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Influence of Evaluation System on Effectiveness of Foreign Students' Mathematical Education

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Abstract

This paper studies the problems of improving the quality of mathematics education of foreign students in Tomsk Polytechnic University. We found out that changes in the evaluation system had provided students progress in studying math. The effectiveness of point rating system introduction is proved according to statistics over the last 5 years. The research involved the application of mathematical statistics, correlation analysis and variance analysis methods. Influence of different evaluation systems on the final grade is shown. We worked out that the studying time started to be used more rationally and the students' activity increased during the term. Observational results showed a higher level of motivation, orderliness and responsibility. Assessment of the permanent knowledge confirmed the expected results.

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Keywords: Foreign students; Calculus; Algebra; evaluation system; exam grade; final grade; average semester grade.

1. Introduction

Over the last few years, higher education in Russian universities has changed to the two level system (Bachelor-Master) widely used in many countries. This gave rise to the necessity to reform educational technologies as well as the evaluation system. The problem of evaluation attracts a lot of attention as it clearly shows a connection between

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a student's activity and his professional advancement. Different evaluation systems have been used for more than 60 years all over the world. The main points of these systems must be accessibility for students and entrants. However, their perfectibility is still discussed (Borland, 2002; Richard Frye et al., 2007; Judith Dodge, 2009).

In Russia this problem has appeared after joining the Bologna process. As a result, the point rating system became well-spread in higher school. Its theoretical aspects are considered by Boev O. & Chuchalin A. (2004); Arzhanik & Chernikova (2010); Perevoschikova (2012).

2. Discussion

This article is dedicated to the comparison between two evaluation systems: traditional and point rating, and finds out their effectiveness. We research the grades in math of several student groups (from 40 to 70 persons) studying IT, based on statistics over the last five years in National Research Tomsk Polytechnic University (TPU).

2.1. The traditional and the point rating evaluation system

In the traditional evaluation system, the total grade of subject is a result of the final examination. Thus, results of studying during the semester don't influence the overall result. And, moreover, the final exam often doesn't show students' competence but continues a studying process. The point rating evaluation system has some advantages: a) encourages students to study regularly; b) controls students' progress; c) raises students' responsibility; d) makes the overall result more predictable; e) stimulates self-education etc. Except for obvious differences, this system is more flexible at management of the studying process. Depending on chosen criteria of evaluation, it is possible to develop necessary skills and expected competences. We mark out the following ways of control: an entrance test, current tests, intermediate control (the sum of current semester tests' marks) and a final test. The overall result (maximum is 100 points) consists of summary control (maximum is 60 points) and a final test (maximum is 40 points). The main idea of an entrance test is to work out problems in some branches of mathematics, which is essential for success in further education. According to the score of this test, lecturers can choose an appropriate studying plan: elite (profound study), basic or adaptive (for weaker students).

2.2. The comparison of the results

The comparison of the marks of Russian State Exam (RSE) in Math and an entrance test is given in the table 1. This table shows that the results of RSE and the entrance test are not the same. It is explained by the difference in aims and contents of these tests.

Table 1. Average marks and correlation between RSE (Math), entrance test and final test in Calculus (the 1st semester)

	2009	2010	2012	2013
Average score of RSE (%)	62,9	68,3	65,1	74,1
Average of the entrance test marks (%)	57,6	46,4	55,4	60
Correlation between RSE and the final test results	0,31	0,34	0,27	0,38
Correlation between entrance test and final exam results	0,52	0,46	0,62	0,4

In 2009 and 2010 the traditional evaluation system was used. The progress in semester had no influence on exam results. There are histograms of average semester grades and exam grades in Calculus in the figure 1. We used ten-point scale. Points greater 5.3 mean "passed".

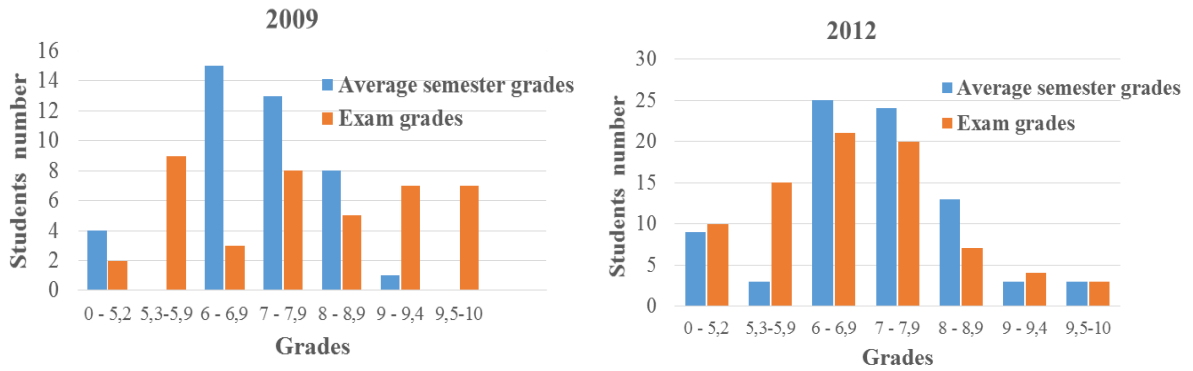


Fig.1. Histograms of average semester grades and exam grades in Calculus.

We see in histogram 2009 that students’ success in a semester correlates weakly with their exam grades. The majority started studying seriously only before exams. However, weak students working hard during the whole term failed. At the same time, stronger ones could miss the lessons and successfully pass the final test. As a rule, such an attitude for studies was followed by a fail in the second semester. Thus, we annually observed 15-20% of stronger students repeating the first year or flunking out.

Since 2011, point rating evaluation system is used in Tomsk Polytechnic University. The advantages of this system can be seen in the figure 1. On the one hand, it supports weak students and encourages the others to study regularly, while ambitious and gifted ones are motivated to prepare for every test. On the other hand, getting points seems to be more important than extending knowledge for some students. Anyway, the reform of evaluation system raised the level of self-motivation.

In figure 2, we see the average final grades for the first and the second semester for the 5 years. Average progress in the first term is obviously poorer than in the second. We should note that subjects of the first semester (Calculus and Algebra) include some concepts that are already known since highschool, for example, ‘limit’, ‘derivative’, ‘vector’, ‘system of linear equations’ etc.

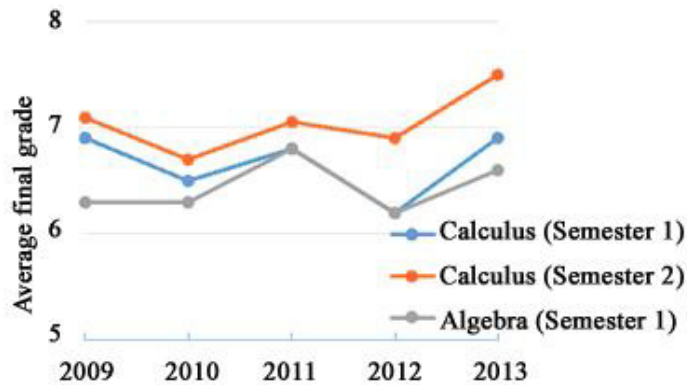


Fig.2. Average final grades for the first and the second semester in Math.

It means students already know basic ideas of these subjects and then generalize their knowledge. The main problem is that students are not able to get a huge amount of information in a short period of time and unify separate facts into one theory. The second semester is more difficult, because students have to study new abstract themes as a continuation of the previous ones.

So we can conclude the students demonstrate significant outcomes – the ability to learn in the second semester.

2.3. Correlations

Lecturers at first expected the new evaluation system to provide a chance to do less exam preparation as students get 60% of a final grade during a semester. The table 2 shows that in 2009-2010 when results of studying during the semester didn't influence a final grade, the correlation between an average semester grade and an exam grade was quite weak (the coefficient of correlation is less than 0.4).

Table 2 Coefficients of linear correlation between average semester grade and exam grade, and between exam grade and final grade

	Average semester grade and exam grade		Exam grade and final grade	
	1st semester	2nd semester	1st semester	2nd semester
	Calculus/Algebra		Calculus/Algebra	
2009	0.35	0.54		
2010	0.38	0.52		
2011	0.35	0.70	0.80	0.91
2012	0.60/0.70	0.40	0.85/0.97	0.86
2013	0.40/0.64	0.60	0.83/0.90	0.90

In the second semester, the coefficient of correlation raised to 0.5. However, after the reform of evaluation system the correlation between average semester grade and exam grade becomes stronger. Also we observe a tendency of a correlation growth in the second semester. Moreover, in the first semester the correlation practically doesn't change during the whole research period (except for 2012), but in the second semester it started growing since 2010. So does about the average semester grade in the first semester; the changes in evaluating had no influence on the final grades (figure 2). In our opinion, the little changes of the average semester grades are connected with the different quality of basic math preparation given at school.

3. Conclusion

In conclusion, the usage of the new evaluation system gave positive results. Students' efforts became more regular and systematic during the semester. The new way of getting a final grade had its role in motivating students for self-education and responsibility. It reduced the difference between weak but hard-working students and strong but lazy ones and let students control their progress during a semester, deal with their current problems and predict their final result based on semester grades. We worked out better knowledge of students in math disciplines. Perhaps the further development of the point rating system will improve the quality of education in higher school.

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