The Establishment and Analysis of the Evaluation System of Target Students' Subdivision Group in Colleges and Universities Based on Ideal Point Algorithm

Xin Zhao[1(✉)], Wei Guo[2], Yongli Lu[3], and Tao Guo[4]

[1] Dean's Office Undergraduate Admissions Office, University of Electronic Science and Technology of China, Chengdu, China
zx@uestc.edu.cn

[2] School of Information & Communication Engineering, University of Electronic Science and Technology of China, Chengdu, China
gw@uestc.edu.cn

[3] Education Center of International Studies, University of Electronic Science and Technology of China, Chengdu, China

[4] Smart Infrastructure, Siemens Ltd., China, Chengdu, China

Abstract. Aiming at the problem of target student source segmentation in Colleges and universities, this paper establishes a segmentation group evaluation system, selects candidate segmentation groups through comparative analysis, and uses ideal point algorithm to get the best segmentation group. Through the analysis, the established evaluation system of target student source subdivision group in Colleges and universities can do a good feasibility study on the selection decision of target student source group in Colleges and universities. The conclusion of the article has wide applicability, can guide colleges and universities to carry out enrollment publicity scientifically and reasonably, and is conducive to further optimizing the structure of student sources.

Keywords: College enrollment · ideal point · comparative analysis

1 Criteria for Evaluating Target Student Source Sub Groups

With the continuous deepening of the comprehensive reform of the college entrance examination, the competition of college students has become increasingly fierce. In order to ensure the quality of students and optimize the structure of students, college enrollment publicity has gradually become the core part of enrollment work. The core content of enrollment publicity is the selection of target students. The target student source group is the group that colleges and universities expect and have the ability to occupy and develop, which can bring the greatest publicity opportunities and the greatest effects for the optimization of the college student source structure. It has roughly similar needs. Colleges and universities have decided to meet their needs with corresponding

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training models and enrollment policies, and can transform the filled student source group. When selecting the target students, we must scientifically and reasonably evaluate the subdivided groups based on the subdivision of the target students. Universities must consider three factors when evaluating the sub groups:

- It has a certain scale and development potential. Colleges and universities must first collect and analyze the academic level and quality of the subdivided groups, their attention to colleges and universities, and their willingness to apply for the examination, especially the groups with appropriate scale and potential to apply for the examination. However, an appropriate scale and potential for taking the examination are relative quantities. A subdivision group with a large number of students, high academic quality and great potential for applying for the examination is certainly attractive, but such a subdivision group is not the most suitable for every university.
- The attraction of segmented group structure. The subdivided group has the ideal scale and willingness to apply for the examination, but it may lack attraction in terms of potential for applying for the examination. Colleges and universities must clearly observe several important structural factors that affect the long-term attractiveness of subdivided groups. In this regard, we can learn from Porter's theory in marketing and summarize the factors affecting the subdivided groups as: existing competitive colleges, potential competitive colleges, alternative colleges, students and middle schools, and may lead to 5 threats: Firstly, the threat of fierce competition among universities in sub groups [1]. Existing competitors refer to the existing competitive universities in the sub group. If these competitive universities are numerous, powerful or have a strong sense of competition, then the sub group is in a stable or declining stage. In order to attract students, universities must pay too high human costs or excessive policy preferences, which makes the sub group lose its attractiveness. Secondly, the threat of potential competition from universities. If a certain segment group may attract new competitive universities to participate in it, these new competitive universities will increase the input of human and resources and compete for the share of students, then the segment group will lose its attraction. The key is whether potential competitive universities can easily enter this segment. If potential competitive universities enter this segment, they will encounter severe barriers, and face greater policy responses from the original universities in the segment, so it will be difficult for them to enter. The lower the barriers to protecting the subdivision, the weaker the policy response of the universities that originally occupied the subdivision, and the less attractive this subdivision will be. Thirdly, replace the threat of universities. If there are alternative colleges or potential alternative colleges in a certain segment, this segment will lose its attraction. Alternative colleges will limit the improvement of the quality of students within the sub group. If the enrollment policies of these alternative universities are adjusted favorably or the competition is becoming increasingly fierce, the quality of the students of this sub group may decline. Fourthly, the threat to the "bargaining" power of student enrollment policies [2]. If the "bargaining power" of students in a certain sub group for the university enrollment policy is strong or is being strengthened, the sub group will not be attractive. Students try to get more enrollment policy preference from universities in the enrollment process, and put forward higher requirements for the quality of talent training and enrollment majors,

resulting in malicious competition among universities, which will pose a great threat to university enrollment. Lastly, the threat of "bargaining" ability in middle school [3]. If the supplier of colleges and universities, middle schools, put forward higher requirements for colleges and universities in the process of enrollment publicity, or the quality of recommended students has been reduced, or the number of recommended students has been reduced, then this segment will lose its appeal.

- The subdivision group cannot be too large or too small [4]. When evaluating whether the subdivided groups have entry value, we must see whether they have a certain scale and demand, which can enable colleges and universities to obtain more high-quality students, so as to achieve the goal of optimizing the structure of student sources. Therefore, the scale of subdivided groups should not be too large or too small. If the number of subdivided groups of students is too large, colleges and universities can not "digest", and colleges and universities can not effectively concentrate their propaganda efforts and carry out maintenance work, they will lose a large number of students; If the number of students in the subdivided group is too small, and colleges and universities "can't eat enough", and the existing enrollment publicity resources can't be used optimally, it is not conducive to colleges and universities to give play to their resource advantages, and will affect the optimization of the student source structure.

2 Establishment of Subdivision Group Evaluation System Based on Ideal Point Algorithm

When establishing the subdivision group evaluation system, the candidate subdivision groups for evaluation are first screened out through comparative analysis, and then the best scheme of the subdivision group is obtained through ideal point algorithm [5].

2.1 Determination of Candidate Sub Groups

When determining the candidate sub groups, the comparative analysis method can be used to comprehensively evaluate the student capacity, potential value, publicity cost and other indicators of the sub groups, so as to achieve the optimal student share with the lowest enrollment publicity cost and obtain the candidate sub groups. It can be divided into three steps, including collecting and sorting out the admission data of each sub group in the past three years, sorting out the main evaluation indicators of the sub group, sorting and comparative analysis. During the comparative analysis, the candidate sub population can be determined through 4 steps [6]:

- Calculate the evaluation index of each sub group. Suppose that there are m sub group decision-making schemes participating in the comparative analysis, and the set is $A_i(i = 1, 2, \cdots m)$. On the basis of collecting and sorting out the enrollment data of m sub groups in the past three years, the main evaluation indicators of the sub groups are sorted out. It is assumed that there are n evaluation indicators in total, and the set is $f_j(j = 1, 2, \cdots, n)$.
- The numbers of all sub groups are sorted according to the unexpected indicators.

- Analyze these sub groups paragraph by paragraph, and first select the top six sub groups in each index for comparative analysis.
- Use mathematical thinking to select subdivision groups. The total market is regarded as a set S, and each subdivision group is regarded as an element of this set, that is $Z = \{A_1, A_2, \cdots A_m\}$.

Z_1: Represents the top six sub groups in the first index f_1, namely $Z_1 = \{A_{f11}, A_{f12}, A_{f13}, A_{f14}, A_{f15}, A_{f16}\}$;

Z_2: Represents the top six sub groups in the second index f_2, namely $Z_2 = \{A_{f21}, A_{f22}, A_{f23}, A_{f24}, A_{f25}, A_{f26}\}$;

Z_3: Represents the top six sub groups in the third index f_3, namely $Z_3 = \{A_{f31}, A_{f32}, A_{f33}, A_{f34}, A_{f35}, A_{f36}\}$.

$Z_1 \cap Z_2 \cap Z_3$: It refers to those sub groups in which all indicators are ranked in the top six among all sub groups with single index ranking in the top six.$Z_1 \cap Z_2 \cap Z_3 = \{A_i, \cdots, A_j\}$, among$1 \leq i \leq m, 1 \leq j \leq m$, namely $A_i, \cdots, A_j$. All indicators of these sub groups rank in the top six, which is the candidate sub group that colleges and universities are going to enter.

$(Z_1 \cap Z_2) \cup (Z_2 \cap Z_3) \cup (Z_1 \cap Z_3) = \{A_l, \cdots, A_k\}$, among $1 \leq l \leq m, 1 \leq k \leq m$: It means that there are at least two sub groups whose indicators rank in the top six among the sub groups whose indicators rank in the top six. This means that besides $A_i, \cdots, A_j$, $A_l, \cdots, A_k$ has at least two indicators ranking in the top six, and these sub groups are also candidates for colleges and universities. Therefore, the candidate sub population is $\{A_i, \cdots, A_j, A_l, \cdots, A_k\}$.

2.2 Determination of the Best Subdivision Group Scheme

Ideal point method is an evaluation function algorithm, which is a multi-attribute decision-making algorithm that makes each target value approach its ideal (optimal) value as much as possible. Among them, the feature of multi-attribute decision-making is that there are a limited number of discrete schemes. Compared with multi-objective programming in operations research, it has the advantages of fewer iterations, convenience and use without considering constraints, and is widely used in the selection and evaluation of decision-making schemes [7].

Ideal point algorithm is an effective method to solve the problem when it is applied to the decision-making of target student group subdivision, target student source determination and enrollment publicity in college enrollment. After calculating the distance from the point represented by each candidate subdivision group scheme to the ideal point and the negative ideal point, it analyzes and compares them, so as to judge the advantages and disadvantages of various subdivision group schemes.

The ideal point algorithm is composed of three elements: In the comparative analysis, n evaluation indexes $f_j (j = 1, 2, \cdots, n)$ are established;m candidate sub group decision making schemes $A_i (i = 1, 2, \cdots m)$ are established in the comparative analysis; There is a decision matrix $D = (u_{ij})_{m \times n}$, where u_{ij} represents the index value of the j index f_j of the i subdivision group scheme A_i. After the decision matrix D is standardized, the

weighted operation is carried out, and then the schemes of each subdivision group are evaluated according to the operation results.

- Assign value to fuzzy student source index. In multi-indicator decision-making, many evaluation indicators of candidate student subdivision groups are fuzzy indicators, which can only be described qualitatively, for example, the quality of student sources is very good, the number of students is large, and the quality of middle school training is high. To apply the ideal point algorithm, first of all, the fuzzy indexes in the sub group evaluation of candidate students should be assigned and quantified. Generally speaking, the best value of the index can be assigned 10.0, and the worst value of the index can be assigned 0. Cost indicators can be set as: maximum 0.0, very high 1.0, high 3.0, general 5.0, low 7.0, very low 9.0, minimum 10.0.Generally speaking, when evaluating the candidate sub groups, the indicators can be selected from three aspects: the quality of students (including simulated examination results, matching degree of selected subjects, matching degree of target majors, etc.), the quality of middle schools (including the number of middle and high-level students, the score of target scores, the rate of reaching the line of the first book, the recommendation degree of middle schools, etc.) and the recognition degree of universities (including the contact frequency of universities, the regional attraction of universities, the industry attraction, etc.).
- Constructing standardized decision matrix. In multi-attribute decision-making, due to the different units, dimensions and orders of magnitude of each evaluation index, direct calculation cannot be carried out, otherwise decision-making errors will be caused. It must be processed first, that is, all evaluation indicators must be standardized, and all indicators in the decision matrix must be transformed into dimensionless and countless standardized values before calculation. The normalization process adopts the method of vector normalization, and it is assumed that:

$$\gamma_{ij} = \frac{u_{ij}}{\sqrt{\sum_{i=1}^{m\times n} u_{ij}^2}}$$

And the weight is considered according to the importance of each indicator. Assuming that the weight of n evaluation indicators is

$$W = (w_1, w_2, \cdots, w_n),$$

among $0 \le w_j \le 1, (j = 1, 2, \cdots, n)$; $\sum_{j=1}^{n} w_j = 1$, the standardized decision matrix is

$$V = (v_{ij})_{m\times n} = \begin{bmatrix} w_1\gamma_{11} & \cdots & w_j\gamma_{1j} & \cdots & w_j\gamma_{1n} \\ \vdots & & \vdots & & \vdots \\ w_1\gamma_{i1} & \cdots & w_j\gamma_{ij} & \cdots & w_j\gamma_{in} \\ \vdots & & \vdots & & \vdots \\ w_1\gamma_{m1} & \cdots & w_j\gamma_{mj} & \cdots & w_n\gamma_{mn} \end{bmatrix}$$

- Establish ideal point A^* and negative ideal point A^-.Let the utility function of each index be monotonically increasing or decreasing. Then the ideal point is defined as A^*, then

$$A^* = \left\{(\max v_{ij}|j \in J^*), (\min v_{ij}|j \in J^-)|i = 1, 2, \cdots, m\right\}$$
$$= (v_1^*, v_2^*, \cdots, v_n^*)$$

  Then the negative ideal point is defined as A^-, then

$$A^- = \left\{(\min v_{ij}|j \in J^*), (\max v_{ij}|j \in J^-)|i = 1, 2, \cdots, m\right\}$$
$$= (v_1^-, v_2^-, \cdots, v_n^-)$$

  among, $J^* = \{\text{Benefit index set}\}$, $J^- = \{\text{Cost indicator set}\}$
- Judge the advantages and disadvantages of each sub group scheme. Let the distance from each subdivision group scheme A_i to the ideal point A^* be S_i^* and the distance to the negative ideal point A^- be S_i^-, then

$$S_i^* = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^*)^2}(i = 1, 2, \cdots, m)$$
$$S_i^- = \sqrt{\sum_{j=1}^{n}(v_{ij} - v_j^-)^2}(i = 1, 2, \cdots, m)$$

  Calculate the relative closeness

$$C_i^* = \frac{S_i^-}{S_i^* + S_i^-}(0 \le C_i^* \le 1)$$

  between scheme A_i and ideal point A^*, Judging by the size of C_i^*, the larger C_i^*, the closer A_i is to the ideal point, the better this scheme is, and the scheme with the largest C_i^* is the best.

3 Conclusion

Based on the theory of target market determination in marketing, this paper establishes the evaluation criteria for the selection of target student source segmentation groups, and constructs the evaluation system for the selection of target student source segmentation groups by using the comparative analysis method and the ideal point algorithm, which provides a scientific and reasonable solution for the further optimization of the college student source structure.

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