

# MOTIVATION TO STUDY – STUDENTS' MOTIVATIONAL RESPONSE ON VARIOUS MOTIVATIONAL ACTIONS IN STATISTICAL COURSES

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## Abstract

Motivation to study is a topic to be studied on various levels of educational process, although the methods to be used can be very different. We have examined the motivational response of university students on various motivational actions.

Credit tests results of a sample of Business and Administration study programme students from the period 2009/10 to 2012/13 were analyzed. During this period several motivational actions were accepted. The most important one was a chance to pass the exam on the basis of credit tests results only, if given 15 or more points from maximum of 20 points. On the other hand the students were given less tries to finish the test.

It was found an increase in mean point results especially in the winter term. There is also an increasing percentage of students able to pass the test on the first attempt and increasing proportion of students who are given exam grade on the basis of the credit tests results. Therefore it can be assumed, that motivation in a form of possibility to be given the exam grade on the basis of credit tests, is very strong.

## Key Words

Extrinsic motivation, Motivation to study, Self-determination, Study results, Tertiary education

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## Introduction

Mathematical based subjects are sometimes considered to be more difficult, especially for students of non-mathematical study programmes. However, mathematical thinking is crucial for today's information and technology based society. The study of mathematics and mathematical based subjects provides the students knowledge skills and attitudes of mind that are essential for successful participation in such a society (Ali et al, 2011).

Therefore mathematical-based subjects should be an essential part of structure of university study programmes. The article deals with students' study results in subjects Statistics I and Statistics II for the Business and Administration study programme. It aims to evaluate the effect of various motivational actions on students' results.

Siddiqui (in Ali et al, 2011) presents several motivational factors for students such as parental pressure, classrooms environment or teacher and peer approval.

Ali et al (2011) provides a list of possible effects of motivation that can e.g.

- Direct behaviour toward particular goals;
- Lead to increased effort and energy;
- Lead to improved performance;
- And others.

Generally, there are two types of motivation which are extrinsic (external) motivation and intrinsic (internal) motivation. The classification is closely connected with the degree of self-determination. Extrinsic motivation refers to motivation that comes from outside an individual. "*External motivation arises by*

*external factors such as family, teachers and environment. External motivation can be given in the form of praise, gifts, good grades, incentives and so on"* (Sendogan and Iksan, 2012).

On the other hand, intrinsic motivation is associated with internal drivers, such as want or desire. It refers to doing something, because it is interested and important for the student, it is an encouragement for a person to do something for his or her self-interest and satisfaction. (Ali et al, 2011, Hassanbeigi et al, 2011, Sendogan and Iksan, 2012).

When intrinsically motivated, people study in activities that interest them, freely just because they want to and without the necessity of material rewards. Extrinsically motivated behaviour, on the other hand, is contributory in nature. In his early research, Deci (1971) stated, that these two forms appeared to be antagonistic, it is that extrinsically motivated behaviours were assumed not to be self-determined.

Later, theory and research have suggested that there are different types of extrinsically motivated behaviours and that these types differ in extent to which they represent self-determined and controlled responding (Ryan and Connell, 1989). Lot of studies have also explored the relation between extrinsically and intrinsically motivated behaviour (Deci, 1971, Deci et al, 1991, Hayenga and Corpus, 2010, Vallerand and Bissonnette, 1992).

There are several studies that have investigated the students' performance and their motivation (e.g. Cheng, P. et al., 2011, Goodman et al, 2011, Erdem Keklik, D. and Keklik, I. 2013). During the past years several steps that aimed to motivate the students in writing the credit tests from statistics in Business and Administration study programme at CULS University, were realized. Thus, in particular the article aims to evaluate the possible motivational response by reviewing the credit test results in past four study years.

## Materials and Methods

Statistics is a part of Business and Administration study programme in the second year of bachelor degree. In the winter term the students are introduced the principles of probability, probability distribution or descriptive statistics and hypothesis testing in the lessons of subject Statistics I., during the summer term mostly the principles of regression and correlation analysis together with time series analysis are taught in the lessons of Statistics II.

During both the winter and the summer term the students are to pass two tests to get the credit. Each test is for twenty points in maximum, the minimum to pass is 10 points. In past years several actions to motivate the students in writing the credit tests were realized.

In the school year 2010/11 the credit test results were for the first time considered a part of the exam grade. The final exam grade was set down as a weighted average of the credit tests results and the exam test results. Next year further actions to motivate the students were realized. From 2011/12 the number of possible tries has decreased to four, while in previous years the students were given three tries for each test that is six in total. Therefore, the students were not motivated to succeed in the first try. Newly, the students were given four attempts for both the 1<sup>st</sup> and the 2<sup>nd</sup> test in one term together. So if the student succeeds in the 1<sup>st</sup> test for the first time and then he fails in the 2<sup>nd</sup> test, he can repeat the second test two times. On the other hand, writing the 1<sup>st</sup> test up to the third try leads in only one possibility of writing the 2<sup>nd</sup> test.

While reducing the number of possible tries, we wanted to motivate the students by rewarding very good credit test results. Therefore, the students were given chance to pass the whole

exam on the basis of good results at the credit tests. Students, who pass both the 1<sup>st</sup> and the 2<sup>nd</sup> test for the first try and are given 15 points and more, do not need to take the exam. For eighteen and more points from both tests the student is given "excellent", the others with 15 or more points are graded "very good".

### Statistical methods used

For data analysis, following statistical methods were used. More details about the methods can be found in e. g. Field (2005) or Freedman et al (2007).

First the data were characterized using basic descriptive statistics: the arithmetic mean and standard deviation (SD). For each subgroup of observations the sample size (n) is given. While there were enough observations in each group and the data show no violations of normal distribution assumption, for numerical variables parametric methods were used. For comparing two independent groups (boys compared to girls), independent samples t- test was used. One-way analysis of variance (ANOVA) was used to evaluate the impact of one factor which is of more than two categories (e. g. differences between various school years). To found out, whether there is difference in tests results' development between boys and girls two-way ANOVA with interaction was implemented. If necessary, for further analysis of ANOVA, Scheffes' method was proved.

For data analysis of qualitative variables, contingency tables were used. The relation between two qualitative variables was evaluated using chi-square test.

It was considered 5% level of significance for all statistical tests. The analyses were performed using statistical software IBM SPSS Statistics, v. 20.

## Results

We examined the test results of a sample of students attending the subject in the last four years. Table 1 summarizes the test results (two tests for each term) for male and female separately in the period 2009/10 to 2012/13. The table provides the sample size, the mean and the standard deviation of the first try. As already mentioned, the maximum for each test was twenty points.

school year			female			male		
			n	mean	SD	n	mean	SD
2009/2010	winter term	1 <sup>st</sup> test	91	10.24	5.17	52	8.64	4.85
		2 <sup>nd</sup> test	91	11.22	4.48	50	8.10	4.31
	summer term	1 <sup>st</sup> test	94	10.95	5.26	43	8.65	5.41
		2 <sup>nd</sup> test	94	9.34	4.51	42	7.61	4.17
2010/2011	winter term	1 <sup>st</sup> test	87	11.80	5.80	29	8.60	4.61
		2 <sup>nd</sup> test	84	11.60	5.26	26	9.33	4.53
	summer term	1 <sup>st</sup> test	104	12.04	5.45	54	8.91	5.00
		2 <sup>nd</sup> test	103	11.62	5.07	49	11.00	5.05
2011/2012	winter term	1 <sup>st</sup> test	194	10.66	5.81	79	9.06	5.43
		2 <sup>nd</sup> test	189	12.04	4.70	76	8.39	5.22
	summer term	1 <sup>st</sup> test	72	12.06	4.55	26	9.38	5.95
		2 <sup>nd</sup> test	71	13.27	4.08	25	10.14	5.66
2012/2013	winter term	1 <sup>st</sup> test	67	11.34	5.66	43	11.55	6.37
		2 <sup>nd</sup> test	61	12.39	4.67	38	11.22	5.27
	summer term	1 <sup>st</sup> test	150	11.46	5.35	71	7.86	5.42
		2 <sup>nd</sup> test	142	11.75	5.13	61	10.20	4.42

**Table 1: Descriptive characteristics of the test results, 2009/2010 – 2012/2013**

It is obvious that number of female exceeds number of male each year. On the basis of the descriptive characteristics we can also expect girls to achieve better results compared to boys. To prove this assumption, statistical tests were performed. The differences between boys and girls in mean points were compared using independent-samples t-test. The test results were compared separately for winter and summer term. Not considering various school years, it was found that there is significant difference between boys and girls in the first as well as in the second test, both winter and summer term. Table 2 provides the independent-samples t-test results.

		test statistic	df	p-value
winter term	1 <sup>st</sup> test	3.12	640	0.00190
	2 <sup>nd</sup> test	6.67	613	<0.0001
summer term	1 <sup>st</sup> test	6.68	612	<0.0001
	2 <sup>nd</sup> test	3.67	585	0.00026

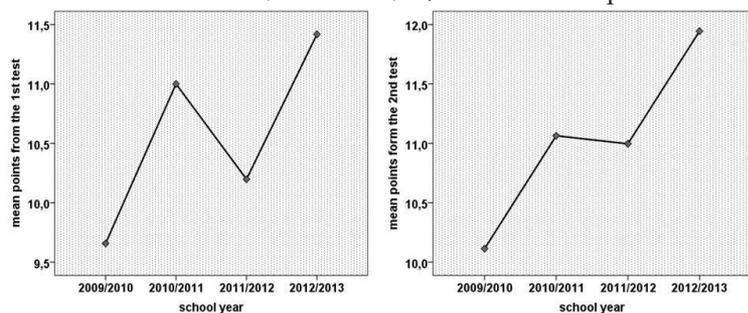
**Table 2: Comparing the test results between boys and girls – independent-samples t-test results**

When various school years were taken into consideration, significant differences were found for almost every test and year excepting the first test in 2009/10 ( $p=0.072$ ), the last test in the school year 2010/11 and both tests in winter term 2012/13. Female are always characterized by higher mean points, the mean difference ranges between 1.5 and 3.6 points.

Due to the main aim of the article, that is to evaluate the effect of various motivational actions on students' results, it was proved,

whether there is any change in mean points in the given period. Each test results, the 1<sup>st</sup> and the 2<sup>nd</sup> test in winter and summer term, were evaluated separately. One-way analysis of variance (ANOVA) with the factor *school year* and post-hoc Scheffe's method were used.

Figure 1 represents the mean points for the 1<sup>st</sup> and the 2<sup>nd</sup> test in winter term from 2009/10 to 2012/13, the first attempt.

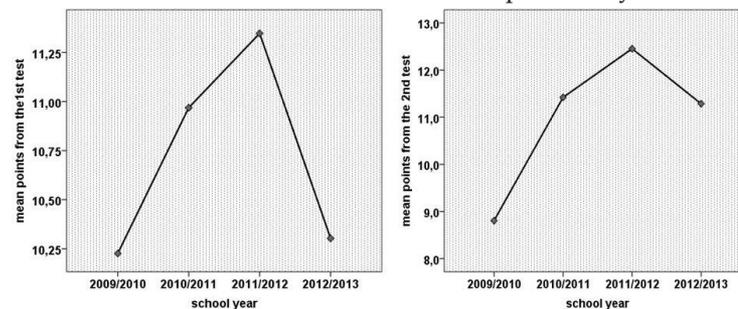


**Figure 1: Mean number of points from the 1<sup>st</sup> and the 2<sup>nd</sup> test in winter term, 2009/2010 – 2012/2013**

There is an obvious increase after 2009/2010, which is stronger for the second test. There is significant difference in mean points for the 2<sup>nd</sup> test ( $p=0.048$ ), for the 1<sup>st</sup> test the results are very close to statistical significance ( $p=0.052$ ). As it was already stated, in 2010/11 credit test results became part of the final exam and from 2011/12 the students were given chance to pass the exam on the basis of credit test results (15 and more points but for the first try only). If 2009/10 is compared to the results from all other years taken together, significant difference is found both

for the 1<sup>st</sup>, as well as the 2<sup>nd</sup> test ( $p=0.047$ , resp.  $p=0.023$ ). The mean increase is about one point (1<sup>st</sup> test: 9.66/10.66 points, 2<sup>nd</sup> test: 10.11/11.21 points).

Similar analysis was performed for the summer term. Figure 2 shows the test results for summer term in past four years.



**Figure 2: Mean number of points from the 1<sup>st</sup> and the 2<sup>nd</sup> test in summer term, 2009/2010 – 2012/2013**

School years 2010/11 and 2011/12 are characterized by increasing mean points compared to 2009/10. Using one-way ANOVA, significant difference was found between the results of the 2<sup>nd</sup> test ( $p<0.0001$ ) with 2009/10 results significantly different in comparison to all other years (Scheffe's method, all  $ps<0.001$ ). Although an increase in mean test results can be observed between 2010/11 and 2011/12, there is clear decrease in the last school year both for the 1<sup>st</sup> as well as the 2<sup>nd</sup> test. Therefore we sought for any reason of worse test results in the last year. In previous years, students who did not pass subject Statistics I in winter term, were not allowed to continue with Statistics II in summer term. Newly, in 2012/13 such students were given chance to continue with statistics in the summer term.

The question is therefore, whether this step could have led to an overall decrease in test results. Hence, following analysis focussed on such students was proved.

It was found, that from the total of 45 students not given the credit because of not passing the credit tests in winter term 2012/13 and despite of it continuing with the subject Statistics II, almost 69% (68.89%) of these students did not pass the credit tests in summer term as well. Most of these students also have problems with other subjects. Boháčková and Brožová (2012) who analyzed the exam grades of FEM students introduced two reasons why students could be of bad results. First they argued that some students are achieving worse results because they are not sufficiently devoted to the preparation even if they do evince the skills needed. Secondly they speak about a group of students who are not able to pass the subject, because their general learning potential and capabilities do not allow them to meet the requirements, although they “do their best” through preparation. Such students are hardly to be encouraged by motivations such as possibility of being given grade on the basis of credit test results.

To evaluate the possible improvement in the test results, it was also studied whether there is any increase in proportion of students, who are able to pass the credit test on the first try. Using chi-square test for contingency table, relation between school year and success on the first attempt was evaluated. Comparing 2009/10 to other years, significant relation between school year (and therefore potential benefits for exam) and passing the test on the first try was found for the 2<sup>nd</sup> test both in winter and summer term. Table 3 summarizes the results of chi-square test.

	test statistic	df	p-value
winter term	4.107	1	0.043
summer term	22.044	1	<0.0001

**Table 3: Relation between school year and successfully passing credit test on the first attempt, 2009/2010 compared to other years – results of chi-square test**

Table 4 and 5 display the proportion of students successfully passing the test on the first try in relation to the school year, this is before and after adopting the rules aiming to motivate the students to better results.

		successfully passing test on the first attempt		total
		NO	YES	
school year	2009/2010	62	79	141
		43.97%	56.03%	100%
school year	2010/2011 to 2012/2013	164	310	474
		34.60%	65.40%	100%
total		226	389	615
		36.75%	63.25%	100%

**Table 4: Successfully passing test on the first attempt in relation to the school year – winter term, the 2<sup>nd</sup> test**

		successfully passing test on the first attempt		total
		NO	YES	
school year	2009/2010	67	69	136
		49.26%	50.74%	100%
	2010/2011 to 2012/2013	125	326	451
		27.72%	72.28%	100%
total		192	395	587
		32.71%	67.29%	100%

**Table 5: Successfully passing test on the first attempt in relation to the school year – summer term, the 2<sup>nd</sup> test**

The results indicate increase in proportion of students successfully passing the test on the 1<sup>st</sup> try in case of the 2<sup>nd</sup> test both in winter and summer term. In the period 2010/11 to 2012/13 the proportion increased to 65.40% compared to 56.03% in 2009/10 (winter term) and from 50.74% to 72.28% (summer term). For the 1<sup>st</sup> test no statistically significant difference in proportion of successes on the first try was found.

It can be assumed that students who were successful in the 1<sup>st</sup> test are than highly motivated to succeed in the 2<sup>nd</sup> test on the first try to be given the exam on the basis of test results. The students are given exam for 15 or more points in both credit tests. It was therefore evaluated, whether students with 15 or more points from the 1<sup>st</sup> test do succeed on the first attempt when writing the second test. Tables 6 and 7 represent the results for school years 2011/12 and 2012/13 in which it was possible to be given the grade on the basis of credit test results.

		2 <sup>nd</sup> test on the first attempt		total
		NO	YES	
1 <sup>st</sup> test for 15 or more points	NO	122	133	255
		47.84%	52.16%	100%
	YES	9	100	109
		8.26%	91.74%	100%
total		131	233	364
		35.99%	64.01%	100%

**Table 6: Successfully passing test on the first attempt in relation to the results of the 1<sup>st</sup> test – winter term**

		2 <sup>nd</sup> test on the first attempt		total
		NO	YES	
1 <sup>st</sup> test for 15 or more points	NO	75	131	206
		36.41%	63.59%	100%
	YES	7	85	92
		7.61%	92.39%	100%
total		82	216	298
		27.52%	72.48%	100%

**Table 7: Successfully passing test on the first attempt in relation to the results of the 1<sup>st</sup> test – summer term**

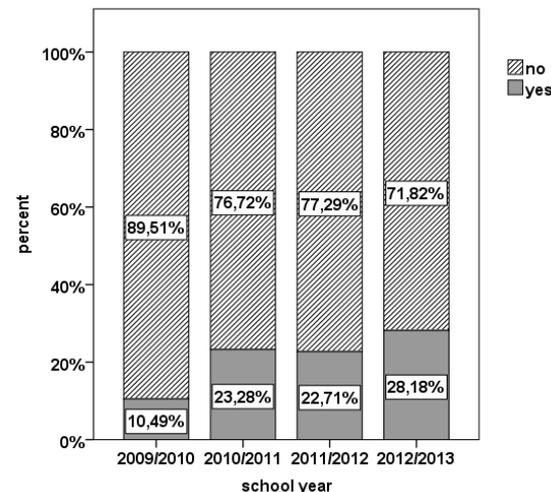
It is obvious, that in both winter and summer term more than 90% of students successfully passing the 1<sup>st</sup> test for 15 or more points, passed the 2<sup>nd</sup> test on the first attempt as well. The relation was evaluated using chi-square test and it was found statistically significant at 1% level of significance as shown in table 8.

	test statistic	df	p-value
winter term	51.943	1	<0.0001
summer term	26.446	1	<0.0001

**Table 8: Successfully passing the test on the first attempt in relation to the results of the 1<sup>st</sup> test – results of chi-square test**

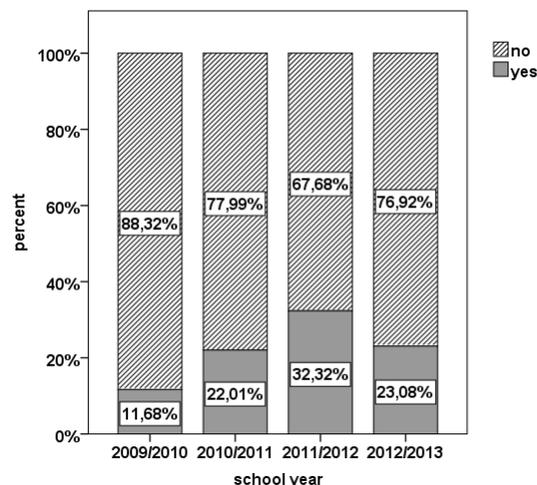
As compared with previous school years, the percentage of students successfully passing the 2<sup>nd</sup> test after being successful in the 1<sup>st</sup> test has increased. For previous two years the proportion ranges from 79.8% in summer term to 88.7% in winter term.

Next, we made a simulation that aimed to evaluate the possible increase in proportion of exam grades being given on the basis of credit tests results. We have computed the percentage of students, who would have been given the exam in that manner in 2009/10 and 2010/11 and the results were compared to 2011/12 and 2012/13. In the last two years the students were given the chance to pass the exam in that manner in practice. Figure 3 shows results for winter term, where there is clear increase after 2009/10. Although in 2010/11 students could not pass the exam by writing the credit tests only, it was the first year in which the credit test results were considered to be a part of exam grade. In school year 2012/13 almost 30% of students (28.18%) succeeded in writing the credit tests and they were not to take the final exam.



**Figure 3: Proportion of students who could be given exam following the credit test results, winter term, 2009/2010 – 2012/2013**

Figure 4 depicts the results for summer term. Although there is a partial decrease at the end of the selected period (2012/13) in proportion of successful students, there is considerable increase after 2009/10. In 2011/12 more than 30% of students (32.32%) passed the exam on the basis of the credit test results. It can be assumed, that the partial decrease in 2012/13 could reflect the results of students who were allowed to attend the subject Statistics II, even that they did not successfully passed subject Statistics I, as mentioned in the text above.



**Figure 4: Proportion of students who could be given exam following the credit test results, summer term, 2009/2010 – 2012/2013**

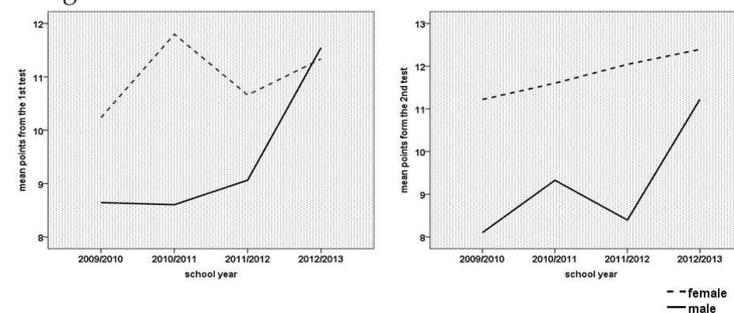
The relation between school year and exam grade was assessed using chi-square test. In table 9, there are results of chi-square test separately for winter and summer term.

	test statistic	df	p-value
winter term	13.772	3	0.003
summer term	14.901	3	0.002

**Table 9: Proportion of students who could be given exam following the credit test results in relation to the school year - results of chi-square test**

For both winter as well as the summer term, null hypothesis about no relation can be rejected. Following figures 3 and 4 it is doubtless, that number of students with possibility of being given exam grade on the basis of credit tests, has increased after 2009/10.

As shown at the beginning, male and female are of different results in long term run. Therefore it was also evaluated whether male and female are of different motivational response. This question was evaluated using analysis of variance with interaction. Figures 5 and 6 depict the mean points for the 1<sup>st</sup> and the 2<sup>nd</sup> test in winter and summer term, separately for boys and girls.



**Figure 5: Mean number of points from the 1<sup>st</sup> and the 2<sup>nd</sup> test in winter term, differences between boys and girls**

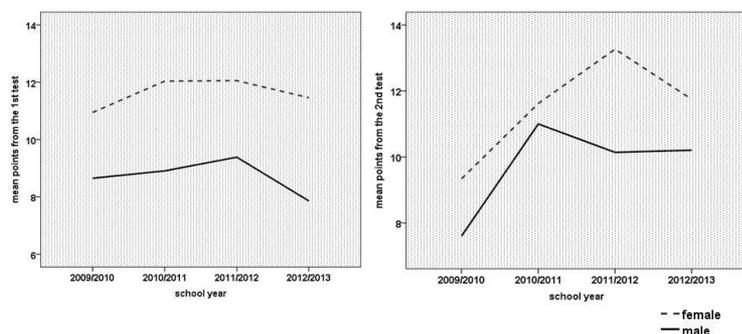


Figure 6: Mean number of points from the 1<sup>st</sup> and the 2<sup>nd</sup> test in summer term, differences between boys and girls

It is obvious, that for both the 1<sup>st</sup> as well as the 2<sup>nd</sup> test in winter term boys catch up girls following the mean points from test. Although there is quite wide difference at the beginning of the period, in 2012/13 boys are of very similar results compared to girls in winter term.

The process in the summer term is little bit different. The first graph of Figure 6, that represents the results of the first test in summer term, depicts clear difference between boys and girls but the development is more or less the same. For both the 1<sup>st</sup> as well as the 2<sup>nd</sup> test there is decrease in mean points at the end of the period that was already discussed previously. To evaluate the differences in test results between boys and girls and also the interaction between gender and school year, which denotes different development in 2009/10 to 2012/13 for boys and girls, analysis of variance (ANOVA) with interaction was computed. The results are summarized in table 10.

		p-value	
		differences between boys and girls	different development of test results between boys and girls (interaction between gender and year)
winter term	1st test	0.002	0.053
	2nd test	<0.0001	0.031
summer term	1st test	<0.0001	0.554
	2nd test	<0.0001	<0.0001

Table 10: Differences in test results' development between boys and girl - results of ANOVA with interaction

The analysis of variance confirms the previous results about different mean points when comparing boys and girls. For the second test in winter as well as in the summer term, there is significant interaction between gender and school year which indicates different development of test results between boys and girls in the given period. For the 1<sup>st</sup> test in winter term the interaction is very close to statistical significance ( $p=0.053$ ). It can be stated that boys are of stronger increase at the end of the period compared to girls in the winter term.

For the second test in summer term, the significant interaction reflects the fact, that the mean results for boys show slight increase, while the mean results of girls are decreasing at the end of the period. Although the test results in winter term can be characterized by increase for both boys and girls, boys show more positive development in school years 2011/12 and 2012/13, so it can be assumed that they are more motivated to pass the test on the first attempt.

## Discussion

The aim of the analysis was to find out, whether there was an improvement in test results between 2009/10 and 2012/13. After 2009/10, several actions that aimed to motivate the students to pass the test on the first attempt and as good as possible, were carried out. As a part of the analysis it was found, that there is significant difference between the results of boys and girls, so it was also evaluated whether boys and girls are of different development and therefore of different motivational response.

The test results were analyzed separately for winter and summer term, each term the students are to pass two credit tests. Differences between the four school years being compared were evaluated using one-way analysis of variance.

For winter term significant difference was found for the 2<sup>nd</sup> test, where there is obvious increase in mean points after 2009/10. For the first test p-value is very close to statistical significance ( $p=0.052$ ). When 2009/10, school year in which the credit test results were not part of the exam, is compared to the whole period 2010/11 to 2012/13, there is significant difference for both the 1<sup>st</sup> as well as the 2<sup>nd</sup> test ( $p=0.047$ , resp.  $p=0.023$ ). In winter term, the mean points (for the 1<sup>st</sup> try) decreased after 2009/10 for about 2 points, while the best results can be observed for 2012/2013, 11.42 points for the 1<sup>st</sup> test and 11.94 points for the 2<sup>nd</sup> test. Therefore it can be assumed, that taking the credit tests results as a part of the exam led to stronger effort of the students. From 2011/12 the students were given chance to pass the exam only on the basis of the credit tests results, when given 15 or more points on the first attempt. This seems to

be even stronger motivation, while it gives the students an opportunity to decrease number of exams to be passed during the examination period.

For the summer term, the results were little bit different. Although there is obvious increase in mean points in 2010/11 and 2011/12 for both credit tests, in 2012/13 the results became worse. In 2012/13 there were 45 students who were not given credit in the winter term, because not passing the credit tests. Though, these students were given chance to pass the subsequent statistical course. In previous years students who were not given credit in winter term, were not allowed to continue in summer term. From the 45 students, almost 70% did not succeed in passing the summer statistical course. This could be the possible reason of decreasing mean points in the summer term 2012/13. However, there is still increase after 2009/10 and therefore a positive motivational response.

It was also studied, whether there is increase in the proportion of students able (or willing) to pass the test on the first try. Comparing 2009/10 to all other school years, significant increase in the proportion was found for the 2<sup>nd</sup> credit test (both winter and summer term). In 2009/10 the percentage of students who passed the 2<sup>nd</sup> test on the first attempt was 56% (winter term) and about 51% (summer term). In next three years the percentage ranged between 62% and 70%, resp. 70% and 76% for the summer term. For school years 2011/12 and 2012/13 we have also limited the number of possible attempts to pass the test. The students are given four tries for the whole school term (for both tests together!), so it forces them to succeed on the first attempt. On the other hand they are given the chance to be directly given the exam grade.

As already mentioned, the students are given the exam grade for 15 or more points. It was therefore evaluated, whether students

who are given 15 or more points from the 1<sup>st</sup> test, do more often pass the 2<sup>nd</sup> test on the first attempt. While the rule with exam grades was established in 2011/12, the analysis was proved for the last two school years only. It was found, that more than 90% of students with 15+ points from the 1<sup>st</sup> test are successful on the first try when writing the 2<sup>nd</sup> test. The relation is highly significant ( $p < 0.00001$ ) for both winter as well as the summer term. Although it could be argued that only clever and diligent students can succeed like this and that it is therefore only a picture of such students, following results (together with previous ones) support our belief in positive motivational response.

It was proved how many students would be given exam grade for 15 and more points for each school year in the given period. In winter term, the percentage increased from 10.5% in 2009/10 to more than 28% in 2012/2013. In summer term the percentage in 2012/13 was 23%, in 2011/12 even more than 32% compared to 11.7% in 2009/10. Using chi-square test, significant relation between the school year and proportion of students to be given the exam grade for very good credit tests results was found. It means that after 2009/10 the percentage of students able and willing to pass the test on the first attempt for 15+ points has highly increased. Therefore it can be assumed, that motivation in a form of opportunity to pass the exam on the basis of the credit tests, is very strong. Surprisingly it looks like if it is highly motivating rather for boys than girls. Analysis of interaction between school year and gender showed, that at the end of the observed period, especially in winter term, boys catch up girls, though girls are generally of better results.

At the beginning of the article two types of motivation were introduced: extrinsic and intrinsic. While extrinsic motivation

relates to motivation that comes outside an individual, intrinsic motivation is associated with internal drivers and therefore with self-determined motivation (see e. g. Ryan and Deci, 2000). Deci et al (1991) studied the relation between extrinsic motivation and self-determination. He makes a parallel between motivation and satisfaction of basic psychological needs. *"Simply stated, motivation, performance, and development will be maximized within social contexts that provide people the opportunity to satisfy their basic psychological needs for competence, relatedness, and autonomy"* Deci et al (1991). Giving the students a chance of being given an exam grade on the basis of the credit tests, seems to be understood a bit different when compared to a classical approach of passing the credit test to be able to go to the exam. During the school term, the students are given some extra work to be worked out from choice. Most of the students who are successful in writing the tests for the first trial with good results regularly work out this voluntary work. Therefore, it can be assumed that this type of extrinsic motivation ('for very good work during the semester you are given the chance not to take the exam'), causes behaviour that is intrinsically motivated ('to be able to pass the test, I need to finish the extra work - which is voluntary').

Following Deci et al (1991) this type of motivation can be understood as *identified regulation*. *"Identified regulation occurs when the person has come to value the behaviour and has identified with and accepted the regulatory process"* (Deci et al, 1991). He gives an example of student who willingly does extra work because he believes it is important for continuing to succeed at particular subject. Although an extra homework is a type of extrinsic motivation, in this case it is completed willingly.

## Conclusion

In the paper we have introduced several motivational actions we have adopted to motivate the students of statistical courses to get better results. Using statistical methods, we proved the impact of these actions on students' results. We compared the credit tests results from the period 2009/10 to 2012/13. The first year the students were to finish the credit tests to be able to get the exam, but the credit tests results were not part of the final exam. Next year the credit tests results became part of the final exam grade, which was computed as a weighted average of both the credit tests results and exam test results. From 2011/12 the students were given chance to pass the exam on the basis of credit tests results if given 15 or more points (from the total of twenty points) on the first try.

It was found increasing mean points from the credit tests after 2009/10. When 2009/10 compared to other years, it was also found, that the proportion of students, who are successful on the first attempt have increased with maximum between around 75%. As a part of the analysis it was found, that girls are generally of better results than boys. Despite of it, it looks like boys are of stronger motivational response than girls, because at the end of the period their results became very similar to girls' mean points. We have also found the proportion of students who would have been given an exam grade for 15 or more points from the credit tests for 2009/10 and 2010/11 and this was compared to 2011/12 and 2012/13. The proportion of students, who would have been given exam in that manner, has increased to about 25% in 2012/13 from about 11% in 2009/10. These findings indicate positive motivational response especially in relation to the possibility of passing exam only on the basis of the credit tests results.

The students are given lot of materials which are available to them in LMS Moodle. Part of these materials is an extra work that is to be finished voluntary. The topic for future research is than an analysis of students' activities in LMS Moodle in correspondence to their study results.

## References

- Ali, R. et al (2011) 'The impact of motivation on students' academic achievement in mathematics in problem based learning environment', *International Journal of Academic Research*, vol. 3, no. 1, pp. 306-309.
- Boháčková, I. and Brožová, I. (2012) 'Assessing students' level of knowledge in profile courses of chosen economic study programmes at the FEM CULS Prague', *Journal on Efficiency and Responsibility in Education and Science*, vol. 5, no. 3, pp. 148-156.
- Cheng, P. et al. (2011) 'Attitudes and motivations of students taking professional certificate examinations', *Social Behavior & Personality: An International Journal*, vol. 39, no. 10, pp. 1303-1314.
- Deci, E. L. (1971) 'Effects of externally mediated rewards on intrinsic motivation', *Journal of Personality and Social Psychology*, vol. 18, no. 1, pp. 105-115.
- Deci, E. L. et al (1991) 'Motivation and Education: The Self-determination Perspective', *Educational Psychologist*, vol. 26, no. 3,4, pp. 325-346.
- Erdem Keklik, D. and Keklik, I. (2013) 'Motivation and learning strategies as predictors of high school students's math achievement', *Cukurova University Faculty of Education Journal*, vol. 42, no. 1, pp. 96-109.
- Field, A. (2005) *Discovering Statistics Using SPSS*, London: SAGE Publications Ltd.

Freedman, D. et al. (2007) *Statistics*, New York: W. W. Norton & Company, Inc.

Goodman, S. et al (2011) 'An investigation of the relationship between students' motivation and academic performance as mediated by effort', *South African Journal of Psychology*, vol. 41, no. 3, pp. 373-385.

Hassanbeigi, A. et al (2011) 'The relationship between study skills and academic performance of university students', *Procedia – Social and Behavioral Sciences*, vol. 30, pp. 1416-1424.

Hayenga, A. O. and Corpus, J. H. (2010) 'Profiles of intrinsic and extrinsic motivations: A person-centered approach to motivation and achievement in middle school', *Motivation & Emotion*, vol. 34, no. 4, pp. 371-383.

Ryan, R. M. and Connell, J. P. (1989) 'Perceived Locus of Causality and Internalization: Examining Reasons for Acting in Two Domains', *Journal of Personality and Social Psychology*, vol. 57, no. 5, pp. 749-761.

Ryan, R. M. and Deci, E. L. (2000) 'Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being', *American Psychologist*, vol. 55, no. 1, pp. 68-78.

Sendogan, V. and Iksan, Z. H. (2012) 'Students' Learning Styles and Intrinsic Motivation in Learning Mathematics', *Asian Social Science*, vol. 8, no. 16, pp. 17-23.

Vallerand, R. J. and Bissonnette, R. (1992) 'Intrinsic, Extrinsic, and Amotivational Styles as Predictors of Behavior: A Prospective Study', *Journal of Personality*, vol. 60, no. 3, pp. 599-620.