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Analysis of the selection of cadets in the higher military schools

Summary

The report presents the main ways of increasing the effectiveness of the two-stage selection of cadets at the higher military schools in Bulgaria from the admission and ranking to the placement in different specializations after the successful completion of the first year.

1. Introduction

Candidates for cadets in the higher military schools in Bulgaria are subjected to a two- stage selection procedure – at the admission and after successful completion of the first year of their study the cadets are placed in different specializations. This report suggests ways to improve the effectiveness of the selection and ranking stages.

2. Comparability between the primary and the secondary selection of cadets

In search of ways to increase the effectiveness of the relation between primary and secondary selection, we collate data from three consecutive years in which the same methodology has been used. [8] The dynamics in the nature of ranking at the admission of the cadets and after completing the first year is presented by mathematical function (Formula 1) in Fig. 1. [3,4]
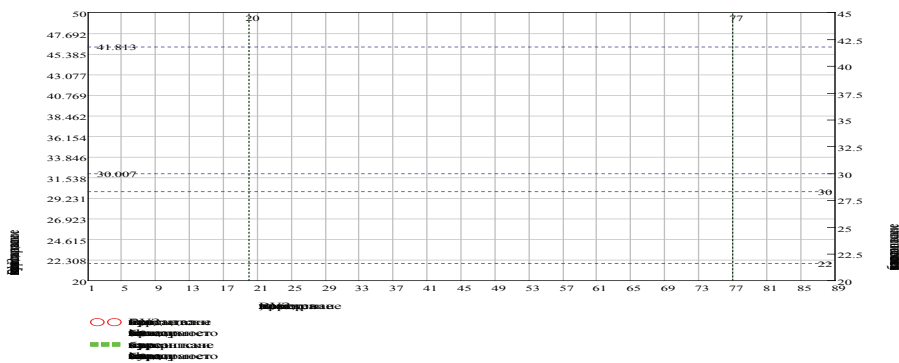

Fig. 1. Ranking of the candidates for cadets at the admission (2006) and after the completion of their 1st year (2007).

$$Обал_{курс}^{I} = f(Kr_{succ}, Kr_{mil\_sys}, Kr_{lead}, Kr_{ind}, Kr_{bal}^{k}) \qquad (1)$$
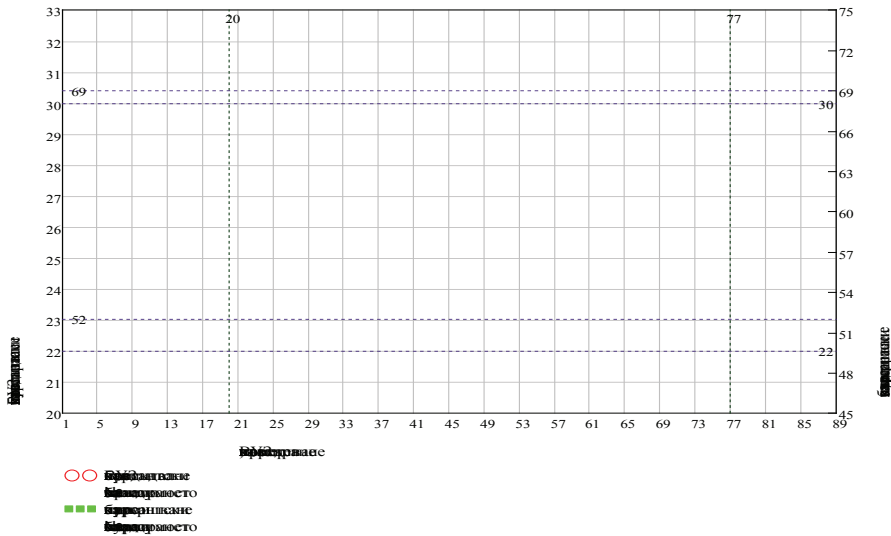
Fig. 2.   Ranking of candidates for cadets at the admission in 2007 and after completion
of the first year in 2008.

The difference in the ranking of candidates for cadets at the admission in 2007 and after completion of the first year in 2008 is shown in Fig. 2.

It is noteworthy that the initial ranking of candidates for cadets to be enrolled at the higher military school, for example in the range of the 20th position, there is an increase of 4-5 times in the ranking values after the first year. This is due to

shortcomings in the methodology for determining the total score: $Общ_{курс}^{I}$ as a result of subjective assessments in the disciplines "Attitude towards the military system and behaviour" and "Leadership".

Meanwhile it reflects the wishes of the cadets to be distributed in a prestigious specialization and/or in the preferred one.

Another trend is observed in the ranking of the cadets after the first year in 2009. Dynamics in the change of dependencies are presented in Fig 3.
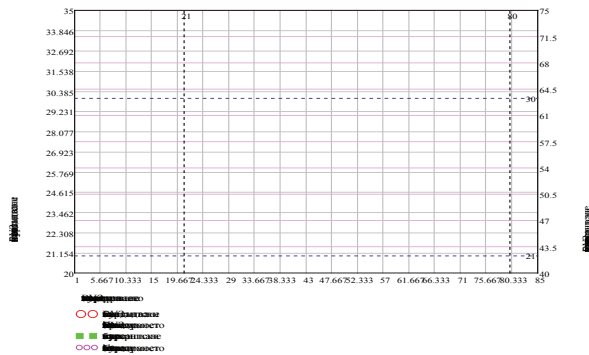
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Fig. 3. Difference in the ranking of the cadets enrolled in 2008 and after the completion of their first year (2009).

Dynamics in the ranking of the cadets who completed their first year of study in 2009 show that those ranked in the first 7–10 positions have kept their positions; dependences from the 20th to the 80th position are identical, over 80th position, however, there are converging trends.
(Fig. 3.) [1].

The data show that the trend seems to be to increase the deviation in the ranking after the first year from the time of their enrollment, and the magnitude of the deviations is displayed in Fig. 5.

Fig. 5. Deviations in the ranking of cadets at their enrollment at the higher military school and after completing their first year in the period 2007–2010. [2]

The trend of changing positions in the ranking of cadets after the completion of their first year shows that over 39% of students have increased their ranking by over four positions, and 38% by more than seven positions, which means that there are inaccuracies in the initial selection of candidates. The following two fac-

tors have an impact on the deviations from the initial ranking and the one after the first year:

- subjective factor – formed by the commanders' subjective assessments under the criteria "Attitude to the military system and behavior" and "Leadership";
- pursuit of achieving higher grades in all subjects.

The complex impact of the two factors is determined on the basis of data in Table 1. and the dynamics of changes in ranking. Hence the ratios of these two factors in the overall ranking can be expressed by the relationship:

$$R^I_{klas} = 0.689 F^I_{sub} + 0.311 F^I_{succe} \quad (2)$$

The significant weight of the subjective factor influence, its value is 68.9%, may have negative influence on the second factor. On the other hand, the desire for choice of specialization is in direct relation to the pursuit of higher grades in all subjects and on this basis re-selection is done.

To reveal the cause of the discrepancies which have occurred, it is necessary that more comprehensive and thorough examination of the records of each candidate be done and on this basis determine how their success changes and the subjective factors which have the greatest impact on it. The evaluation of selection effectiveness requires a comparative analysis of the criteria for ranking and distribution of cadets upon completion of the initial selection.

3. Identification of the priorities and the hierarchy of the existing elements involved in the system of admission and training of cadets

A tool for qualitative modeling of complex problems in the system of admission and training of cadets is a procedure in which part of the elements of are components that form a candidate's score, which for the purposes of the analysis should be arranged in relative weight, i.e. priority [5,6,7].

A variant of such a hierarchy of priorities defined in the existing methods is presented in Table 1

Tab. 1.   Components, arranged by relative weight, which form the total score for admission of cadets[2]

№	Elements of the methodology for admission of cadets	Relative weight	Prospective weight
1	Written examination in a subject from the curriculum of the secondary school/ state exam assessment	0.345	0.255
2	Written test in English, French or German	0.005	0.002
3	Physical fitness test	0.155	0.153
4	Psychological test	0.195	0.265
5	Medical examinations	0.255	0.325
		total 1.00	total 1.00

Relative weights ordered as per the importance of the components which form the candidate's score in perspective (Table 1) shows that the top of the hierarchy is the item Medical examinations - 0.325. It is almost equal to the elements – Written examination in a subject from the curriculum of the secondary school/ state exam assessment and Psychological test. The latter implies the need to offer options for increasing the adequacy of the system of admission and training of cadets.

4. Methodology for admission and training of cadets

Determining the effectiveness Eff_{home}^{kad} of the methodology for admission:

$$C_{kad}^{exa} = f[O_a(\ddot{A}\c{C}\grave{E}) \, T_{lang}^{exa}, T_{fi\_fit}^{exa}, T_{psy}^{exa}, M_{inp}^{healt}] \; (3)$$

On this basis, it is necessary to take account of changes to the key elements involved in the formation of C_{kad}^{exa}, the most important of which is Changes in the relative weight of the written competitive examination in a subject from the curriculum of secondary school / assessment of the state graduation exam. The ranking of each candidate for a cadet, according to the methodology for total score formation is determined by the formula:

$$Bal_{other}^{s} = 2O_a + O_b + O_m + O_f + (O_e) \; (4)$$

The total score of the candidates for cadets is presented in separate intervals which range from 20.00 to 33.00 and the number of candidates in each interval has similar laws for the distribution of magnitudes.

By using the average data for the admission of cadets for 2006–2012, the laws on distribution as per candidate's total score between these dependencies is shown in Figure 6.
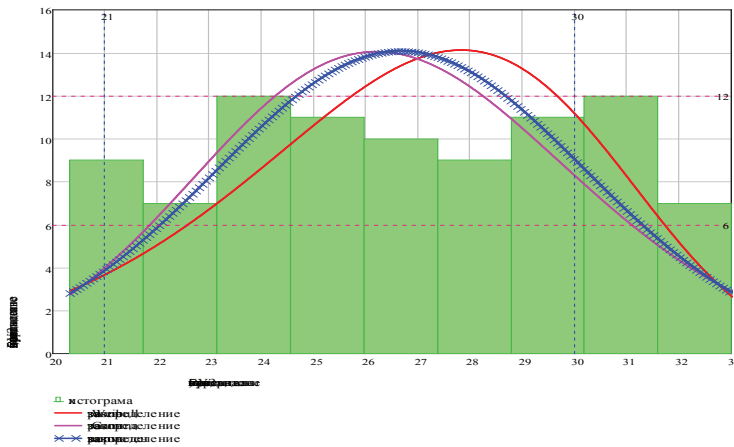
Fig. 6. Laws on distribution of candidates' total score by intervals on admission to a higher military school for the period 2006–2012

These dependencies related to the distribution into intervals of the total score of a candidate obey the normal distribution law. The remaining laws on distribution take into account the proximity of the data of the histogram to higher values of the deviations than the actual values. The special feature of the presented histogram is the relation of the number of prospective cadets enrolled with total score less than 21,00.

An important part in increasing the efficiency of the method of admission of cadets is the particularity of the relation: candidate's total score and the assessment of the admission exam or assessment of the state exam.

Data used with average values concerning the admission period 2006–2012, the specifics are presented in Fig. 7.
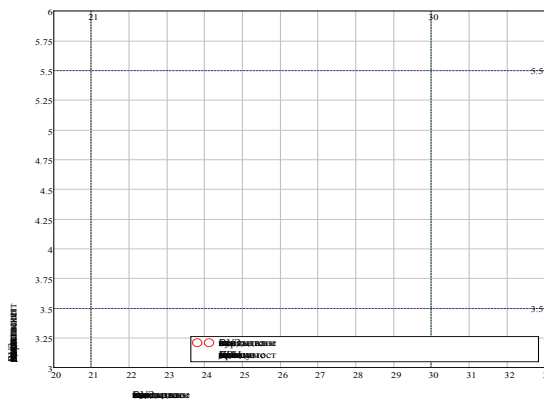

Fig. 7. Relation between candidates' total score and the assessment of the admission exam or state exam upon entering university for the period 2006–2012. [2]

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The relation between the values of the admission score and the assessment of the speciality or the state exam for entering higher military school consists of two main parts. One is approximately linear – in $21.00 \leq Bal^s_{kad} \geq 30.00$, the other – highly nonlinear in $Bal^s_{kad} \leq 21.00$.

Specificities between critical points show that: between critical point № 1 and № 2 the range of the admission score is: $20.50 \leq Bal^s_{kad} \leq 21.00$, which is a decreasing function compared within $3.505 \leq O_a \leq 3.559$. And at values $20.00 \leq Bal^s_{kad} \leq 20.50$, it is respectively $3.15 \leq O_a \leq 3.505$, expressed by the relation between critical points №2 and №3 which is approximately four times reduction in the value of O_a in comparison to the magnitude of the total score. That dependence is due to the assessments obtained by the candidates at the admission exams in different subjects, and taking into account the formation of Bal^s_{kad} test scores of the Psychological test.

For example, should all other conditions be equal and the entrance score is 17,00 and the assessment is $O_c = 3.00$, it is still possible to form $Bal^s_{kad} = 20.00$, which is implausible for the admission procedure. Furthermore, candidates who have total score $20.00 \leq Bal^s_{kad} \leq 21.00$ always – in the ranking after the first year and after completing their study –90...95% of them keep the same positions, which substantially reduces the quality of education. To compensate for this, it is advised that the minimum score be changed to $Bal^s_{kad-min} \geq 21.00$. Under this condition, the assessment of the competitive exam or the assessment of the state graduation exam needs to be $O_a \geq 3.5.$. Moreover, the nature of the relation between points № 5 and № 6 is linear, where $21.00 \leq Bal^s_{kad} \leq 25.00$ and can be expressed by a linear equation. And the relation between points №6 and №7 is linear as well, where $25.00 \leq Bal^s_{kad} \leq 30.00$ with significant values of the coefficient a.

Hence, to increase the efficiency of the selection procedure of candidates for cadets and bring it closer to the ranking after the first year of study, it is essential that mandatory minimum score of 21.00 be introduced for all candidates.

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Закон за отбраната и въоръжените сили на Република България (изм. ДВ. бр. 100 от 20 Декември 2011г.)**.**