is also a problem of matching between candidates and enrollment units. This article attempts to find some simple and effective methods to reduce the emergence of extreme situations like schools failing to recruit any

students. The author simulates a small matching by using DA mechanism, and tries to propose some simple adjustments to avoid extreme situations to a certain extent.

2. COMPARISON OF ENROLLMENT OF SPORTS SPECIALTY STUDENTS BETWEEN CHINA AND THE UNITED STATES

The author learned that, in the United States on the other side of the ocean, there are also separate admissions for college students with specialties in sports. The American society generally believes that most people with strong athletic ability have a sufficient sense of collective honor, cooperation ability and leadership, and their personalities are more tenacious and strong in resisting pressure. Therefore, compared with China, there are more students in the United States who are willing to enter universities through sports specialties.

For those students who want to enter a prestigious American school through sports expertise, the university admissions officer will carefully review every extracurricular activity record that the student fill out on

the public application platform. Regarding sports activities, questions such as which sports activities the student have participated in, how much they have engaged in, whether they are core players, whether they have achieved any competition achievements, the length of weekly training and the length of the annual season are all key issues. However, the enrollment of Chinese colleges and universities is not detailed enough. It just depends on whether the best grades achieved by students in high school meet the requirements. In the matching between schools and students, American schools have a clearer and more comprehensive understanding of students, ultimately making the matching results satisfy more schools and students.

3. OVERVIEW OF SCHOOL ENROLLMENT MODEL UNDER BILATERAL MATCHING THEORY

3.1 Introduction of course allocation model

As a new branch of economics, matching theory was first proposed by two Americans mathematicians D. Gale and L. S. Shapley (1962) and cited in the university admissions and marriage matching problem[1]. It is a systematic study of the market matching function. Such as workers and enterprises, schools and students, where "bilateral" means that the participants in the market always belong to only one of two disjoint sets, and "matching" refers to the nature of bilateral exchanges in the market, that is, their respective "sensitive sexual preference list".

The two typical algorithms (Boston mechanism, SOSM) in school choice problem matching theory are the two most common volunteer filling mechanisms - volunteer priority and parallel volunteer modeling. Between 1999 and 2005, the voluntary priority mechanism has been adopted in the enrollment of Boston public schools. However, since then, several economists in the field of matching theory, abdulkadiroglu, pathak, Roth, Ergin, sonmez, Chen, etc., have explained the serious defects of the Boston mechanism from the perspectives of mathematical derivation and empirical analysis, helping Thomas payzant successfully persuade the Boston School Committee to replace the voluntary priority mechanism with parallel voluntary. China's college entrance examination enrollment also adopted voluntary priority before 2008, and then changed to parallel voluntary. I believe it also has the influence of matching theory. Generally speaking, the voluntary priority mechanism will bring no small loss of social efficiency and well-being, which can be avoided by parallel volunteering. So far, economists are still studying the advantages and disadvantages of various school selection mechanisms under different backgrounds, so

as to contribute to the fairness and efficiency of enrollment.

3.2 Establishment of research model

The characteristic of China's college entrance examination enrollment system is that the whole process is completely dominated by the state. Candidates participate in the examination uniformly held by the state, and then evaluate and fill in their volunteers. If they meet the score line of the colleges and universities reported in advance batch or the first volunteer, their examination files will be read and reviewed by the schools to be admitted and then admitted; if unfortunately, the candidates do not meet the required scores, they will continue to enter the adjustment process organized by the state according to their reported parallel application. If colleges of their reported parallel applications still have enrollment places, enrollment will be completed, and vice versa. The national admissions agency will always organize the matching between students and colleges throughout the college entrance examination process. According to the bilateral matching theory, the college entrance examination is a centralized market and belongs to a single unified admission mechanism. The enrollment of high-level sports teams is one of the early batches. Once dropped, they will often not be admitted to any school because most of the students' cultural achievements are relatively weak compared to other students. Chen Xiu (2021) also put forward the problems of recruiting channels and the lack of effective communication between colleges and universities in the problems and countermeasures of high-level sports teams in colleges and universities[2].

After Gale and Shapely proposed the "Gale-Shapely mechanism" based on the marriage problem, they continued to extend it to the field of school enrollment, designing a university enrollment model under the "GS mechanism", and then based on the mechanism, three other matching algorithms derived from this field are the optimal trading cycle mechanism, the Boston mechanism and the score dictatorship mechanism. Under the framework of bilateral matching theory, the problem of university enrollment can be regarded as an optimal mechanism that seeks to meet the conditions of fairness, no waste, and Pareto optimality. The basic model can be expressed in the following form:

Suppose there are two groups of students and school, denoted by S and U respectively, student set S=S1, S2, S3..., school set U=U1, U2, U3...

Definition 1: The number of people admitted to each school is not more than the number of places admitted.

Definition 2: Under the whole mechanism, the ranking of each student's school preference corresponds to the school matching result one-to-one.

Definition 3: The matching process μ is fair. For any two students S1 and S2, if the preference of S1 is lower than that of the school that admitted S2, the school that admitted S2 must have a higher evaluation of S2 than S1.

Based on the above settings, the optimal university admissions model satisfies the following conditions:

Condition 1: There is no waste in the matching process μ.

Condition 2: Every student is rational in the matching process μ.

Condition 3: The matching process μ is stable.

Condition 4: The operation of the entire mechanism is strategy-proof.

Condition 5: The matching process μ Pareto is optimal, and there is no other matching process that can be used for Pareto improvement.

4. EXISTING STUDENT-SCHOOL BILATERAL MATCHING

4.1. Admission Process[3]

1. College entrance examination registration: refer to the specific registration process of each province and city for registration.

2. Announcement of Admissions Guidelines for High-level Sports Teams: Various colleges and universities have announced the admissions guidelines one after another.

3. High-level sports team registration: students register according to the enrollment guidelines issued by each college and submit relevant materials.

4. High-level sports team qualification review: Each college will review the information provided by students who sign up for the test.

5. Special test: Special test is conducted in the form of national unified examination or university examination.

6. Publicize the qualified list: generally publicize on the official website of the institution or other official websites.

7. Take the National College Entrance Examination

8. Confirm the institution to be admitted: Candidates who have passed the special test and whose scores in cultural courses have also reached the institution's admission discount points need to sign the proposed admission agreement or the proposed admission confirmation form with the institution.

9. Volunteer

10. Receipt of Admission Notice

4.2. The entry conditions for high-level sports teams[4]

Only those who meet the registration conditions specified in the annual enrollment work of ordinary colleges and universities and meet one of the following conditions can apply for examination: (1) those who graduate from senior secondary education school, obtain the national level II athlete certificate or above, and obtain the top 6 main players in collective events or the top 3 in individual events in competitions at or above the provincial level in senior high school; (2) Having the same educational level as graduating from senior secondary education, obtaining the certificate of national first-class athlete (including) or above, or the top 8 main players in national (or international) collective events in recent three years.

4.3. College entrance examination matching model under DA mechanism

Matching stage is from the moment the school announces the qualified list (Process 6) to the moment the students received Admission Notice (Process 10). The matching mechanism of the current college entrance examination is the PA mechanism, but because the matching mechanism of high-level sports team enrollment is much simpler than the matching mechanism of the college entrance examination, the DA mechanism can be used for matching.

Now design a set of matches. Some students went to the school they wanted to go to and took the test. After the students took the test, the school gave a qualified list, that is, the school's preference for students.

U1-S1, S2, S3, S4, S5

U2-S1, S2, S6

U3-S3, S4, S7

Table 1. School's preference for students

School/preference	1	2	3	4	5
U1	S1	S2	S3	S4	S5
U2	S1	S2	S6		
U3	S3	S4	S7		

In the qualified list, for example, the two most preferred students of university U1 are S1 and S2, because they have achieved better results in the school's test, thus they only need to get a lower score B to be admitted to the school, while other students (such as students S3, S4, S5 in the qualified list of the university U1) need to get a higher score A in the college entrance examination before they can be admitted by the school.

After each school publishes the qualified list, students will know which schools they have passed, and then students will give their preferences for these schools These students who enrolled through the high-water sports team often fill in fewer applications, because they often only appear in the qualified list of a few universities. In the author's model, each student has only one or two preferences. (When student S3 fills in his volunteer, S3 prefers U1 to U2, but in the qualified list of U1, S3 ranks lower, and he has to need to get a higher college entrance examination score A to be admitted by U1. But in the qualified list of U2, S3 is ranked higher, he only needs to get a lower college entrance examination score B to be admitted by U2).

Remark：scoreA > scoreB

Student's volunteer filling (student preference for school)

S1-U1

S2-U1

S3-U1,U3

S4-U3

S5-U1

S6-U2

S7-U3

Table 2. Student's volunteer filling

Preference/ student	S1	S2	S3	S4	S5	S6	S7
1	U1	U1	U1	U3	U1	U2	U3
2			U3				

S3 did not meet the U1 requirements of the college entrance examination score A, reached the U3 requirements of the college entrance examination score B, so was U3 admission.

S6 did not meet the U2 requirements of the college entrance examination score A, so fell into the list.

S7 did not meet the U3 requirements of the college entrance examination score A, so fell into the list.

So final admission result is：

U1-S1,S2,S5

U2-U2

U3-S3,S4

S6-S6

S7-S7

Table 3. Final admission result

	S1	S2	S3	S4	S5	S6	S7
U1	Matched	Matched			Matched		
U2							
U3			Matched	Matched			

At this time, it was found that the U2 did not match with any students, because some students chose other schools, some did not meet the required college entrance examination score, therefore, the extreme situation appeared.

4.4. Two plans for improvement

To reduce the occurrence of extreme situations, the author will provide two plans.

Plan 1: Make more qualified high school students attend the college entrance examination.

Plan 2: Provide an alternate list to meet the requirements of the college entrance examination scores.

After giving the college entrance examination preferential treatment, all the students now meet the college entrance examination score requirements.

The school's preference for students is still：

U1-S1,S2,S3,S4,S5

U2-S1,S2,S6

U3-S3,S4,S7

Table 4. School's preference for students

School/preference	1	2	3	4	5
U1	S1	S2	S3	S4	S5
U2	S1	S2	S6		
U3	S3	S4	S7		

The student's preference for the school is still：

S1-U1

S2-U1

S3-U1,U3

S4-U3

S5-U1

S6-U2

S7-U3

Table 5. Student's preference for the school

Preference/student	S1	S2	S3	S4	S5	S6	S7
1	U1	U1	U1	U3	U1	U2	U3
2			U3				

The match result is now:

U1-S1, S2, S3, S5

U2-S6

U3-S4, S7

Table 6. Match result

	S1	S2	S3	S4	S5	S6	S7
U1	Matched	Matched	Matched		Matched		
U2						Matched	
U3				Matched			Matched

It can be found that more of the qualified students obtained better matching results relative to the previous ones, and U2 also avoids the extreme situation of not being able to recruit students.

Plan 2: Provide an alternate list to meet the requirements of the college entrance examination scores in the alternate list

Table 7. Alternate list for U2

School/preference	1	2	3	4	5
U2	S8	S9	S10	S11	S12

For students who have participated in the U2 test but are not on the qualified list, U2 also publishes an alternative list (the test scores of students on the alternative list are worse than those on the qualified list, but the school believes that the utility of recruiting the alternative list is greater than that of not recruiting students, so U2 is listed on the alternative list according to the test scores of these students), Students S8 and S9 met the corresponding college entrance examination scores, and their first volunteer was U2, so U2 accepted S8 and S9.

5. CONCLUSION

Different requirements for students in different schools will affect the school's choice of Plan 1 and Plan 2. If the school attaches more attention to students' physical ability compared to the college entrance examination score, it can choose plan 1; because after the changes are made, more enrolled students are on the qualified list, and their sports performance is better than students outside the qualified list; on the contrary, if the school does not care so much about the student's sports performance, it is more concerned than plan 1 students' cultural achievements, and it can choose plan 2 .

Improvements to both programs have helped schools and students have more matches, but both have sacrificed the interests of some schools, with Plan 1 matching by lowering students' college entrance exam scores and Plan 2 matching by lowering student test scores. In reality, some schools may not adopt either plan, and schools may be reluctant to reduce the requirements for student enrollment by enrolling more students. Other schools are reluctant to adopt these programs, and perhaps one student who was originally admitted to the school chose to go to another school because another school lowered the admission requirements. Of course he got a better offer for the student, but for the school, because the student went to another school, the school enrolled one less student.the enrollment of sports specialty students is very imperfect, and there are many areas worthy of improvement by relevant departments.In his article "changes and Reflection on the enrollment system of high-level athletes in Colleges and universities", Hao Xinghua puts forward some methods in his article "changes and Reflection on the enrollment system of high-level athletes in Colleges and universities"to solve the shortcomings in the current enrollment system of high-level athletes[5]. The Ministry of education has made specific requirements for the enrollment of high-level sports teams in Colleges and universities[6]. Firstly, the article clarifies the orientation of the pilot work. Secondly, it refines the sports team enrollment methods. Thirdly, the essay strengthens the qualification examination and testing. Finally, the article improves the admission requirements of cultural courses.

REFERENCES

[1] Gale D and Shapely L.S. College Admissions and the stability of marriage [J]. American Mathematical Monthly，1962，（69）.

[2] Chen Xiu. Problems and countermeasures of high-level sports teams in colleges and universities[J]. Forestry Teaching, 2021(10): 91-94.

[3] How to recruit high-level sports teams? [J] . examination and enrollment, 2019 (z1): 44

What are the entry conditions for high-level sports teams? [J] . examination and enrollment, 2019 (z1): 43-44.

[5] Hao Xinghua. Changes and Reflection on the enrollment system of high-level athletes in Colleges and universities [D]. Xiamen University, 2019.

[6] Huo Yongfeng. How does the state stipulate the enrollment of high-level sports teams in Colleges and universities? [J]. examination and enrollment, 2021 (03): 63.