

Predictive value of the entrance examination for the academic efficiency of students at the Faculty of Physical Education in Zagreb

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The research on the impact of the students' cognitive status, conative status (characteristics of personality), level of the sport specific skills, motor status (abilities), and their secondary school grade point average on his/her progression in the higher education (the physical education teacher training) was carried out on a sample of 182 undergraduate students who had passed the entrance examination for admission to the Faculty of Physical Education in the 1993/94 academic year. The difference in 19 measured variables between the group of students enrolled in the third year of the study and of those who did not register in it was determined by discriminant analysis. Neither univariate nor multivariate differences of results were statistically significant, except for the difference in the grade point average from the secondary school. The outcome suggests, as far as this stage of analysis is concerned, that the observed aptitude classification procedure failed to comprise fundamental factors responsible for the efficiency in studies at the Faculty of Physical Education in Zagreb. However, as the entrance selection procedure already reduced the considerable portion of variability of the employed variables, that is, the least efficient and capable candidates were eliminated, a plausible speculation that prosperity in the higher education training and teaching could have been influenced by other factors than the examined ones, must be taken into consideration. That notion remains an issue for the further investigation.

Proficiency, competence and expertise of highly educated, well-trained practitioners has a direct influence on the effects induced by kinesiological, that is, programmed and directed exercise processes in physical education and sport. Therefore, their professional training and education should be of the extremely high quality. In addition, evaluation of the quality of the university teaching is in accordance with the policy announcement of the Croatian government¹

The goal of the classification procedure of the aptitude entrance examination is to select applicants – future students - who are maximally suitable for the curriculum of the Faculty of Physical Education. That is an indirect attempt to establish the best possible ratio between the successful and unsuccessful students. Simultaneously, the probability of their success in subsequent professional ac-

tivity is enhanced. Also, successful students are more content with studying, therefore their self-esteem is enhanced, too. The more precise selection of students, the lower number of unsuccessful and, consequently, low self-esteem students.

Certain efforts have been attempted by the cognate faculties in Croatia to create uniform examinations for the admission and selection of applicants. However, before any decision on whether to transform the examination procedures could be reached, it would be useful to examine the value of each classification procedure ever applied, as well as its predictive validity for the success of students in progression during the training of physical educators and their professional activity.

The selection of applicants at the universities in USA is rather interesting: College Entrance Examination Boards are at the high-school graduates' disposal to orientate and prepare the future students for a specific scientific field and faculty. Students are eligible for admission if they have graduated from the accredited secondary school (gradua-

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tion certificate has to be submitted) and if they have passed the entrance requirements examination before the Board.

According to the number of published papers dealing with that subject in Croatia, a few professionals and scholars showed any interest in evaluating their own teaching effectiveness, as well as the quality of the entrance examinations. The research on how the decisions about the procedures of selection have been reached might be of some interest, too. The well-known fact is that only few professionals in higher education institutions have tested the predictive validity of the examinations. The most of them have undertaken that in the frame of the tutorial procedure for students' graduation theses (final papers).

Several authors studied metric characteristics of measuring instruments employed in the entrance examinations of higher education institutions (Radukić, 1990; Puljko, 1996); the others examined the predictive validity of the entrance examination's instruments for the prognosis of the academic achievement throughout the study as a whole (Boban, 1994; Ničota, 1995; Žužul, Lugomer and Kulenović, 1984) or for forecasting the students' efficiency in a particular course of a study curriculum (Cvjetković, 1995; Španjol, 1988; Đumlan, 1988).

The connection of the cognitive and conative (personality) characteristics of students with their success in particular subjects was examined, too (Stančec, 1979). Apart from the listed above, there were also several attempts to determine the characteristic profile of a student who had graduated from the undergraduate course of a study – Bachelor of Science/Art (Lukač, 1993).

Several research efforts encompassed the secondary school population that had advanced to the higher education institutions. They highlighted the cognitive functions of students and contribution those functions had in the variability of the secondary school grades (Sakač, 1968; Šerbetar, 1988).

In our research we paid special attention to the previous studies that treated relation between grades students achieved in physical education and in other secondary school subjects, and the cognitive abilities (Sakač, 1968; Babiak, 1973; Šerbetar, 1988).

Most of the papers were graduation theses written by students of kinesiology (physical education) and psychology.² In these papers researchers were focused on the construction and evaluation of the measuring instruments, be-

sides the other scientific and professional purposes, administered at the entrance examinations at the Faculty of Physical Education. However, the prognostic value of these examinations for the profile of the future kinesiologists has never been thoroughly tested.

This article tries to evaluate the success of students progressing in their study according to the data collected during the entrance examination and selection of applicants for the training of physical education teachers (kinesiologists) in Zagreb.

Since the foundation of the Faculty the procedure and the content of the entrance examination has sustained numerous modifications in order to design the best possible procedure for selection of applicants. During first several years of the Faculty's existence the most important elements to be tested were various types of skills specific for several sports (motor knowledge). The motor and cognitive abilities and conative (personality) characteristics later accompanied them. In recent years the grade point average from the secondary school has been added to the entrance selective procedure.

The exact and rigorous assessment of the entrance examination contents and its efficacy in predicting the students' future progress in a study at the Faculty or in later professional activity has never been accomplished. Therefore, this article is the first attempt to determine relations between the entrance examinations' results and the academic success in the physical education teacher training.

The difference in progressing into the higher year of a study between the full-time students admitted at the state expense and those who pay personally the scholarship fee was tested. Namely, the enrolment of two categories of the full-time students is approved: (a) the first 103 students on the classification list (rank - order is based on the number of points students acquire in the classification procedure) will study at the state expense³, (b) from the rest the permitted number of students, defined by the enrolment decision, will pay their scholar fee personally. Only stipulation for the latter is that they must satisfy and surpass the qualification suitability threshold, defined as the minimum of the required points acquired in the categories of motor abilities and sport specific skills (motor knowledge).

Additionally, the paper investigates which segments of the entrance examination affect mostly and to what extent the future progression in academic training.

² Many of them were published in the Croatian scientific journal "Kinesijologija". The journal was established in 1971. Since 1966 (volume 28, Number 1) the journal is available in English under title "Kinesiology", too (ISSN 1331-1441).

³ Ministry of Science and Technology of the Republic of Croatia is paying for their scholarship fee.

METHOD

Table 1.

Spearman-Brown reliability coefficients of cognitive tests

Test	N	r_{11}
cog 1	515	0.94
cog 2	515	0.88
cog 3	471	0.92

Objectives

There were two research objectives:

1. To establish difference between ordinarily registered full-time students who do not pay the scholarship fee (*no fee*) and those who are to pay personally for their study (*fee*).

2. To establish proportion of influence of the observed variables on the discrimination between the successful (who have managed to enrol in the 5th semester) and *unsuccessful* students (who failed to satisfy the requirements for the admission in the 5th semester).

Participants

The assessment was based on the results of the entrance examination for the admission to the Faculty of Physical Education in Zagreb in the 1993/94 academic year. In order to verify the research objectives and for the purpose of the statistical processing, the subjects (N=182) were divided into groups on the basis of the following two criteria:

1. The type of admission in the 1st semester of a study (a) *no fee students* (N = 103) and (b) *fee paying students* (N = 79);

2. The way of meeting the enrolment requirements for the 3rd year of the scholarship (a) *registered* (N = 88) and (b) *unregistered* students (N = 94; i.e. those who failed to meet the obligations for signing up in the higher year of studies).

Variables

The entrance examination included the secondary school achievement (grade point average) and the assessment of cognitive abilities, conative characteristics (characteristics of personality), skills specific for several sports (i.e. sport specific skills or motor knowledge), and motor abilities. The battery of tests comprised the following tests for the selection of applicants:

- cognitive status:

- input processing – perceptive reasoning (*cog1*) – perceptive identification and discrimination test by B.Dvorak, published in 1977 by *Republička samoupravna interesna zajednica za zapošljavanje*. On each item of the test it is necessary to find out which of the four pictures is identical to the given one.

- parallel processing – spatial relations (*cog2*) – visualisation test by Thurstone and B. Dvorak, published in 1977 by *Republička samoupravna interesna zajednica za zapošljavanje*. On each test item it is necessary to establish which of the four geometric bodies corresponds to the given scheme.

- serial processing – symbolic reasoning (*cog3*) – antonym – synonym test by D. Tarbuk, published in 1977 by *Republička samoupravna interesna zajednica za zapošljavanje*. On each test item one needs to find two similar or two opposite words in the four words set.

The reliability coefficients for cognitive tests were calculated on a sample of males and females of different ages from the selected Croatian towns (Tarbuk, 1977).

- conative (personality) status.

The questionnaires according to the cybernetic model of personality (Momirović and Ignjatović, 1977) were constructed by Prot and Momirović, 1984:

- regulator of defence reactions (*alpha*) – all classes of behaviour which can be classified under the term anxiety. The example of an item: “I don’t feel self-confident enough.”

- regulator of attack reactions (*sigma*) - all classes of behaviour which can be classified under the term aggressiveness. The example of an item: “I’m easily got mad..“

- regulator of the organism functions (*chi*) - all classes of behaviour which can be classified under the term conversion or conversion reactions. The example of an item: “My heart is sometimes beating very fast without obvious reason.”

- regulator of personality homeostasis (*delta*) - all classes of behaviour which can be classified under the term dissociation. The example of an item: “I believe they are following me.”

- regulator of integrating personality features with social requirements (*eta*) - all classes of behaviour which can be classified under the term morality. The example of an item: “They say that I am childish.”

Table 2.

Spearman-Brown reliability coefficients and Cronbach's alpha of conative tests

Test	N	r_{tt}	α
alpha	199	0.94	0.94
sigma	199	0.92	0.93
chi	199	0.94	0.94
delta	199	0.96	0.96
eta	197	0.95	0.95
epsilon	199	0.94	0.95

- regulator of activity (*epsilon*) - all classes of behaviour which can be classified under the term extraversion – introversion. The example of an item: "I am quick in work."

The reliability coefficients for conative tests were calculated on a sample of 199 male students of physical education, who attended the 2nd, 3rd, and 4th year of study in academic year 1983/84 (Bosnar et al., 1984).

sport specific skills (motor knowledge):

swimming (*swimming*), athletics (*athletics*), gymnastics (*gym*), combat sports (*comb-sp*);

motor abilities:

co-ordination (*polygon*), rhythm (*rhythm*), repetitive strength (*sit-ups*), explosive strength (*sdm*), and the alternative movements velocity (*tapping*);

grade point average computed from the four secondary school grades and graduation examination grades (*average grade*).

The maximum an applicant could earn at the entrance examination testing was: 25 points in the assessments of the cognitive and motor abilities; 30 points in the sport specific motor skills assessment; 20 points for the maximal secondary school grade point average; in total 100 points were available. The conative status was observed just as a possible contraindication.

Data Processing

The following procedures were employed in order to accomplish the set objectives of the research:

1. The contingency table was analysed to determine the differences among students on the basis of two binary variables:

- The type of admission in the 1st semester of the study at the Faculty of Physical Education (*no fee and fee paying*)
- the actual registration into the 3rd year of the study at the Faculty of Physical Education (Registered, successful – Unregistered, unsuccessful).

2. The discriminant analysis of the two groups of students (Registered and Unregistered, that were created on whether a student was admitted into the third year or not), was carried out in order to determine what features differentiate the groups and what is the degree of differentiation among results derived from the entrance examination variables. Original, raw data of the each examinee's result in each testing variable, and not the transformed ones that appeared as points on the rank list, were used to preserve the original variance of variables.

Descriptive parameters and coefficients of variability of results were determined for the two groups of subjects (Registered - Unregistered), and for all variables. Data processing was carried out by means of the *Statistica* programme, ver. 5.0, at the Faculty of Physical Education, University of Zagreb.

RESULTS AND DISCUSSION

The frequencies of students classified on the basis of two variables: (a) fulfilment of the requirements for admission to the third year of the study, and (b) the mode of the scholarship fee payment, are presented in table 3.

It became obvious (see Table 3) that 88 students, almost evenly of both admission types, met the requirements for registering in the third year of the study. That was little less than 50% of the total of students enrolled in the academic year 1993/94. Results of χ^2 - test showed no statistically

Table 3.

Contingency table

	Fee free	Fee paying	Total
Registered	50	38	88
Unregistered	53	41	94
Total	103	79	182

significant differences among frequencies of students, who had been classified on the basis of two binary variables. Although the fee paying students, paying personally for their scholarship fee, had achieved poorer results in the entrance examination tests, they enrolled into the third year of the study in the percentage almost equal to the percentage of the no fee paying students' enrolment. The success of the self-paying students could be attributed to their enhanced motivation for work during the study, because the better

grades they get, the less will they pay according to the Faculty rules.

Therefore, regardless of the placement on the entrance examination list, it could be concluded that all students had equal chances to complete their education successfully. Success in studies obviously depends on something else. Perhaps the additional analysis could give the survey of elements contributing to the efficiency of studying.

Table 4

Basic parameters of variables; multivariate analysis of variance (MANOVA), and discriminant analysis of differences between the successful and unsuccessful students

	Basic parameters			MANOVA					Structure coefficients
	Registered N=88			Unregistered N= 94			F- remove		
	M	SD	V	M	SD	V	df (1,162)	p-level	
alpha	117,78	16,04	0,136	121,88	16,04	0,138	2,20	0,14	-0,30
sigma	102,75	15,96	0,155	105,95	15,96	0,173	2,05	0,15	-0,22
hi	141,33	8,16	0,058	142,11	8,16	0,057	0,31	0,58	-0,12
delta	141,10	6,96	0,049	142,13	6,96	0,052	0,00	0,99	-0,17
eta	134,80	10,47	0,078	135,29	10,47	0,078	0,80	0,37	-0,06
epsilon	60,65	16,30	0,269	57,63	16,30	0,273	0,63	0,43	0,23
aver-grad	3,48	0,63	0,181	3,22	0,63	0,165	9,12	0,00	0,55
cog1	28,26	5,46	0,193	29,66	5,46	0,172	3,14	0,08	-0,32
cog2	24,57	6,55	0,267	25,61	6,55	0,282	0,00	0,96	-0,18
cog3	35,27	8,58	0,243	36,02	8,58	0,258	0,46	0,50	-0,10
swimming	3800,55	615,19	0,162	3751,78	615,19	0,142	0,86	0,35	0,10
polygon	313,50	48,17	0,154	319,90	48,17	0,162	1,25	0,27	-0,16
athletics	2,97	1,40	0,471	2,78	1,40	0,525	1,01	0,32	0,16
gym	5,60	2,36	0,421	5,06	2,36	0,524	1,47	0,23	0,26
comb-sp	2,30	1,34	0,583	2,36	1,34	0,627	1,46	0,23	-0,06
rhythm	529,14	63,39	0,120	532,94	63,39	0,092	0,38	0,54	-0,08
sit-ups	78,81	59,69	0,757	68,31	59,69	0,704	0,63	0,43	0,24
tapping	40,76	3,71	0,091	40,87	3,71	0,079	0,00	0,97	-0,04
sdm	262,84	20,52	0,078	263,95	20,52	0,074	0,68	0,41	-0,07

Differences among the successful and unsuccessful students

The successful/unsuccessful admission into the third year of the study was a classification variable. Differences between two groups of students were observed relative to their performance in the entrance examination tests.

Differences (see Table 4) between the students who had managed to enrol into higher year of the study and those who had failed to register in, indicated that the only significant difference (at the level of 0.01) was the grade point average from the secondary school. It was also evident from the descriptive statistics indices. The cognitive abilities, conative characteristics, the level of sport specific skills (motor knowledge) and motor abilities did not differentiate two groups of students.

The variability indices, however, suggested that the unregistered group of students showed less homogeneity in the tests of the cognitive abilities and of the sport specific skills, but was more homogenous in the secondary school grades and in the motor ability tests. Even that was insufficient to obtain any statistically significant differences between the registered and unregistered group of students. Still, these indices could be considered as a useful basis for the diverse approach to solving the problem.

The discriminant analysis, conducted on the results of the entrance examination classification procedure at the Faculty of Physical Education in the year 1993, revealed no differences between the students registered into the 5th semester of the study (Registered, *N* = 88) and the students who failed to meet the requirements for admission (Unregistered, *N* = 94). The obtained discriminant function is not statistically significant (see Table 5). Therefore, the analyses of a single variable correlation with the function were not justified; it would be better to consider them as possible indications of impact. Very low correlations between almost all variables and the discriminant function (see Table 4) were apparent. That was an indication that the battery of tests employed in the entrance examination had very poor predictive validity for the progression in the physical edu-

cation teacher study. The only exception was the grade point average from the secondary school and its contribution to the differentiation of students was the greatest. Additionally, if we consider the univariate difference tests too, then only the level of engagement during the previous educational period would differentiate two groups of students.

The variables for assessing the cognitive abilities, conative characteristics, sport specific skills, and motor abilities do not differentiate the successful from the unsuccessful students. Neither the univariate nor the multivariate tests showed anything. For the time being it is better to treat the negative correlations of the cognitive tests with the discriminant function (-0.32, -0.18, and -0.10) as randomly obtained results, because of insignificance of the discriminant function, and leave them for further analyses. Special attention should be directed to the analysis of the causes, that is to the study on the particular curriculum courses/ subjects that might had been the reasons for students' failure to register into the higher year. It is quite possible that the mentioned and tested abilities of students affect the academic success in different study subjects differentially.

Based on the results of the discriminant analysis a classification matrix was derived (Table 6) showing what was the probability of enrolment into the third academic year if the outcomes of the entrance examination tests were taken into account. Such an analysis was the additional indication of validity of the applied measuring instruments. The observed results are represented in rows, and the predicted results are shown in columns. The first column and the position of students in cells indicate that it was easier to foretell how many students would fail to enrol than how many were going to enrol into the 3rd year of the study (72% versus 66%). According to the classification matrix there should have been 84 registered students, out of whom 58 (or 65.91%) from the group (*N* = 88) of actually registered, and 26 (or 27.66%) from the group (*N* = 94) of actually unregistered. Error in the process of predicting the success, based on the battery of tests used, was immense.

Table 5

Significance test of the discriminant function
(Chi-Square Tests with Successive Roots)

Canonical R	Wilks'λ	χ ²	df	p-level
0.383	0.853	27.066	19	0.103

Table 6

Classification matrix. Rows: actual classifications;
columns: predicted classifications

	% correctly classified	Registered	Unregistered
Registered	65.91	58	30
Unregistered	72.34	26	68
Total	69.23	84	98

CONCLUSION

There were two research objectives. The first goal was to investigate the differences in the efficiency in academic progression between the applicants who have enrolled in the Faculty of Physical Education on the fee free basis, that is, who study on the state account, and the applicants who pay personally their scholarship fee. Almost equal percentage of meeting the requirements for admission into the higher academic year has been established in both groups of students.

Within the second objective, the predictive value of the entrance examination at the Faculty of Physical Education in Zagreb was investigated. Research results, as far as the predictive validity of the entrance examination procedure is concerned, suggested that it was impossible to make predictions of the future study efficiency based on the employed battery of tests. In general, the battery of tests and other indicators of the qualities of applicants, which were components of the entrance examination procedure, are not strong enough to represent the academic values of students. The only sign of predictive value can be found in the grade point average from the secondary school. The necessity for thorough and detailed study on the factors of efficacy in the study and later professional activities is more than obvious. It is almost painful to conclude that exhausting and expensive classification procedure has no predictive validity for the progression of students towards the 5th semester of the physical education teacher preparation.

Consequently, only the secondary school grade points should be considered as a possible predictor of academic success in the physical education teacher study. They may indicate working habits acquired during the previous schooling, which undoubtedly could be one of the factors of the successful study. The positive transfer of knowledge, acquired during the secondary school training, specially in the course subjects such as anatomy, physiology, and quantitative methods, is possible, as well. Further, it is rather possible that self-concept in successful students is higher than in less successful ones. Namely, in several research (Coopersmith, 1967; Morrison, 1973; Grgin and Lacković-Grgin 1989) it has been shown that global measures of school achievement have higher correlation with global measures of self-concept than other achievement measures (according to Lacković-Grgin, 1994, p. 26). In our research the secondary school grade point average (global measure) was exactly employed as a predictor of the subsequent efficiency. Therefore, it might be possible that successful secondary school students manifested more self-confidence in meeting the study requirements. Thus the significant contribution of the grade point average in the classification procedures and study success has been plausibly justified.

On the other hand, the fact that no other segment of the entrance examination assessment played any significant role in the academic success prediction, is the origin of frustration and bewilderment. There is a slight possibility that these segments will show their real value at the end of the study, when students will pass all the specific subjects' examinations, elements of which had been comprised in the entrance examination testing procedure. The same can be applied to the dimensions of student's personality that are indispensable for the execution of elements and skills, which are supposed to be expressed within the contents of the specific subjects. The value of the applicants admission procedure for predicting the progress throughout the whole study will be assessed in the future research that is going to be conducted after the graduation of the observed generation of students.

The entrance classification examination is supposed to have, beside its selective value, a certain predictive value, too. The data acquired through the entrance examination procedure should be the prognostic basis for predicting the later progress in the study. It is quite clear that all admitted students are not going to graduate.

In addition to all above listed conclusions, one fact, that can vindicate the research results, should be taken into consideration. The classification procedure separates and eliminates candidates who do not satisfy the requirements, that is those who have low or no predispositions for the physical education teacher training (poor health condition, unacceptable conative characteristics, and poor swimming skills) and those who display less than a minimum of specific skills in different sports or have poor motor abilities (i.e. candidates who do not surpass the set threshold). The remaining candidates are ranked according to the attained results. Disqualification of a great number of unfit applicants narrowed the variability of variables significantly. So, that can be a possible cause for the poor predictive value of the employed test battery.

This research is a part of the triennial scientific project at the Faculty of Physical Education in Zagreb. One of diverse goals of the project is to explore and evaluate quality of the entrance examination and of the whole study. In further studies the causes for passing or failing on examinations of particular subject courses will be thoroughly investigated.

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