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ANALYSIS OF STUDENTS' RESULTS IN DISTANCE-STUDIES CENTRES

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Abstract

The present paper focuses on the study results of students of distance-studies centres carried out by the Faculty of Economics and Management at the Czech University of Life Science in Prague. The centres are situated in areas with a generally low concentration of universities and therefore the possibility of university education is relatively low. We observed the students who entered the study field of Public Administration and Regional Development in the academic year 2009/10 and the monitoring lasted first three semesters of their studies. We selected five different courses studied at the centres and subjected them to statistical analyses. The findings show differences in the rigorous nature of the selected courses, students of different age and gender and, last but not least, among individual centres. This information can be useful both for students and studies centres management. For the statistical analysis we used Statistica 9 software.

Key Words

Distance-studies centres, study results, statistical analysis

Introduction

The distance-studies centres of the Faculty of Economics and Management (FEM), Czech University of Life Sciences (CULS) are situated in various places, prevailingly in rural regions of the Czech Republic. These regions have a lower number of university graduates than the Czech average. The lower average education corresponds with higher unemployment and lower salaries. The regional differences are remarkable and the situation has not changed much. Altogether CULS has eight such distance-studies centres.

The reasons for the lower educational level could generally be the worse economic situation, a weaker tradition in higher education as well as others. But recently we can see two very clear problems.

First, young students study at universities in big cities and after their graduation they do not return to the regions. There are no specific measures or motivations to keep them in smaller places. Regional firms and offices rarely offer fellowships and getting a job in a big city is usually easier.

The second reason can be found in the more complicated studies for adults. They have to commute to bigger places and improving their qualification is more expensive as well as time demanding. They often have to study in order to keep their jobs and improve their position.

The regional studies centres offer the possibility to study on lifelong courses as well as getting regular university graduation. The education in these centres is a combination of contact lessons and self-study. The contact lessons are provided in the regions so that the students do not have to travel to Prague. Also the exams and administrative are done in the centres. In fact, the students have to travel to the university in the capital only to pass the state exam.

The only research done found so far, by other authors, concerning the CULS distance-studies centres was a questionnaire survey among the students in these centres focused on demographic structure and differences between male and female students by Dömeová, Vydrová and Jindrová (2010). They found a very weak difference only, significant only in two of the questions. There has also been research done in lifelong education concerning mainly education for adult learners. In promoting lifelong education it is necessary to stress the cooperation between local governments and schools or adult education centres (Stasane, 2007). Rowland and Rubbert (2001) researched the history of adult education in correspondence to particular study modes applied to distance-studies in higher education in the UK. In their article they stress the overuse of the Internet as the teaching aid for distance leaners who often have difficulty coping with the complexity of web pages and they provide recommendations on how to improve the existing information services. Applying information technologies in lifelong education and in distance-studies in particular, is discussed for example in Rodriguezrosello (1993), Bard (1996), and Lloyd, Moore and Kitching (2001). At CULS the use of on-line support in distance-studies centres has been discussed by Houška and Beránková (2010).

However, the rate of successful study in the distance-studies centres is not very high. For instance, of the students that we examined, only 75% students in our observed year progressed to the 2nd year of study in the regular way (i.e. without retaking or interrupting the studies etc.). The objective of the paper is to find out particular problems the students could be encountered what they should concentrate on and what they should be

aware of. This is done by means of statistical analyses of the set of students' study results. At the same time, our findings should present centre administrators and the department staff responsible with invaluable incentives to make the studies easier and help the students improve their study results. During our research we have not intentionally done a survey based on questionnaires. Respondents very often do not pay enough attention to filling in the questionnaire and what is more, it has become obvious that even without a questionnaire significant and important findings can be achieved.

In this paper we extended and deepened our results already observed in Jarkovská, Kučera, Vydrová and Varvažovská (2011) with the results observed in another course. Besides, we focused our analysis on the results of those students who graduated from the individual courses successfully only.

Material and Methods

The Characteristics of Courses Examined

We dealt with students majoring in Public Administration and Regional Development (PARD) who began their studies in the academic year 2009/10. In this year, this study area was available in four distance-studies centres: Klatovy, Litoměřice, Most and Šumperk. In other distance-studies centres either a different or no study area was available. We examined the results obtained from five selected courses, each representing a different type.

The first course, Mathematical Methods in Economics and Management (MMEM), is taught in the winter semester of the first-year of studies. It is indisputably the most difficult subject. Owing to the fact that within PARD there is no course in mathematics as a separate subject, MMEM comprises selected areas in mathematics, in particular the basics of linear algebra

and differential calculus of functions containing one variable. This part makes up approximately 35% of the course. The remaining part consists in theoretical basics of mathematical methods applied in economics to systems analysis and optimum management and their simple applications. It definitely concerns the most theoretical subject of the study area and it is relatively remote to its focus.

Another selected course was the Systems Analysis of Product Verticals (SAPV), taught in the summer semester of the first-year of studies. It directly follows MMEM but it is much more practically oriented. The objective of the course is to expand the knowledge of methods and approaches from the point of view of system approaches to various types of problems.

We also observed how students were successful in the studies of foreign languages (FL). The foreign languages are taught as one two-semester course, at the end of which the students take an exam. The languages taught at the distance study centres are English and German. In the examined year the students could choose from English or German at A1 level in all distance-studies centres. In Most they could also take English at the more advanced A2 or B1 level.

The Fundamentals of Regional Development (FRD) is one of the profile courses of this study area. The course objective is practical, i.e. to teach students how to prepare and implement different environment-friendly, socially acceptable and economically beneficial development programmes. The students are introduced to the issues of regional development and its mechanisms, including institutions in the CR and EU. The students receive theoretical knowledge as well as practical skills in respect to problem definition, particular projects preparation and the principles of project implementation. At the end of the course the students sit a written exam. The exam tests their

theoretical knowledge as well as their ability to apply the skills to particular practical questions. This type of final examination, i.e. a written test, is shared by all the courses under observation.

The last course under investigation was the Fundamentals of Statistics (FS). The course objective is to introduce basic statistic concepts and their qualified application in economic routine. The course covers selected methods of descriptive statistics, data research analysis, the elements of probability theory, inductive techniques of estimation theory and statistical hypothesis testing, as well as an introduction to the research of statistical dependencies. Course graduates receive theoretical knowledge of formal statistical approaches applied to the research of social-economic reality. The teachers of particular courses taught in one or two distance-studies centres at the most.

Let us add that at most Czech universities and schools of higher education a four-mark system of evaluation is applied, where 1 (excellent) is the best mark. Then follows 2 (very good) and 3 (good). Mark 4 (failed) means that the student failed an exam.

Statistical Testing

First, we considered a pair of courses. For each pair we assessed the difference between the exam results. This was done by the testing of statistical hypotheses on the results. A statistical hypothesis is a certain presupposition about the characteristics of the distribution of the examined random variable. The testing of a given hypothesis is the procedure by which we would make the decision about the validity or refusal of a null hypothesis on the basis of random choices. Usually, we tested the null hypothesis H_0: $\mu_1 = \mu_2$, i.e. there were no statistically important differences between the two examined samples.

The analysis of variance (ANOVA) enabled us to assess the differences between mean values of not only two samples, but also among three or more. We applied this in order to compare the examination results among different centres, among different courses in each centre, and thus among different teachers for a particular subject. We chose the Kruskal-Wallis one-way variance analysis which is a non-parametrical form of the analysis of variance.

When finding out the dependencies between individual observed subjects it is convenient to use one of the dependence tightness measures. If the observed features assess the sequence, it is convenient to use the Spearman rank-order correlation coefficient which assesses the degree of dependence between the observed features where the distribution of probability is unknown.

We used the attributive risk and odds ratio for the analysis of a specific factor impact on students' results. In particular, we compared a success rate of individual subject exams between male students and female students and between individual pairs of the centres. The attributive risk expresses an absolute effect of the observed factor (e.g. gender). It told us how higher the possibility to pass an exam was within one group (e.g. male students only) in comparison to another group (e.g. female students). It is calculated as follows:

$$AR = \frac{a}{a+b} - \frac{c}{c+d} \qquad (1)$$

where a and b is a number of students who passed and failed the exam in the former group, respectively, and where c and d is a number of students who passed and failed the exam in the latter group, respectively.

It is also possible to calculate its relative form which is indicated as AF using the following formula:

$$A F = \frac{\dfrac{a}{a+b} - \dfrac{c}{c+d}}{\dfrac{a}{a+b}} \qquad (2)$$

The odds ratio assesses a chance to pass an exam. It is calculated as follows:

$$OR = \frac{d}{b} \qquad (3)$$

If OR = 1, there is no dependency between the observed variables. OR > 1 means that affiliation with the second group is a risk factor, and vice versa, OR < 1 means that the affiliation with the second group is a protective factor.

The last tool was a categorical data analysis. The basic test for finding out the dependence of two variables was the χ^2 test on mutual (in)dependence in a contingency table. If the value of the χ^2 found was bigger than the critical one, the assessed variables were dependent. Another evaluation method consisted of using the p-value compared with the significance level. If the p-value was less than the required significance level, the event was assessed to be statistically significant. For the contingency table we also computed the Pearson contingency coefficient

$$C_P = \sqrt{\frac{\chi_P^2}{\chi_P^2 + n}} \qquad (4)$$

which took values from the interval $\langle 0; \sqrt{(q-1)/q} \rangle$, where $q = \min \{r, s\}$, where r and s are the numbers of the contingency table rows and columns, respectively. It took the value of 0 in the case of statistical independence. Being given fixed values of n, r, s, the bigger value of C_P we obtained, the stronger the dependence was.

Using categorical data analysis we discovered to what extent the study success depended on the gender and age of the student.

For more information about statistical testing in general see Agresti (2002).

Results and Discussion

The examined set compiled the total of 267 students, from which 95 students were from Klatovy centre, 101 from Litoměřice centre, 32 from Most and 39 from Šumperk. In the academic year 2009/10 245 were first-year students. There were an additional 22 students who started studying earlier, 12 of them took an exam in FS, 11 in FRD, and 1 in FL.

The Comparison of Overall Results of Individual Subjects

First, we found out if and to what extent the results in individual subjects differed. The information is presented in Table 1.

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	MMEM	SAPV	FL	FRD	FS
Total number of students	219	173	195	180	177
Number of successful students	168	147	195	170	173
Number of students who failed	51	26	0	10	4
Successful students (%)	77%	85%	100%	94%	98%
Mean grade of all students	2.429	2.306	1.236	2.500	2.435
Mean grade of successful students	1.952	2.007	1.236	2.412	2.399

Tab. 1: Student results in individual subjects

By far the best results were obtained by the students of FL. Furthermore, according to the mean grade of all students, the students were also relatively successful in SAPV, which was followed by MMEM, then FS with the worst results being obtained in FRD. The students therefore seemed to find FL significantly easier than specialist subjects where there were generally no greater differences in feasibility.

Rather a large number of the students did not pass the exam from theoretical-mathematical subjects MMEM and SAPV at all. Nevertheless, the results of successful students in these subjects were obviously better than in the other observed specialist subjects, FRD and FS. Moreover, their results in MMEM were better than in SAPV. In contrast, there were considerably fewer unsuccessful students failing FRD and FS (weaker students did not proceed to the second year of studies where they would sit these exams). On the other hand, there were also fewer students with excellent or very good marks in FRD and FS.

The Comparison of Results per Individual Student

Then we observed relationships and connections between the results for individual subjects per student. We used Spearman correlation coefficients. The analysis was carried out for two different sets: one for the set of all students and one only for the set of those who passed all exams successfully. There were altogether 101 such successful students. Correlation matrices are presented in Table 2 and 3. The coefficients in italics were statistically insignificant at the significance level of α=0.05.

Subject	MMEM	SAPV	FL	FRD	FS
MMEM	1.000	0.317	0.018	0.011	0.409
SAPV	0.317	1.000	-0.036	-0.015	0.077
FL	1.018	-0.036	1.000	-0.047	-0.064
FRD	0.011	-0.015	-0.047	1.000	0.072
FS	0.409	-0.077	-0.064	0.072	1.000

Tab. 2: Spearman rank-order correlation coefficients

Subject	MMEM	SAPV	FL	FRD	FS
MMEM	1.000	–0.425	0.144	–0.068	0.569
SAPV	–0.425	1.000	–0.081	0.047	0.010
FL	0.144	–0.081	1.000	0.016	–0.053
FRD	–0.068	0.047	0.016	1.000	0.082
FS	0.569	0.010	–0.053	0.082	1.000

Tab. 3: Spearman rank-order correlation coefficients – only successful students

From these matrices it can be derived that, to a certain extent, individual students reached similar results in MMES and FS (i.e. each student was either good or bad in both subjects). The correlation coefficient was more than 0.4 in the set of all students and even 0.57 in the set of only successful students.

This can be explained by the fact that both subjects are based on mathematics and successful students are those with relatively good mathematical minds.

An interesting situation can be observed for the dependence between the results in MMEM and SAPV. In the set of all students the positive correlation coefficient was 0.32 and, on the contrary, the negative coefficient for successful students was –0.425. Both coefficients were of a relatively high value; however, they were not statistically significant at the significance level of α=0.05. For statistical analyses the present set is sufficient enough. Nevertheless, we suppose that for a more extensive statistical set such high coefficients would prove as statistically significant. This means that worse students often fail those subjects or, if they did not pass one, they did not have a good result in the other. In contrast, the students who graduated from both subjects successfully were either good in the former and bad in the latter or the other way around. Those students who had problems with the more theoretically focused MMEM probably concentrated more on thematically closer SAPV and reached better results there. On the other hand, those who had no problem passing MMEM underestimated SAPV. This might mean that although both subjects are thematically close, MMEM is far more theoretically oriented than SAPV and therefore, the former could be more suited for theoretically oriented students whereas the latter to the practically oriented ones. Besides, from the fourth semester the students with very good marks had the possibility to transfer to another form of studies where no school fee was required. Therefore the students with worse results from the first semester which included MMEM might have been more motivated to pass SAPV successfully in the second semester and vice versa.

Other correlation coefficients did not exceed 0.2 in absolute value. This means that there was no other statistically significant dependence between the results of individual students.

The Comparison of Results in Individual Distance-Studies Centres

In the following analysis we endeavour to find out if and to what extent the results of individual subjects differed among individual centres. Thanks to the fact that in almost all centres the courses were conducted by different teachers, we could find out to what extent the teacher's quality and adaptation of various special measures in the centres influenced the students' study results.

We calculated the attributive risk and odds ratio for all subjects within each couple of the centres. In the analysis, even those students who did not endeavour to pass the exam were regarded as those who failed. Moreover, we applied the Kruskal-Wallis test, similarly to the analysis in the previous chapter, to two different sets: one for the set of all students and one for the set of those who passed all exams successfully only. The results are summarised in Tables 4-9. Each table first presents the centre where the students were more successful altogether.

	MMEM	SAPV	FL	FRD	FS
Most - passed	17	20	23	22	24
Most - failed	16	13	10	11	9
Most – successful students (%)	52%	61%	70%	67%	73%
Litoměřice - passed	45	46	71	55	60
Litoměřice - failed	56	55	30	46	41
Litoměřice – successful students (%)	45%	46%	70%	54%	59%
OR for Most	1.32	1.84	0.97	1.67	1.82
OR for Litoměřice	0.76	0.54	1.03	0.60	0.55
AR	7%	15%	-1%	12%	13%
AF for Litoměřice	14%	25%	-1%	18%	18%
AF for Most	16%	33%	-1%	22%	22%
Significant difference for all students	No	No	No	No	No
Significant diff. for successful students	Yes	No	No	No	No

Tab. 4: The comparison of results in Most and Litoměřice

	MMEM	SAPV	FL	FRD	FS
Šumperk - passed	30	13	29	28	30
Šumperk - failed	9	26	10	11	9
Šumperk – successful students (%)	77%	33%	74%	72%	77%
Most - passed	17	20	23	22	24
Most - failed	16	13	10	11	9
Most – successful students (%)	52%	61%	70%	67%	73%
OR for Šumperk	3.14	0.33	1.26	1.27	1.25
OR for Most	0.32	3.08	0.79	0.79	0.80
AR	25%	-27%	5%	5%	4%

AF for Most	33%	-82%	6%	7%	5%
AF for Šumperk	49%	-45%	7%	8%	6%
Significant difference for all students	No	No	No	No	No
Significant diff. for successful students	No	No	No	No	No

Tab. 5: The comparison of results in Šumperk and Most

	MMEM	SAPV	FL	FRD	FS
Klatovy - passed	77	69	73	65	72
Klatovy - failed	8	16	12	20	13
Klatovy – successful students (%)	91%	81%	86%	76%	85%
Most - passed	17	20	23	22	24
Most - failed	16	13	10	11	9
Most – successful students (%)	52%	61%	70%	67%	73%
OR for Klatovy	9.06	2.80	2.64	1.63	2.08
OR for Most	0.11	0.36	0.38	0.62	0.48
AR	39%	21%	16%	10%	12%
AF for Most	43%	25%	19%	13%	14%
AF for Klatovy	76%	34%	23%	15%	16%
Significant difference for all students	No	Yes	No	No	No
Significant diff. for successful students	No	Yes	No	No	No

Tab. 6: The comparison of results in Klatovy and Most

	MMEM	SAPV	FL	FRD	FS
Šumperk - passed	30	13	29	28	30
Šumperk - failed	9	26	10	11	9
Šumperk – successful students (%)	77%	33%	74%	72%	77%
Litoměřice - passed	45	46	71	55	60
Litoměřice - failed	56	55	30	46	41
Litoměřice – successful students (%)	45%	46%	70%	54%	59%
OR for Šumperk	4.15	0.60	1.23	2.13	2.28
OR for Litoměřice	0.24	1.67	0.82	0.47	0.44
AR	32%	-12%	4%	17%	18%
AF for Litoměřice	42%	-37%	5%	24%	23%
AF for Šumperk	73%	-27%	6%	32%	29%
Significant difference for all students	Yes	No	No	No	No
Significant diff. for successful students	Yes	No	No	No	No

Tab. 7: The comparison of results in Šumperk and Litoměřice

	MMEM	SAPV	FL	FRD	FS
Klatovy - passed	77	69	73	65	72
Klatovy - failed	8	16	12	20	13
Klatovy – successful students (%)	91%	81%	86%	76%	85%
Litoměřice - passed	45	46	71	55	60
Litoměřice - failed	56	55	30	46	41
Litoměřice – successful students (%)	45%	46%	70%	54%	59%
OR for Klatovy	11.98	5.16	2.57	2.72	3.78
OR for Litoměřice	0.08	0.19	0.39	0.37	0.26
AR	46%	36%	16%	22%	25%

	MMEM	SAPV	FL	FRD	FS
AF for Litoměřice	51%	44%	18%	29%	30%
AF for Klatovy	103%	78%	22%	40%	43%
Significant difference for all students	Yes	Yes	No	No	No
Significant diff. for successful students	Yes	No	No	No	No

Tab. 8: The comparison of results in Klatovy and Litoměřice

	MMEM	SAPV	FL	FRD	FS
Klatovy - passed	77	69	73	65	72
Klatovy - failed	8	16	12	20	13
Klatovy – successful students (%)	91%	81%	86%	76%	85%
Šumperk - passed	30	13	29	28	30
Šumperk - failed	9	26	10	11	9
Šumperk – successful students (%)	77%	33%	74%	72%	77%
OR for Klatovy	2.89	8.63	2.10	1.28	1.66
OR for Šumperk	0.35	0.12	0.48	0.78	0.60
AR	14%	48%	12%	5%	8%
AF for Šumperk	15%	59%	13%	6%	9%
AF for Klatovy	18%	144%	15%	7%	10%
Significant difference for all students	No	No	No	No	No
Significant diff. for successful students	No	No	No	No	No

Tab. 9: The comparison of results in Klatovy and Šumperk

Results in MMEM turned out to be significantly worse in Litoměřice than in any other centres. This may be caused by the fact that in Litoměřice the teacher was a professional mathematician, a graduate from the Faculty of Mathematics and Physics at Charles University, whose methods of conducting

the course were not as practically oriented as that of other teachers who graduated from CULS. Besides, after consultation with the teachers, we found out that in Klatovy the teacher gave the students the possibility to attend extra lectures in Klatovy. In Šumperk they applied a system in which students successful in this course could officially tutor their colleagues in lower years of studies, which helped the students to pass the exam and continue further in their studies. These were other reasons that could make the MMEM exams for the students of the centre easier.

A significant difference was also revealed for SAPV. The best results were reached in Klatovy, statistically significantly better in comparison to Most and Litoměřice. Most probably, it was thanks to the extra lectures mentioned above. The tables reveal rather bad results in Šumperk, even though the Kruskal-Wallis test did not prove any statistically significant difference. They were probably caused by the SAPV consultation being scheduled at the end of the semester. Tutoring by older students in this case did not help either. However, the unsuccessful students rescheduled the exam to the next year and continued in their studies.

For the other courses no statistically significant difference was found, even though there was a different teacher in each centre. Therefore, we can assume that the personality of the teacher or the organization of the course had no important impact on the subject results.

Interestingly, however, a wide-spread surmise that the centres with a lower number of students reach better results did not testify. On the contrary, probably thanks to good course organization, it was Klatovy centre with a relatively high number of students that reached the best results.

The Comparison of Results of Individual Subjects in Individual Distance-Studies Centres

Let us have a look at how different the results in individual centres were in general. Again we applied the Kruskal-Wallis test for two different sets similarly to our previous analysis. In Table 10 and 11 we also present mean grades in single subjects in particular centres.

	MMEM	SAPV	FL	FRD	FS
Litoměřice	3.14	2.86	1.27	2.65	2.43
Klatovy	1.92	1.76	1.12	2.51	2.54
Most	2.48	2.88	1.14	2.30	2.35
Šumperk	1.71	1.46	1.52	2.34	2.28

Tab. 10: Mean grades in the set of all students

Based on the Kruskal-Wallis test in the set of all students in Litoměřice, the results from FL were statistically significantly better than in all other subjects and, besides, the results from FS were statistically significantly better than those from MMEM.

In Klatovy, the results from FL were again statistically significantly better than from all other subjects. What is more, the results from FS and FRD were statistically significantly worse than the results from MMEM and SAPV.

In Most the only statistically significant difference was observed when comparing the results from FL with other subjects and in Šumperk when comparing FL with FS and FRD only.

	MMEM	SAPV	FL	FRD	FS
Litoměřice	2.26	2.16	1.21	2.53	2.21
Klatovy	1.81	1.57	1.17	2.36	2.34
Most	1.56	2.67	1.11	2.22	2.22
Šumperk	1.63	1.13	1.50	2.13	2.38

Tab. 11: Mean grades in the set of successful students

In the set of successful student in Litoměřice, the Kruskal-Wallis test found out the only statistically significant difference when comparing the results from FL with all other subjects. The same difference was also found in Klatovy; however, here the test revealed that the results from SAPV were statistically significantly better than the results from FS and FRD. In Most the only statistically significant difference was found when comparing the results from FL with FS and SAPV. In Šumperk no statistically significant differences were found.

All in all, if we concentrate on the results of successful students, the following situation seemed to be typical: the results in FL were better in comparison with all other subjects, especially with FS and FRD. This situation occurred in both big centres: Litoměřice and Klatovy. In Most and Šumperk there were only few successful students to consider the situation typical for small centres. However, even there a few interesting facts can be found. In Most the students were surprisingly good in MMEM. When comparing results from FL, and even taking into account all students and not only the successful ones, there were differences between Šumperk and other centres. This study result difference can be best explained by the application of the different testing methods used in Šumperk than in other centres.

The Dependency of Students' Results on Gender

We applied Pearson χ^2 test which did not reveal any significant dependency of students' results on their gender for any of the subjects. There showed to be only certain dependence for FL, the p-value was 0.07, C_p was 5.34 and better results were achieved by female students.

Moreover, we calculated the attributive risk and odds ratio. As seen in Table 12, this analysis did not show any great differences either, not even for FL.

	MMEM	SAPV	FL	FRD	FS
Successful female students	70%	60%	80%	72%	72%
Successful male students	58%	54%	71%	55%	61%
OR for female students	1.65	1.26	1.60	2.13	1.64
OR for male students	0.61	0.79	0.62	0.47	0.61
AR	11%	6%	9%	17%	11%
AF for male students	16%	10%	11%	24%	15%
AF for female students	20%	11%	12%	31%	18%

Tab. 12: The comparison of results for women and men

The Dependency of Study Results on Students' Age

First, let us point out the age structure of the students in general. The oldest student was born on 22nd August, 1954 and the youngest on 22nd August, 1990. The average date of birth was around 11th October, 1977, the median being 26th January, 1978. For better imagination of the age structure, let us also mention the bottom quartile 29th December, 1972 and top quartile 11th June, 1983.

In order to apply Pearson χ^2 test, we divided the students into two groups based on the median, the "old" and "young". At this point a significant dependency for SAPV was revealed (p-value 0.024 and C_p=9.43 for the set including unsuccessful students, and p-value 0.040 and C_p=6.45 for successful students set only) and for FRD (p-value lower than 0.002 and C_p=5.08 for the set including unsuccessful students, and p-value lower than 0.005 and C_p=10.73 for successful students only). Also, the Pearson correlation coefficient values proved rather stronger dependency than during Pearson χ^2 test application for gender; they were significantly higher. In both cases it was the older students who were more successful, with their practical experience being probably reflected in their results. In Figure 1 and 2, the results in SAPV and FRD, dependent on the date of birth of the students, are presented graphically. The horizontal axis shows the date of birth, the vertical axis the mark obtained at the examination.
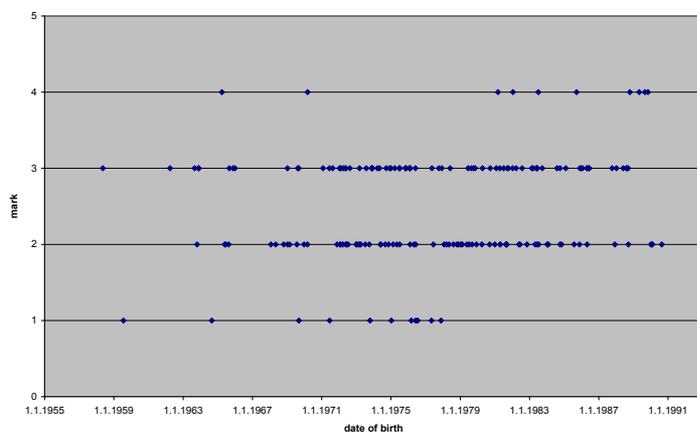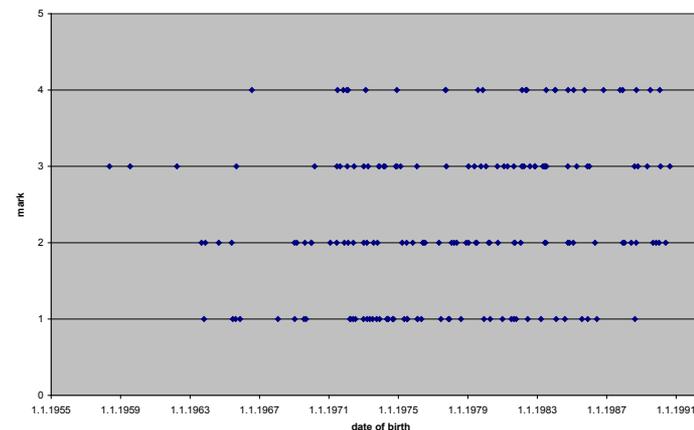

Fig. 1: Results in SAPV

Fig. 2: Results in FRD

For the other courses no statistically significant dependency of study results on the student's age was revealed. It is worth mentioning one p-value of almost 0.15 for the results in MMEM, but only in the set of all students including the unsuccessful, revealing that among the unsuccessful students there were fewer younger than older students. All other p-values oscillated around 0.5 or higher.

Conclusion

The statistical analyses carried out in this article on the results of selected subjects in distance- studies centres have, above everything else, shown what in particular the students should be aware of in their studies, which types of subjects they might find difficult and, last but not least, which study group is endangered the most.

All in all, based on the mean scores of all students, not only the successful ones, the most difficult subject was not MMEM which includes mathematics, generally regarded as student's nightmare. Rather surprisingly and contrary to our expectation, it was FRD which represented profiled specialist subjects. FS also seems to be harder than MMEM. However, the difference among the three subjects was insignificant. Contrastingly, FL turned out to be significantly easier. In respect to a narrow selection of the subjects, no one would surely believe that it is the only easy-to-study subject. Nevertheless, it is definitely an interesting finding that for the students FL does not present any obstacle in their studies of other specialist subjects. However, when interpreting the difficulty of the subjects, we must take into account the fact that the students who did not manage to pass exams from MMEM or SAPV did not continue in their studies and therefore did not even take exams from FRD and FS.

What we may find surprising for FL is the fact that good results were obtained even by older students – despite the conditions for learning foreign languages at secondary schools – with the exception of Russian which, however, was not on the list for the particular year under observation – were much worse than those of younger students. Slightly, though not significantly, better results were achieved by women rather than men. However, the differences in results among individual centres show that the results to a certain extent also depend on the method and manner of testing.

The results in MMEM show that the difficulty of theoretical subjects should not be underestimated. In the centres, it presents the same "obstacle" for all students, and the mean scores depend neither on age nor gender of the student. The greater time distance for the older students from their secondary school studies was probably compensated for by a higher quality of teaching during their school attendance and partially by their life experience.

In SAPV, FS and FRD students show generally similar results as in MMEM. However, in practically oriented subjects of FRD and SAPV it was the older students who achieved significantly better mean scores and did not fail so often, probably thanks to their work experience, while the younger students probably tended to underestimate the subjects because it did not contain much of generally feared theories.

Nevertheless, if we restrict our observation to those students who passed the exams successfully only, then the results in MMEM and SAPV were better than in FRD and FS, moreover, in case of one of the study centres, this difference was statistically significant. This was caused by the fact that the students often dropped out of their studies after the first study year due to MMEM and SAPV. However, if we concentrate only on the results of the successful students in MMEM and SAPV, it is revealed that they are either better in one subject while being worse in the other or vice versa. This may be caused by the different character of those two subjects: MMEM is theoretical while SAPV is practically oriented.

The dependency between the results in other subjects per student was not proved in our analysis.

Our research has shown that the study results and the students' approach to the difficulty of individual subjects attitude can be also influenced by the centres themselves as well as by the university. It did not prove successful to conduct the course with a too theoretically oriented teacher, because it leads both to worse mean scores and to a more frequent failing the exam. In contrast, the students welcomed the possibility to be tutored by their former successful colleagues-students, or

graduates provided by the centre. The first-year students might also benefit from extra optional consultations in order to pass the exam in difficult theoretical subjects. On the contrary, the impact of the centre size (the number of students) on the results did not prove.

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