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Analysis on the Mechanism of Chinese College Admission System

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Abstract: The college entrance examination has a history of more than fourty years in China. With the development of the society, the previous admission system has revealed more and more drawbacks, such as "high scores and low admission" which means the students who got the high score was not into the high reference college. Also, some schools are not full. In order to continue to exploring the entrance exam's admission mechanisms. First, it describes the operation mechanism of the existing admission methods and analyzes the advantages and disadvantages, and then puts forward an application of foreign deferred acceptance (DA) algorithms to the college entrance examination and analyzing the advantages and disadvantages. The paper conducts a questionnaire to investigate the satisfaction of students and parents with the previous admission system and some privileges, and analyses the results of these data. In addition to this, the paper uses an example about Inner Mongolia's university admission mechanisms and some drawback of this. Finally, this paper clarifies that the DA algorithm cannot be applied to the college entrance examination admission mechanism because of the large number of candidates and provinces in China.

Keywords: application of algorithms, reference mechanism, fair competition

1. Introduction

The gaokao, China's university entrance examination, is the first way and means of selecting talents on a large scale in China; it is an important tool for promoting class mobility within China; and it has also accumulated important intellectual support for national development. The college entrance examination has a history of more than sixty years until today. It must have a rigorous admission system as the most important examination in the life of a Chinese student. However, as time goes by, there have been numerous cases of students failing to get into their ideal schools because of the flaws in the admissions system of the gaokao. There are also cases of people taking advantage of regional differences to migrate to the college entrance examination (the admission scores of each province in China are not the same due to various factors, and some candidates from regions with high admission scores go to low-scoring provinces before the college entrance examination to take the examination in order to seek lower admission scores) [1], which not only violates the original intention of the

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college entrance examination, but also affects the fairness of the college entrance examination, seriously threatening the fairness of China's social resources and talents [2]. These not only violate the original intention of the college entrance examination but also affect the fairness of the college entrance examination, which seriously threatens the fairness of China's social resources and the sustainable development of talents. With the development and improvement of society, the old system needs to be constantly improved and updated. In previous studies, some scholars have proposed the gradient volunteer and parallel volunteer which are currently being implemented. These two admission methods can to a certain extent to solve the shortcomings of the old system, such as do not know the score of the risk of blindly choosing a school, and according to the number of people in each province and the different educational resources using different test papers and to give some special students appropriate extra points to maintain the fairness of the results of the admission. These measures are based on China's national conditions to develop, can efficiently solve the problems in China. Although parallel volunteering has been implemented for many years, there are still many students and parents who suggest that this admission method is not the best solution. This paper proposes a hypothesis to apply the Deferred Acceptance (DA) algorithm to the admission of China's college entrance examination.

The paper shows how the DA algorithm works in China's college entrance examination and the improvements it brings to college entrance examination admission, such as the reduction of the number of sliding grades and the fairness of the overall admission. Finally, this article clarifies the operation of applying DA algorithm to college entrance examination admission, analyzes the difference between DA algorithm and China's national conditions, and the reasons why this mechanism has not been adopted by the predecessors. In addition, the article also puts forward some effective suggestions for the reform of the college entrance examination through questionnaires.

2. Mechanisms Applicable to College Admission

2.1. Sequential Mechanism

The sequential mechanism works in two rounds. In the first round, all students' first choices are retrieved. Each school admits students in descending order based on their high school entrance exam scores. Students who are not admitted and schools that do not complete all enrollments move on to the next round. In the second round, students who were not admitted at the end of the first round and schools that did not complete their full enrollment are retrieved. For schools that have not yet completed their full enrollment, all students who applied to the school on their second choice will be admitted in descending order according to their scores on the college entrance examination until the school has used up all of its enrollment quotas or until all of the students who applied to the school on their second choice have been admitted. Students who have not been admitted and schools that have not completed the full enrollment proceed to the next round of admission, and so on [3,4].

This mechanism is highly efficient, and allows universities to have different preference list. However, the sequential mechanism has several irrefutable disadvantages. First, this mechanism is not Pareto efficient, for there might be pairwise blockings; it can cause wastes of social resources. To be more specific, the student who applies later may be better than the one before him or her but the school cannot give up the previous choice. Second, as someone change his or her preference list according to the information, the whole process is manipulated.

2.2. Parallel Mechanism

The student is assumed having x preferences and these preferences are listed from highest to lowest. The system prioritizes the first preference of the student with the highest score, then the first preference of the student with the second highest score, and so on. Once the first preference is

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retrieved for all students, the second preference is considered based on the student's score until the x^{th} preference [3,5].

This mechanism is more stable than the sequential mechanism, because its possibility of making mistakes is greatly reduced. Also, it is more efficient than the DA algorithm, since most students can finish choosing schools in a satisfying condition; it effectively takes advantage of social resources.

However, there are still problems. After experimenting the examples with less options, the study shows that there are still accidents for better students to fail entering universities. Besides, score is the only factor for schools [6].

2.3. Deferred Acceptance (DA) Algorithm

In DA algorithm, both students and schools are allowed to have preference list, and can rank the opposite side in multi-factors. The mechanism begins with students making proposals to their top ranked schools, then the schools will tentatively hold the highest students (no more than the maximum number schools can obtain) using their preference list. Those students who get rejected will give proposal to their second top ranked school and schools will reconsider them with the student they tentatively hold to refresh the decision list. The mechanism stops when no student is making new proposals.

Different from the former two mechanism, DA algorithm can lead to a stable [7] and strategy-proof [8] result. For students, reporting the preferences truthfully is the only way to get to the ideal outcome. Additionally, there is no individual blockings and pairwise blockings, so the possibility of a high-caliber student attending a low-caliber school that does not match him is negligible. Unlike the existing mechanism used in China, which only ranks students using the score of gaokao, through DA algorithm, schools can have their own preference list and form a unique way of assessment, examples of GPA or competition. Then the schools can evaluate the various aspects to make a comprehensive understanding of the level of students.

If DA algorithm got so many pros, why it is not applying to the whole world education entrance system? There are some prominent disadvantages. When applying to the countries with large population base, it becomes hard for schools to make a comprehensive report of the characteristic of student, not like countries the UK or the US, other aspects of students been considered by school to make a clear acknowledge about the student, for examples of the GPA, academic competition or non-curriculum experience, or even using the mean of personal statement, due to the overpopulation and the variety in the way of assessing student among the different provinces, it becomes extremely tough and time-consuming for schools to review each student and give a preference list, which means it will be difficult for them to choose the student to tentatively hold. Moreover, when school changes to rank students on multi-factors, this could lead to a non-transparent operating process, unlike using the score to assess, there is not even an explicit criterion, schools have different preferences for student characteristics, then it becomes hard to define match quality. At the same time, the non-public standard of ranking makes it easy for schools to manipulate and further lead to unfairness of the entrance, for instance, student with poor performance can go to a top university due to the family relationship or donation of large amount of money, while everyone but school and student knows about the uneven matching [3,9].

2.4. Special Mechanism Used in Inner Mongolia

At the same time, when reviewing the China college admission system, there is a province called "Inner Mongolia", whom applies a new way of entrance, which is Real-time Interactive Mechanism (RIM). The completeness of the filling in information makes the public thinking this is the new mechanism to replace the parallel mechanism. More specifically, students are accessed to their current

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ranking in one and only one school that they want to apply for, and adjust according to its maximum enrollment number, decide to switch or not to another school (Students can only stay in one school waiting list). In this process, it may occur that though the student ranked at 35th when there is only 30 seats, he will still stay in the list, since those ahead of him may choose to go to a better school, but at the same time, he should be wary of students better than him entering the queue and coming in front of him. When getting closer to the deadline, student who is outside the enrollment number needs to react quickly to move to his next preferable school.

In this special mechanism, students can have a clear understanding of their performance, and making changes to the school and major with the help of transparent open mechanism, consequently, this can connect students with the most suitable schools. Therefore, why this is not using in the remaining part of China, the answer to this is the workload is too huge for the real-time update of the system, some network problem may affect the normal operation of the system. At the same time, there may be manipulation, for instance. Wealthy student A can bribe other high caliber students to first assign to the school which A plans to go, then the remaining students in the waiting list are been lowered in the ranking and quit the queue since they are thinking it is difficult for them to apply the school successfully. Subsequently, just before the time is up, those students get bribed suddenly leave the waiting list of the school, therefore A is getting into his dream school though his level does not match with it [10].

3. Questionnaire Design

To have more comprehensive evaluation from more people to get their opinion towards different kinds of mechanisms, a questionnaire is designed and collected to make further investigations.

The first set of the questionnaire (Table 1) is mainly about the knowledge and understanding of the human subjects and also their comments about the reform of the Chinese college admission system. This set is aimed to see if the parallel mechanism used at present is effective enough for Chinese high school students and its popularity. Thus, it is apparent to see if a thorough revolution is needed. Also, the 4th question can reflect the importance of reducing the possibility of "get in by the back door", thus help decide the necessary of conducting a strict censorship. This study targets students who need to take or have already taken the college entrance examination and their parents.

Table 1: Satisfaction on Current Chinese College Admission System.

Questions	Contents	Aim
Q1	Satisfaction on Allocation Outcome	Effectiveness of Parallel Mechanism
Q2	Support of a Complete Reform	Need for a Thorough Revolution towards the DA Algorithm
Q3	Mastery of Basic Skills	Popularity of Parallel Mechanism
Q4	Frequency of "cheating"	Necessary of Conducting a Strict Censorship

Addition to the general question been asked in the formal part, the questionnaire (Table 2) also contains content about the special case of the mechanism used in Inner Mongolia, and planning to know what are the attitudes towards the differed mechanism used in China.

Table 2: The attitude towards the Real-time Interactive Mechanism.

Questions	Contents	Aim

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Table 2: (continued).

Q1 (for those who are using the mechanism in Inner Mongolia)	Scoring the existing mechanism and willingness to switch	The necessity and satisfaction on reforming the mechanism
Q2 (for those who are using the mechanism in the main land of China)	Scoring the existing mechanism and willingness to switch	
Q3	The main hinder of both the parallel mechanism and the Real-time Interactive Mechanism	Hints for the further improvement of the mechanisms

4. Data Analysis

4.1. Data Analysis on Current Parallel Mechanism

In total, 217 questionnaire results from students and 136 questionnaire results from parents were collected. By calculating the percentage, the study shows that approximately 70% students and parents are satisfied with the parallel mechanism, as shown in Figure 1; 96% of them prefer not forming a revolution, as shown in Figure 2.

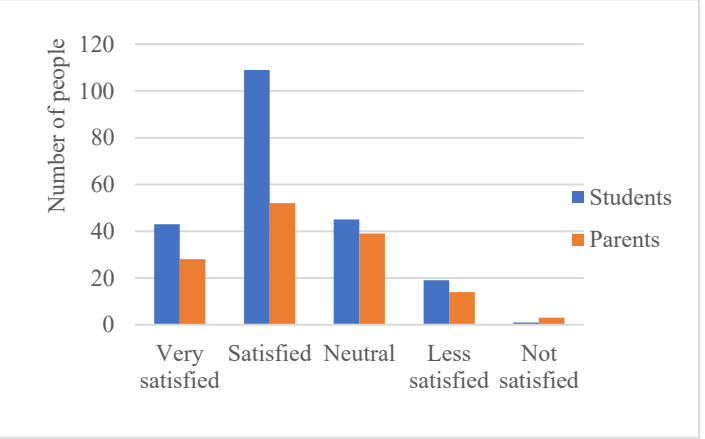

Figure 1: Satisfaction on Allocation Outcome.

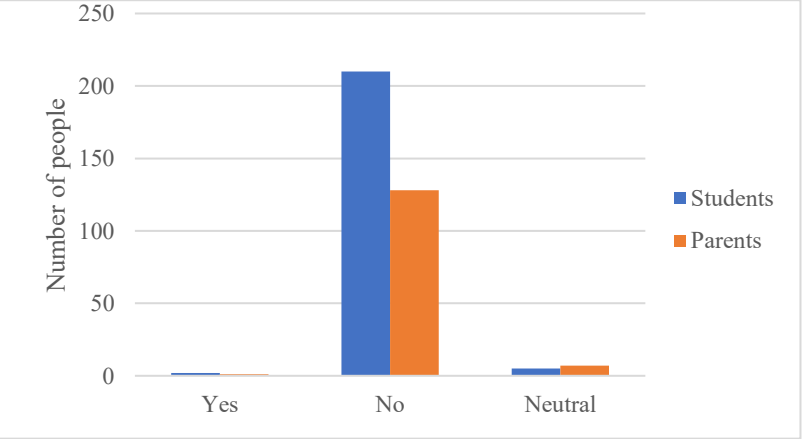

Figure 2: Support of a Complete Reform.

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Most of the students and parents know skills to fill in the preference list, but there are still a lot of people who are unfamiliar with it according to Figure 3. Besides, nearly 80% students and parents view the frequency of "cheating through the mechanism" serious displayed in Figure 4; moreover, compared to the students' data, parents' tend to be more scattered.

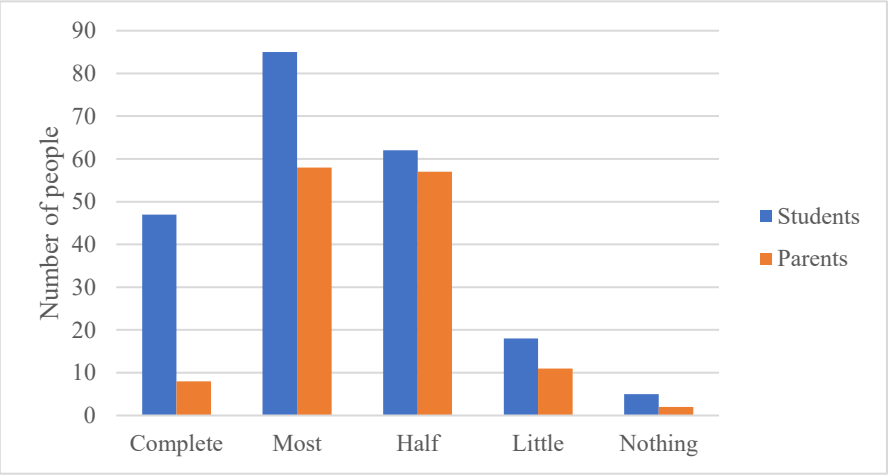

Figure 3: Mastery of Basic Skills.

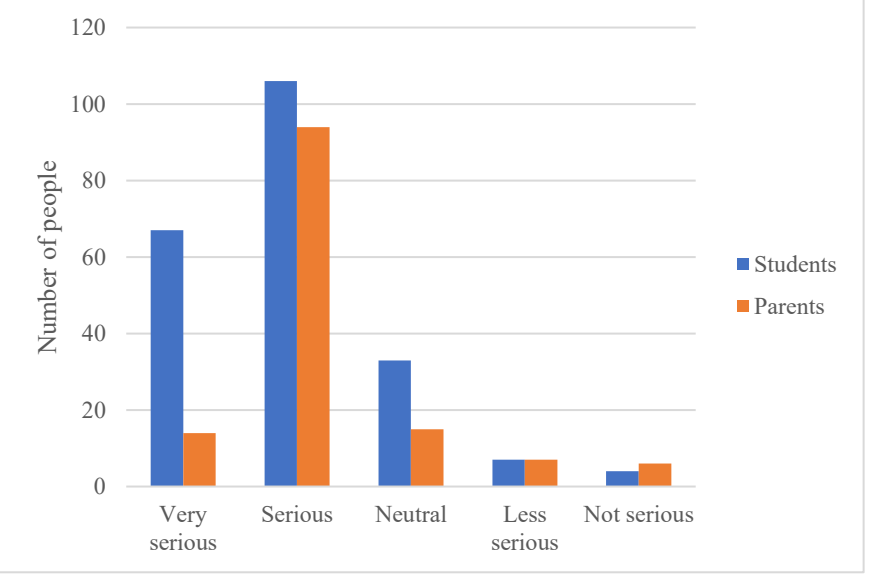

Figure 4: Frequency of "cheating".

Summarizing the findings from the figures, the present parallel mechanism is useful enough but just needed a little improvement, which means it is not suitable for the Chinese College Admission System to reform the whole process into DA algorithm.

There could be several reasons for this. First, a revolution from the sequential mechanism towards the current one has already cost a long time adapted, so students and parents are tired to adjust to another new one. Second, since in China, score is still a determining factor, mechanisms containing various university preference lists like the DA algorithm are not so effective, but policies for considering various factors play essential roles.

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4.2. Data Analysis on the Special Case of Inner Mongolia

In this additional questionnaire, 131 questionnaires are been collected from students and 84 questionnaires from parents, who is or whose child is experiencing the college admission system using the parallel mechanism. At the same time, there are also 60 questionnaires from students and 56 from parents, who is or whose child is experiencing the college admission system using the RIM.

By comparing the both diagram of the separation of the satisfaction on parallel mechanism-which is demonstrated by Figure 5. The study shows that most of the parents and students give score higher than 3, means they are quite or strongly satisfied with the existing parallel mechanism and only around 10% of people stated that they are unhappy with the mechanism. According to the willingness to switch to RIM, almost all the parents are refusing to do the change, and approximately 80% of the students emphasize that it will be fine for them to stay with the parallel mechanism.

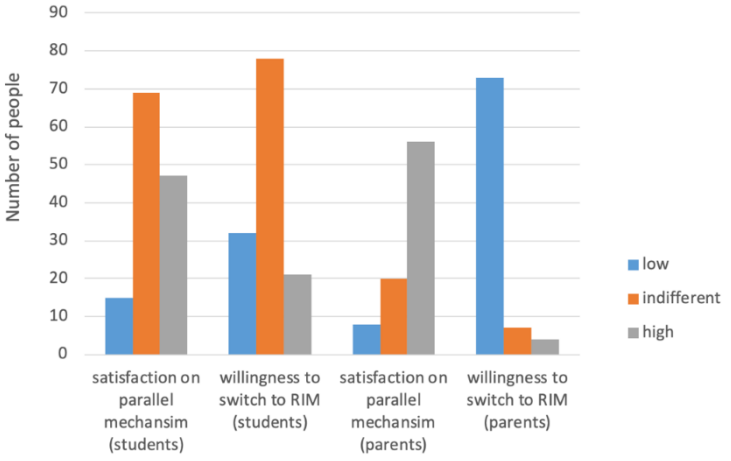

Figure 5: Findings on parallel mechanism.

Focusing on the RIM with the data in Figure 6, parents in Inner Mongolia shows a mixed view of the performance of the RIM and desiring to switch to the parallel mechanism, while there are still half of the parents who are indifferent in the switch. The number of students giving higher score to the RIM diminished as the level of satisfaction gets higher, and at the same time, they also want a reform.

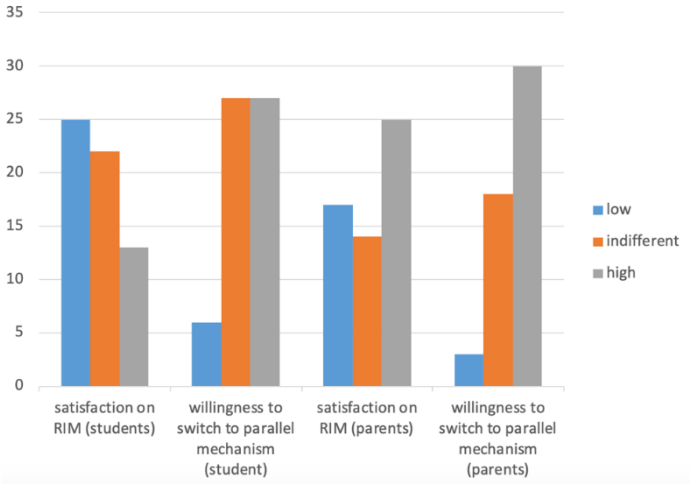

Figure 6: Findings on RIM.

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Summarizing the figures, the overall comments on the parallel mechanism is poorer than the RIM, though there are advantages for the RIM, such that it is straight-forward to see the ranking and the likelihood of applying to the colleges, the risk and the uncertainty also exists, students in Inner Mongolia need to evaluate the possibility of falling to the next round; this could be the reason why they are desiring to switch to the parallel mechanism.

5. Conclusion

In order to solve the unfair situation caused by the loopholes and problems in the voluntary reporting system of the Chinese college entrance examination, in the article, the comparison between several different mechanisms that can be applied to the system are made through questionnaire surveys and further develop base on existing relevant literature by comparing pros and cons that occur under the mechanism and the effectiveness of pairing results obtained under these mechanisms. Through the analysis process, it has been proved that parallel mechanism which is currently adopted by the system is most suitable for the system but in order to provide a fairer result for all students and enables them to enter a school they like and are able to match, some improvements have to be made. Since the Chinese college entrance examination is an important exam that determines the fate of many students, it is very valuable and meaningful to analyze the known problems and try to adjust them. This is also the research conducted in this article which is the embodiment of the importance of innovation.

Due to China's excessive population, by analyzing the establishment conditions and the number of matching steps of different mechanisms, some mechanisms (such as DA algorithm), that can lead to better results in ideal state have been eliminated because the uncertainty is too high and the steps are complicated which is so time consuming. Therefore, conclusion which is same as many experts gets the mechanism currently being used is the best one considering all factors. However, under the existing mechanism, many unfair situations such as get in by the back door, high scores and low admissions always occur from time to time. At the same time, only based on the grades to decide whether to admit a student or not also leads to the neglect of students' other abilities. The results of the questionnaire also show that many students who need to take the college entrance examination have already found the existing problems in current mechanism and hope to make some changes. Therefore, the analysis of the article finally concluded that the framework of the original mechanism should be maintained, but some changes should be made appropriately. Firstly, increase the monitor system for students who enjoy preferential policies such as extra points for the college entrance examination. This is for strictly eliminate the phenomenon of getting in by backdoors. Secondly, require universities to add students' physical and artistic abilities as scoring criteria.

In order to further prevent the unfair situation of using preferential policies to cheat, the government should increase the review mechanism for students who enjoy preferential policies to determine whether they meet the requirements for enjoying preferential policies, such as verifying their family income, make sure they really study in areas with poor educational resources instead of only transferring to school in these regions when the college entrance examination is approaching aims to enjoy the policies. In this way, it is guaranteed that those who can finally enjoy the preferential policies are the students who are really in need of help. In addition, in order to protect students' multi-faceted abilities except for academic performance, the Education Bureau can further promote the spread of education of art and sports, and take art and sports scores into the college entrance examination scores at a certain proportion.

However, it can be seen that the number of samples sampled is too small which is not enough and this may lead to inaccurate results of analysis. At the same time, the questionnaire only focused on the thoughts and attitudes of college entrance examination candidates towards the voluntary system for the college entrance examination, but ignored the satisfaction of students who have already taken the college entrance examination and entered the university with the schools assigned to them by the

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voluntary system. Therefore, if there is an opportunity to do follow-up research, continuous tracking of the satisfaction of college entrance examination students is also necessary. At the same time, the implementation difficulties of the reform policy and economic loss are also realistic limiting factors that prevent the reform from being continuously promoted. Since the college entrance examination is a national exam and there are too many participants, the reform system to be fully rolled out is actually very cumbersome and it is easy to cause different regions to form temporary different systems and mechanisms due to different reform progress, which will lead to more serious regional inequality. It will further affect fairness and the popularity of the government. Therefore, policies can be carried out in different regions first, and relevant departments should communicate with each other to make improvement and adjustment on the plan based on people's acceptance and the speed of reform.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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