

## Efficacy of the Academic Competition (Olympiad) System of Admission to Higher Educational Institutions (in Chemistry)

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**Abstract**—The association between the academic competition (Olympiad) results and subsequent academic performance during the first two years at a higher educational institution was examined. The data for three cohorts ( $N = 738$ ) of students of the Chemistry Department, Moscow State University, were analyzed, including the results of international and nationwide academic competitions in chemistry, university grade point averages, and Unified State Examination scores. It was shown that students admitted on the basis of academic competition results (winning or prize-winning) perform significantly better during the first two years at the university than those admitted on the basis of Unified State Examination scores. It was shown that the results of academic competitions of different levels are not equal in predicting subsequent academic performance for students.

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The Olympiad movement is a system of academic contests that aims to support gifted school students and to develop their cognitive skills, intrinsic learning motivation, logical and creative thinking abilities, and their interest in scientific research. Winners of schoolchildren Olympiads tend to choose prestigious higher educational institutions. In 2011, the five Russian universities they preferred most were (in descending order): Lomonosov Moscow State University (MSU), Bauman Moscow State Technical University, Higher School of Economics, Siberian Federal University, and St. Petersburg State University. In 2011, the MSU admitted 1961 academic competition winners and prize-winners (Olympians) and, nationwide, 4% budget places at higher educational institutions were given to Olympians, while in 2010 they accounted for only 1.6% of the enrollment.

In 2010 and 2011, the All-Russia Rectors' Union undertook a study into the academic performance demonstrated by students of different higher educational institutions [1, 2], based on the data available for 150 thousand students. The results of the first end-of-term exams showed that the Olympians achieved

higher grade point averages than the students admitted through the standard procedure (4.0 against 3.7, 4.1 against 3.8, and 4.1 against 3.9 for the 1st, 2nd, and 3rd terms, respectively). The proportion of “excellent students,” and students who get only good and excellent marks among the Olympians is also higher, compared to that among the students admitted on the basis of Unified State Examination (USE) scores (46.4 against 38.9, 47.2 against 40.5, and 52.7 against 46.1% for the 1st, 2nd, and 3rd semester, respectively). Comparison of the academic achievements demonstrated at the first end-of-term exams by the students enrolled in 2010 and a year earlier showed that the gap in performance between Olympians and students admitted on regular terms increased (49.3 against 39.2% for 2009). Thus, findings of the inter-university study of student performance indicate solid grounding and high creative abilities in students who participated earlier in schoolchildren Olympiads. The Olympians consistently demonstrate better academic performance compared to their peers admitted on regular terms.

The exam results at the end of the first and second terms indicated progressive convergence of the academic achievements of the Olympians and students

admitted on regular terms. One possible reason may lie in the gradual expulsion of underachieving students, among which the proportion of non-Olympians is lower. On the other hand, it is possible that non-Olympians become more interested, and/or Olympians less interested in learning. There is a need to investigate these hypotheses.

In 2004, the MSU introduced a system of admission rules alternative to the USE that grants benefits to winners and prize-winners of regional, nationwide, international, and some other school-children Olympiads applying to MSU and some other higher educational institutions. Under the current practice of admission, Olympiad winners, depending on the level of Olympiad, may be admitted without examination, or their achievement may be equated to 100 points on the USE for the specialty discipline of a particular department. The first results of application of this approach (in the case of the MSU Chemistry Department) have validated the efficacy of this admission system, through which gifted students can be attracted to the leading Russian universities [3]. It was also shown that the academic performance demonstrated by Olympiad winners admitted to the MSU Chemistry Department without exams was significantly superior to that of students admitted by the standard procedure (four entrance exams). The highest and most consistent performance was displayed by former winners of the International Mendeleev Olympiad and of the All-Russia Schoolchildren Olympiad.

After eight years of experimental application of the USE, which was first introduced in 2001, a decision on its mandatory application was made. However, even after more than 10 years since the start of this educational experiment, the validity of this system of school graduates' knowledge assessment and their admission to higher educational institutions is a subject of ongoing debate (see [4]). It is a well-known fact that the developers of the USE modeled it after the system existing in Western countries. One example is the Scholastic Aptitude Test (SAT) that has been used in the USA for assessment of learners' knowledge since 1926. It consists of SAT I: Reasoning Test and SAT II: Subject Test. The SAT I test includes 3 parts: critical reasoning (analyzing scientific texts on social, humanitarian, or natural sciences), mathematics (number and operations, algebra and functions; geometry; statistics, probability, and data analysis), and (since 2006) writing (writing grammatically and

setting out ideas clearly). The SAT II test consists of two (sometimes three) tests on specific subjects and two more tests at learners' wish. It should be noted that the SAT evaluates school abilities, rather than knowledge of individual subjects, and the general character of SAT improves its validity. Since 1959, the Academic Competence Test (ACT) has been used along with SAT to assess the school graduates' knowledge. In order to be admitted to a higher educational institution, an entrant must provide his/her SAT or ACT scores, as well as information on school performance over the three final years, and to write an essay justifying the reasons for his/her interest in a specific higher educational institution.

It was shown [5] that SAT score, along with school grade point average, is a reliable predictor of academic performance at higher educational institutions. The USE system practiced in the Russia does not take into account the overall schoolchildren's performance at school and concentrates their attention on 3 (or 4 at most) subjects, while all other subjects are ignored during the last years of secondary school. The implications of this innovation are beyond the scope of this study, but there is a need to analyze whether the USE score is a reliable predictor of academic performance, and whether it offers any advantage over the results of entrance exams and school grade point averages in prediction of subsequent performance of students at university. Within the present study, we compared academic achievements of Olympians with those of students admitted on the basis of their USE scores.

The data on psychological predictors of performance at the USE reported by Russian researchers are scarce. To our knowledge, there are only three studies concerned with psychological variables predicting the senior schoolchildren's USE performance [6–8], and only our own previous study was dedicated to the psychological characteristics of the Olympians [9].

Studies of subsequent performance of the Olympians undertaken by foreign researchers indicated their significant achievements (for Math Olympians, see Campbell [10] and for Physics Olympians, Feng, Campbell, and Verna [11]). At the time of those studies, the former winners ( $N = 55$ ) of Olympiads were at the age of 22.4 on average and had a total of 328 published works, including patents; 55% had either defended their theses, or were writing their

**Table 1.** Grade point averages at the first end-of-term exams and USE scores for the Olympians and students admitted on the basis of USE scores in 2009–2010 ( $p < 0.001$ )

Subject	University admission procedure			Significance of differences, Fisher's $F$ test (2;466)
	winning Olympiad	USE scores, with Olympiad results	USE	
First end-of-term exams				
Inorganic chemistry	4.57 (0.65)	4.04 (0.78)	3.82 (0.81)	40.05 <sup>a</sup>
Mathematical analysis	4.27 (0.88)	4.02 (0.89)	3.87 (0.96)	7.54 <sup>a</sup>
Average score	4.43 (0.66)	4.03 (0.70)	3.86 (0.76)	25.52 <sup>a</sup>
USE				
Russian language	76.6 (8.72)	76.2 (9.51)	76.6 (8.26)	0.13
Mathematics	75.8 (8.54)	72.6 (9.46)	71.6 (9.80)	8.16 <sup>a</sup>
Physics	72.1 (11.1)	68.2 (8.96)	67.8 (8.95)	7.89 <sup>a</sup>
Chemistry	85.7 (8.63)	81.3 (7.78)	82.3 (10.3)	9.19 <sup>a</sup>
Average score	77.7 (6.38)	74.5 (5.94)	74.6 (6.77)	10.66 <sup>a</sup>

<sup>a</sup> $p < 0.05$ .

dissertations; some of them rejected academic career in favor of business or industry.

These studies suggest that the distinct psychological features of the Olympians may be those typical to gifted individuals, such as, intrinsic motivation to learning, interest in cognition, goal-setting ability, and grit.

#### Predictors of Academic Performance of Students of the MSU Chemistry Department

The aim of this study was to evaluate the role played by the USE scores, Olympiad results, and learning motivation in academic performance at a higher educational institution. We examined the association between the USE scores on various subjects (two mandatory exams, in Russian language and Mathematics, and two elective ones, in Chemistry and Physics) and the subsequent academic progress at a higher educational institution (with chemistry as an example), assessed the academic performance of Olympians against that of students admitted on the basis of USE scores, and identified the differences in motivation, personality traits (such as grit) and psychological well-being between the two groups.

To this end, we present the analysis of the following data: USE scores, prize-winning in international and nationwide Olympiads, and academic performance of 738 students admitted to the MSU

Chemistry Department in 2008–2010.

#### *Winning an Olympiad and Academic Performance at the University*

Not only final, but also interim evaluation results were taken into account in calculation of the performance indicators. For example, in the case when an exam was retaken, the final score on the subject was calculated as the average of the scores for all the attempts.

Olympians showed significantly better academic performance than the students who did not win prizes at Olympiads, which corresponds to the data obtained earlier for the 2008 cohort students [12]. In the first end-of-term exams (we analyzed the data for the students enrolled in 2009 and 2010,  $N = 469$ , see Table 1), Olympians performed much better than did non-Olympians.

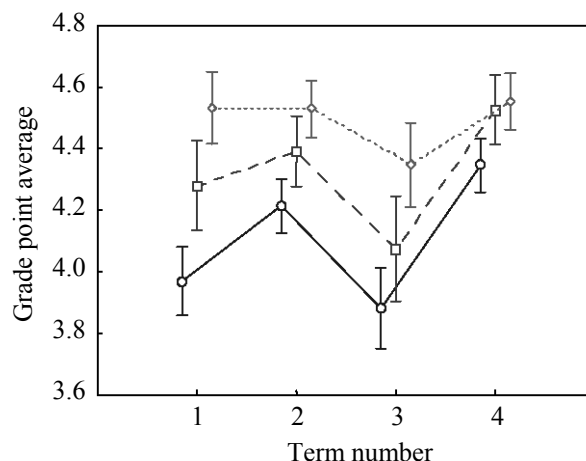
The percentage of students who were not admitted to the first end-of-term exam session in 2009–2010 is 12% for Olympians against 22% for the students admitted on the basis of their USE scores [ $\chi^2(1) = 7.64$ ,  $p < 0.01$ ]. As to the students who retook at least one exam, the proportion for Olympians is 24% against 37% for those admitted on the basis of USE scores [ $\chi^2(1) = 8.94$ ,  $p < 0.01$ ]. This superiority of the Olympians over the students admitted on the usual

terms (USE scores) was preserved after the second and third end-of-term exams.

The achievements of the students who were laureates of International Mendeleev and All-Russia Schoolchildren Olympiads (any of its four stages) ( $N = 51$ ) are even higher: The average score on inorganic chemistry exam is 4.84 (standard deviation 0.37) and on mathematical analysis, 4.58 (standard deviation 0.81).

Table 1 compares the USE scores gained by the Olympians and students admitted on the basis of USE scores only. The former show significantly higher average scores on mathematics and physics exams are significantly higher. At the same time, they differ only slightly from those of non-Olympians, and in the case of exams on Russian language and chemistry, which is their speciality subject, no significant difference is present. In our opinion, these data should be treated with caution: Being certain that their admission to the desired university is a settled matter, the Olympians may have had lower motivation for passing the USE. Moreover, some of the Mendeleev Olympiad winners did not submit their USE scores.<sup>1</sup>

Using the sample data on students' admission to the MSU in 2008 and 2009, we compared the academic achievements of the Olympians with those of the students admitted on a competitive basis with Olympiad scores accounted for, as well as those of the rest of the students admitted on the basis of USE scores (2009) or entrance exam results (2008). The average scores gained at the first four end-of-term exam sessions were used as indicators of academic performance. Repeated Measures ANOVA (factors: cohort, admission procedure) revealed differences in academic achievements between the three groups [ $F(2;374) = 16.66$ ;  $p < 0.001$ ;  $\eta^2 = 0.08$ ]: Olympians gained significantly higher scores, compared to both non-Olympians (Fisher post-hoc test,  $p < 0.001$ ) and the students admitted on a competitive basis with partial account for Olympiad results ( $p < 0.01$ ). The interaction of the examination time and admission procedure significantly contributed as well [ $F(6;1122) = 6.68$ ;  $p < 0.001$ ;  $\eta^2 = 0.04$ ]: the difference in the scores gained by Olympians and non-Olympians is not equal across the terms. As seen from Fig. 1, Olympians



**Fig. 1.** Grade point averages (with 95% confidence intervals) of the end-of-term exams during the first four terms for the students admitted to the Moscow State University in 2008–2009 ( $N = 380$ ). Students admitted: (◇) on the basis of Olympiad results, (□) with Olympiad results counted, and (○) on competitive basis.

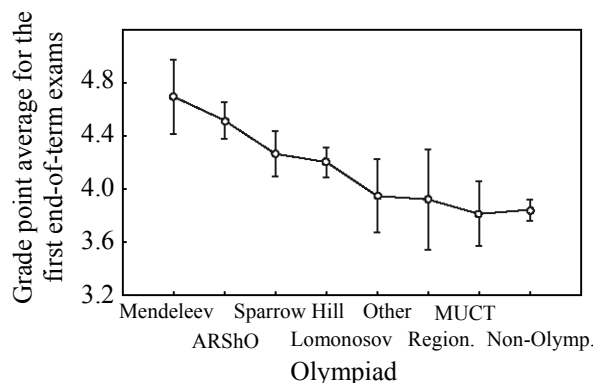
demonstrated not only higher, but also more consistent performance from one term to another; at the same time, the gap in academic performance between Olympians and non-Olympians displays a closing trend. There were no significant effects of the cohort factor and its interactions with the two other factors, which suggests similarity in the trends observed for students enrolled in 2008 and 2009.

The above-described analysis did not include the scores gained by the students who were expelled (or those who resumed their studies after an academic leave) during the first two years of the university and thus did not have the average end-of-term exam scores for all the four terms. However, the proportion of students expelled during the first two years (whose average scores were not included in comparison) was 15% for Olympians, 21% for the students admitted with Olympiad scores partially accounted for, and 29% for those admitted on the basis of USE scores competition [these differences are statistically significant:  $\chi^2(2) = 10.23$ ;  $p < 0.01$ ]. Thus, the real gap in academic performance between Olympians and non-Olympians is even larger than revealed by the above analysis.

#### *Comparative Performance of Olympiad Winners*

Comparison of the academic achievements between the groups of university students who won different Olympiads shows that the laureates of nationwide and International Olympiads (All-Russia Schoolchildren

<sup>1</sup> Some of the International Mendeleev Olympiad winners who were admitted to the Chemistry Department of MSU without exams, are citizens of other countries who did not take the USE.



**Fig. 2.** Grade point averages for the exams at the end of the first term exams for Olympians and non-Olympians (admitted in 2008-2010) ( $N = 695$ ). (Mendeleev) International Mendeleev Olympiad, (ARShO) All-Russia Schoolchildren Olympiad, Lomonosov, "Conquer Sparrow Hills!" Olympiad, (Region.) regional Olympiads, (MUCT) Mendeleev Russian University of Chemical Technology Olympiad, and (Non-Olymp.) Non-Olympians.

Olympiad and Mendeleev Olympiad) demonstrate better academic performance not only in their subjects of specialization. The data is given below on the performance of students who won the following Olympiads ( $N = 414$ ): Mendeleev Olympiad ( $N = 24$ ), All-Russia Schoolchildren Olympiad ( $N = 98$ ), "Lomonosov" Olympiad ( $N = 157$ ), "Conquer Sparrow Hills!" Olympiad ( $N = 65$ ), Moscow University of Chemical Technology Olympiad ( $N = 32$ ), regional Olympiads (Moscow, St. Petersburg, All-Siberia;  $N = 13$ ), and other Olympiads ("Nano," "Step in the Future," "Information Technologies," "Future Researchers,"  $N = 25$ ). Non-Olympians constituted the comparison group ( $N = 281$ ).

The above-listed student subgroups exhibited significant differences in academic achievement, as measured by the scores gained at the first end-of-term exams [ $F(7;687) = 14.90$ ;  $p < 0.001$ ]; overall, group differences accounted for 13.2% of the variance in exam performance. Comparison of the academic achievements among the former Olympiad participants (Fig. 2) shows that the winners and prize-winners of the Olympiads represent a non-uniform sample, evidently due to different difficulty levels of the Olympiads considered.

Research carried out by the all-Russian Union of Rectors (2011) found that contrary to the earlier situation when there were five or more Olympiads whose winners and prize-winners showed high

academic achievement at the university level, more recently only three competitions remained in this position, namely, "Lomonosov," "Phystech," and the Interregional and multidisciplinary academic competition of the Higher School of Economics [2].

As our data on the Fig. 2 shows, the highest results were demonstrated by the winners of the International Mendeleev Olympiad and winners of the All-Russian Olympiad of schoolchildren (WOS), confirming the existing data [3]. Winners of the Olympiads held by the MSU ("Conquer Sparrow Hills!" and "Lomonosov") also showed rather high results. Winners and prize-winners of these four Olympiads exhibit significantly higher achievement (the Fisher criterion,  $p < 0.001$ ) in comparison to students enrolled on the basis of USE scores. In turn, the average scores shown by winners of regional competitions, university-specific, and other Olympiads are not statistically different from those of students admitted on the basis of USE scores (although higher variability in student achievement among the winners of these competitions suggests they may differ in difficulty).

When achievement was traced over four terms (data were available for 2008 and 2009 cohorts), a similar picture was observed, with a monotone tendency towards reduction of performance differences between the winners of the various competitions and non-Olympians (the share of variance in student GPA explained by Olympiad vs. USE admission terms was 13.8% for Term 1, 9.2% for Term 2, 7.9% for Term 3, and 5.6% for Term 4). This may suggest that non-Olympians tend to "catch up" with Olympians who are model students with a positive attitude towards the process of learning.

#### *USE and Olympiads as Academic Performance Predictors*

Psychometrically, an advantage offered by USE scores as a university admission criterion consists in that the USE provides differentiated evaluation on a 100-point scale. USE scores in four subjects (plus an extra subject specific for each particular university) can explain a higher percentage variance in academic performance, compared to achievement in Olympiad on one subject.

Table 2 presents the results of the correlation analysis for the USE scores and first end-of-term exam GPA of students admitted through different procedures. The closest correlate of academic

**Table 2.** Correlations between the USE scores and the first end-of-term exam scores for two student cohorts (admitted in 2009 and 2010)

Subject	Students' subgroup based on the admission procedure			Total sample ( $N = 464$ )
	olympiad winners ( $N = 133$ )	olympiad prize-winners, with olympiad results partially counted ( $N = 168$ )	admitted on competitive basis (USE scores) ( $N = 163$ )	
Russian language	0.18 <sup>c</sup>	0.21 <sup>b</sup>	0.25 <sup>b</sup>	0.20 <sup>a</sup>
Mathematics	0.33 <sup>a</sup>	0.37 <sup>a</sup>	0.24 <sup>b</sup>	0.34 <sup>a</sup>
Physics	0.50 <sup>a</sup>	0.45 <sup>a</sup>	0.26 <sup>b</sup>	0.42 <sup>a</sup>
Chemistry	0.47 <sup>a</sup>	0.33 <sup>a</sup>	0.33 <sup>a</sup>	0.38 <sup>a</sup>

<sup>a</sup>  $p < 0.001$ ; <sup>b</sup>  $p < 0.01$ ; <sup>c</sup>  $p < 0.05$ .

performance is the USE score in Physics. Observed differences in the degree of association between the three student groups suggest that academic performance of students who were Olympiad winners on their subject of specialization is primarily determined by the knowledge of this subject, while performance of students admitted on the basis of USE scores relies more upon their general learning skills. This conclusion was also confirmed by the results of our analysis of the correlation between the students' performance and psychological variables [13]: the winners of subject Olympiads demonstrated higher intrinsic motivation (interest in studying chemistry proper), compared to non-Olympians, whose performance was also driven by different forms of extrinsic motivation.

General linear model analysis was performed to provide quantitative comparison of the relative contributions of the USE scores and Olympiad achievements to students' scores on their first end-of-term exams. The model revealed a satisfactory level of prediction [ $F(6; 415) = 28.69$ ,  $p < 0.001$ ,  $R^2 = 0.29$ ]. The most significant predictors of academic performance were USE scores in Physics [ $F(1; 415) = 25.88$ ,  $p < 0.001$ ,  $\eta^2 = 0.059$ ] and Chemistry [ $F(1; 415) = 23.17$ ,  $p < 0.001$ ,  $\eta^2 = 0.053$ ]. The USE scores in Russian language [ $F(1; 415) = 4.79$ ,  $p < 0.05$ ,  $\eta^2 = 0.011$ ] and Mathematics [ $F(1; 415) = 3.80$ ,  $p = 0.052$ ,  $\eta^2 = 0.009$ ] proved to be relatively weak predictors. Fairly low unique contribution of the USE Math scores can be explained by the fact that the knowledge of mathematics relevant to natural sciences is also needed to pass the USE in Physics. The contribution of the admission procedure [ $\beta = 0.18$ ,  $p < 0.001$ ,  $\eta^2 = 0.044$ ] was slightly less significant than that of the USE scores in Physics and Chemistry, though much a

stronger than that of the USE scores on both non-profile subjects, Russian and Math.

To test the hypothesized validity of the USE scores and Olympiad achievements as long-term predictors of academic performance, we carried out correlation analysis for all the first four end-of-term exam GPAs ( $N = 221$ ) using the data for the 2009 cohort. Though it tended to decrease gradually with time, the association of the USE scores remained significant throughout the first two years of study (for the average score of four exams: the correlation coefficient  $r$  was estimated at 0.51 for the first and second, 0.47 for the third and 0.44 for the fourth term,  $N = 221$ ,  $p < 0.001$ ). The role of the admission procedure also tends to decrease ( $r = 0.31$  and  $0.23$  for the 1st and 2nd end-of-term exams, respectively, and  $0.21$  for the 3rd and 3th end-of-term exams,  $p < 0.01$ ), indicating a gradual reduction of the gap in academic performance between Olympians and non-Olympians.

Overall, our results show that, when applied as entrant selection criteria by higher educational institutions, both the USE scores and Olympiad achievements are valid predictors of subsequent performance demonstrated at the first end-of-term exams. The predictive power of winning an Olympiad (based on the proportion of variance explained, a comparable correlation with academic performance would be  $r = 0.36$ ) is approximately equal to that for scores on one USE exam. However, the data suggest that the Olympiad achievements and the USE scores are not interchangeable predictors of subsequent student performance. The Olympiad achievement criterion allows to select the most successful students, while the USE scores serve as a good criterion in the medium range of academic success.

*Demographic Characteristics as Predictors of Academic Performance of Chemistry Students*

Among the variables significantly correlated with students' performance during the first two years of study there were also the students' gender and region of origin. Like in the above-described analysis, we used Repeated Measures ANOVA for the 2008 and 2009 cohorts, without taking into account the data for expelled students ( $N = 380$ ). Independent variables were gender, admission procedure (2 levels: including Olympiad achievements/USE scores only), and region of origin (3 levels: Moscow and its vicinity, other regions of Russia, and foreign countries).

The difference in performance between male and female students was only significant in the non-Olympian group (the effect of interaction of gender and admission procedure:  $F(1;371) = 5.01$ ;  $p < 0.05$ ;  $\eta^2 = 0.013$ ). In that group female students performed significantly better, but the effect of gender was not significant for the whole sample. During the first two years of study, female students both from among Olympians and non-Olympians (with expelled students excluded) exhibit steady performance, while the academic performance of male students tends to monotonically deteriorate [ $F(3;1113) = 15.03$ ;  $p < 0.001$ ;  $\eta^2 = 0.039$ ].

The region of origin also proved to be a significant predictor [ $F(1;371) = 6.11$ ;  $p < 0.05$ ;  $\eta^2 = 0.016$ ]. Foreign students (winners of the international Mendeleev Olympiad) demonstrated the highest and most consistent performance, students from other regions of Russia showed medium performance, and students from Moscow performed fairly low (in comparison with the two other groups). This can be explained by the differences in the election criteria used: only the best-trained students arrive from abroad and from other regions of Russia, while residents of Moscow constitute the bulk of the sample. This effect of the region of origin is independent of the more powerful main effect of admission procedure [ $F(1;371) = 21.70$ ;  $p < 0.001$ ;  $\eta^2 = 0.055$ ].

To get a better insight into the association between the demographic variables and students' performance, we analyzed specific patterns of academic performance exhibited during the first two years of study by students from two cohorts (admitted in 2008 and 2009, except for those expelled,  $N = 380$ ). To this end we used the end-of-term GPA scores for each of the first four terms. The GPAs were standardized within each

cohort, after which cluster analysis was applied (Ward's method using Squared Euclidean distances). As a result, five groups were identified (Fig. 3): (1) "excellent students," demonstrating consistently high performance ( $N = 142$ ); (2) students who get only good and excellent marks, demonstrating a positive trend ( $N = 53$ ); (3) students demonstrating medium performance with a positive trend ( $N = 59$ ); (4) students demonstrating medium performance with a negative trend ( $N = 55$ ); and (5) students demonstrating poor performance with negative trend ( $N = 71$ ). The students who were expelled and resumed their study constituted a separate group ( $N = 116$ ).

The uniformity of the distribution of the values of each demographic variables across the student performance groups was tested using chi-square test. The results obtained (Table 3) provide the demographic portrait of students who demonstrated different achievement pattern during the first two years of study. For example, most low achievers and expelled students are male natives of Moscow, admitted on a competitive basis. By contrast, among high-performing students, the proportion of females, natives of other regions of Russia, and foreign countries proved to be significantly higher than expected. Mediocre students are, for the most part, those admitted on a competitive basis with Olympiad achievements counted. Our data show that some of the Olympians (roughly a quarter of the sample) show negative performance dynamics. A possible reason may be lower levels of psychological well-being and personality potential (that predict students' productivity and good performance) in a small proportion of Olympians. This makes it hard for them to cope with difficulties associated with studying at a big university and entering a new stage of their life in a big metropolis of Moscow [11].

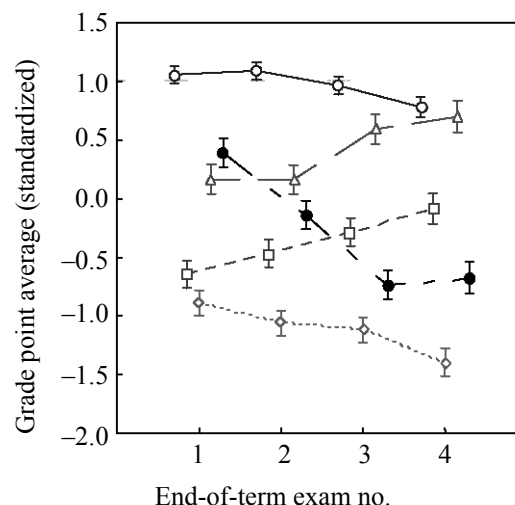
To summarize, the Olympiad achievements and USE scores are reliable criteria for admission to natural science departments of universities. At the same time, admission procedure based on each of these criteria has its specific features and advantages, benefiting certain types of secondary school graduates.

Psychological characteristics [12] of students admitted on the basis of their Olympiad achievements are consistent with a more steady performance in the long term, compared to that of students admitted on a competitive basis. In particular, Olympians demonstrated higher intrinsic motivation and lower extrinsic motivation to learning. They also reported greater

confidence in their choice of the specific department, which indicates a stronger motivation to studying Chemistry. Also, Olympians have better consistency of interests and higher purposefulness, as well as enhanced self-control capacities, they are able to concentrate on the task set and suppress unwanted impulses in order to achieve significant goals. In short, Olympians have stronger learning and achievement motivation [15] and higher personality potential [14].

To conclude, more research is needed to evaluate the efficacy of the two systems of entrant selection, especially in humanities. Some experts believe that humanities “suffer” most severely from the consequences of school graduates’ admission to universities on the USE score basis. The reason lies both in the type and content of the USE tasks and associated superficial approach to teaching humanities. In this situation, educational process is transformed into “races,” in which school teachers concentrate their efforts on preparation of their students to the USE, emphasizing rote learning of formal, unsystematic, and fragmented knowledge. The study of the Russian Rectors’ Union [2] showed that Olympians admitted both in 2009 and 2010 who chose social sciences performed poorer, on the average, than did non-Olympians admitted on usual terms.

The following conclusions can be drawn from this study:



**Fig. 3.** Standardized grade point averages of clusters for the first four end-of-term exams (vertical lines represent the 0.95 confidence level). (○) Excellent students, (Δ) students who get only good and excellent marks, (□) positive dynamics, (●) negative dynamics, and (◇) underachieving students.

(1) Students admitted to universities on the basis of their Olympiad achievements significantly outperform students admitted on a regular USE score competition basis during the first two years of studies. The high results achieved at Olympiads predict subsequent academic performance with varying degrees of reliability. The highest academic performance is

**Table 3.** Percentage of students with different demographic characteristics in students’ groups demonstrating different performance dynamics<sup>a</sup>

Demographic variable		Percentage in indicated performance group, %						Sign. of diff.
		Excellent	Good	Medium:Positive	Medium:Negative	Poor	Expelled	
Gender	Male	58	32	39	76	65	84	$\chi^2(5) = 64.7;$ $p < 0.001$
	Female	42	68	61	24	35	16	
Region of origin	Russia	56	62	54	51	47	40	$\chi^2(10) = 30.2;$ $p < 0.001$
	Moscow	34	34	46	47	52	56	
	Countries of the far abroad	10	4	0	2	1	4	
Admission procedure	Olympiad	50	34	8	31	21	19	$\chi^2(10) = 66.5;$ $p < 0.001$
	Olympiad + competitive selection	25	19	34	31	20	23	
	Competitive selection	25	47	58	38	59	58	

<sup>a</sup> Gray-highlighted cells contain higher than expected data.



demonstrated by winners of International Mendeleev Olympiad and All-Russia Schoolchildren Olympiad, as well as of two MSU Olympiads, "Conquer Sparrow Hills!" and "Lomonosov".

The results of Olympiads and the USE scores are weakly related, independent predictors of academic performance in students. They independently contribute to subsequent academic achievement of students. The USE scores in different subjects possess different predictive power with respect to subsequent academic performance. For example, the most significant predictor of academic performance in the field of fundamental chemistry taught at the university is the USE score in Physics. This finding is essential for the procedure of admission to a higher educational institution.

Students admitted on a competitive basis and on the basis of their Olympiad achievements have different psychological characteristics. Although high USE scores and winning Olympiads are both indicative of persistence and grit, they are backed by different internal causes. There are essentially different motivational patterns behind these achievements. Olympiad winners possess significantly higher purposefulness, intrinsic motivation, and interest in learning, which explains their consistently high long-term performance. Psychological well-being of the Olympians is not associated with their academic performance.

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