COMPARISON OF RESEARCH ENGAGEMENT OF PHD STUDENTS AT VARIOUS STUDY PROGRAMS AT CULS PRAGUE: AN INTRODUCTORY STUDY

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Highlights

- *Doctoral study programs are assessed with research in focus.*
- *There is no significant difference in time allocated to research*
- *Form of study has impact on involvement in research projects*
- *PhD students at CULS Prague are dissatisfied with their research outputs*

Abstract

In an attempt to improve the quality of doctoral studies and the satisfaction of PhD students at the Czech University of Life Sciences Prague (CULS Prague) the authors disseminated online questionnaire among all PhD students in May and June 2014. The questionnaire covered areas related to doctoral study, PhD supervisors, doctoral scholarship, research publications, and last but not least, to satisfaction with the doctoral study. In this article, responses related to research, such as allocation of time to doctoral studies, allocation of time to research, involvement in research projects and satisfaction with research outputs, are analyzed. The authors provide comparison of all above mentioned domains according to faculties as well as form of doctoral studies at CULS Prague.

Keywords

Doctoral studies, evaluation, PhD students, questionnaire, Pearson´s test, Cramer´s V

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Introduction

The higher education system in the Czech Republic is mainly financed from the budget of Ministry of Education, Youth and Sport (MEYS). The majority of Higher Education Institutions´ (HEI) budgets depend on the institutional funding. This institutional funding is mainly influenced by the number of students (at all levels), types of study programs and indicators of quality and performance. Currently, this part covers approximately 80% from the whole MEYS budget (MEYS, 2014). Moreover, 22.5% out of these 80% are influenced by quality and performance indicators. Quality is, among others, influenced by HEIs´ research results. In the Czech Republic, research results are measured based on a scheme developed by Research, Development and Innovation Council (RVVI, 2013).

Consequently, the importance of high profile research results has risen substantially. Moreover, due to a decrease of MEYS budget the competition for state funding in Czech higher educational system has increased. HEIs´ performance has become an issue and comparative analyses have been recently published. For example, Vltavská and Fischer (2013) evaluated the labor productivity of HEIs' employees according to the teaching and research productivity. Furthermore, Flégl and Vltavská (2013) presented the efficiency analysis of the Faculties of Economics using Data Envelopment Analysis and production function analysis. Dlouhý (2012) proposed a model for funding allocation among HEI´s departments based on publication productivity. Most recently, Jablonský (2014) presented a performance analysis of Czech scientists with respect to their publication activities. Jablonský also discussed the potential of bibliometric indicators as a tool for department, faculties or HEIs evaluations. In general, the authors use mathematical modeling for performance analysis in higher education, mainly benchmarking analysis. These benchmarking analyses use either nonparametric approaches based on Data envelopment analysis - DEA (Johnes, 2006; Korhonen, Tainio and Wallenius, 2001) or parametric approaches based on Stochastic Frontier Approach - SFA (Furková, 2013; McMillan and Chan, 2006; Stevens, 2005)

As a result of increased competitions, many HEIs introduced internal stimulation schemes to enhance quality as well as quantity of research output of both PhD students and academic staff. In addition to the stimulation scheme the Faculty of Economics and Management (FEM), Czech University of Life Sciences Prague (CULS) launched Project for Innovation of the doctoral study program (IDSP) in March 2012 (Flégl, Tichá and Stanislavská Kvasničková, 2013) in order to deal with long term dissatisfaction of research performance. The project includes several parts (activities), such as Methodological workshops for PhD students and PhD supervisors. All project parts focus on improvement of research performance, mainly on PhD students and partly on PhD supervisors. PhD students at FEM have had lower level of research results in comparison with the other faculties at CULS Prague (Flégl, Tichá and Stanislavská Kvasničková, 2013).

The main cause of generally lower level of research results of FEM PhD students is related to inactivity of substantial proportion of PhD students. As Flegl and Vostra Vydrova (2014) pointed out a huge percentage of PhD students (in some cases more than 60%) at CULS Prague had produced zero research results during the period 2007-2011. There is a number of various reasons behind low performance of PhD students. The influence of PhD supervisors on research results of PhD

students is one of important reasons (Barnes and Austin, 2009). Pinheiro, Melkers and Youtie (2014) observed that coauthoring with the supervisor is a significant source of publications. Moreover, coauthoring and mentoring have positive impact for future research performance (Hilmer and Hilmer, 2009; Kyvik and Smeby, 1994). Besides the student-supervisor relationship, it is important to analyze other potential causes of lower level of research performance, such as allocation of time to doctoral studies or involvement in research projects.

The objective of the article is to provide an overview of PhD students' performance with regard to differences among faculties and form of studies (full-time and part-time). This overview includes areas related to a time allocation to doctoral studies, time spent on research, involvement in research projects and satisfaction with research outputs. Univariate and multivariate statistical analysis of categorical data is used to process data.

The next parts of the article are divided as follows: the following part specifies the analyzed data and describes statistical methods used for the data processing. The main part of the article focuses on the findings obtained through questionnaire and on the detailed description of responses. Discussion of findings and brief comments conclude the article.

Materials and Methods

Data specification

Czech University of Life Sciences Prague provided in total 18 doctoral study programs in 29 PhD specializations at its faculties[1] in the year 2014 (CULS, 2014). In these study programs, in total 1093 PhD students were enrolled. In April 2014, the authors prepared online questionnaire for the evaluation of PhD studies at CULS. The questionnaire covers six main areas: *questions related to students´ introduction, questions related to doctoral study, questions related to PhD supervisor, questions related to doctoral scholarship, questions related to research publications*, and *questions related to satisfaction with the doctoral study*. This article, however, focuses only on questions related to research activity. As several PhD study programs are taught in foreign language (mainly English) the questionnaire was prepared in both Czech and English version. The questionnaire contains of open-ended and closed questions, as well as a combination of both types. The main purpose of the questionnaire was to find out reasons of satisfactions and dissatisfactions with current doctoral studies at CULS Prague.

The questionnaire was disseminated among all PhD students in May and June 2014. The dissemination was supported by an official email sent to all PhD students. The authors also sent a reminder to this survey 2 weeks after the first dissemination. In total, 187 PhD students (representing 17.11%) have expressed their opinions about PhD studies at CULS Prague. Out of those 187 responses, 72 PhD students were males and 115 were females (Table 1).

Residency	Gender		
	Male	Female	**Total**
Czech & Slovak residents	71	113	184
Foreign residents	1	2	3
Total	72	115	187
Share	38.50%	61.50%	

Table 1: Number of responses by gender and residency (source: own calculation)

In addition, the respondents can be divided into two basic groups according to their residency, i.e. Czech & Slovak residents and foreigners. Only 3 responses from foreign PhD students were returned. From this reason, responses from foreign residents are excluded from the analysis. The majority of the PhD students (61.41%) stated their permanent residence is in Prague and in Central Bohemia region (Table 2). This distribution is influenced by the location of CULS in Prague. PhD students with the permanent residence outside of the Czech Republic represent only 2.72% of respondents.

Table 3 summarizes the distribution of the respondents regarding their age. The majority of the PhD students are in the group 26-30 years old (72.28%). Considering that the majority of master students in the Czech Republic graduate around the age 26 and the length of doctoral studies at CULS Prague are 3 years in general, so this age distribution reflects well the conditions. Interesting finding is that 5.43% (10 out of 187 responses) of PhD students are older than 41 years old. Doctoral studies are not a matter only of a younger generation, but CULS Prague is also able to attract older students usually for part-time studies.

Region	**Czech & Slovak residents**	**Share**
City of Prague	64	34.78%
Central Bohemia region	49	26.63%
South Bohemian region	7	3.80%
The Pilsen region	4	2.17%
Karlovy Vary region	3	1.63%
The Ústí region	13	7.07%
Liberec region	7	3.80%
Hradec Králové region	7	3.80%
The Pardubice region	7	3.80%
Vysočina region	9	4.89%
Southern Moravia region	2	1.09%
The Olomouc region	1	0.54%
Moravian-Silesian region	5	2.72%
Zlín region	1	0.54%
outside the Czech Republic	5	2.72%
Total	184	100.00%

Table 2: Regions of permanent residence (source: own calculation)

[1] Faculty of Economics and Management (FEM), Faculty of Agrobiology, Food and Natural Resources (FAFNR), Faculty of Engineering (FE), Faculty of Environmental Sciences (FES), Faculty of Forestry and Wood Sciences (FFWS), and Faculty of Tropical AgriSciences (FTAS).

Age groups	Czech & Slovak residents	Share
0-25	14	7.61%
26-30	133	72.28%
31-35	20	10.87%
36-40	7	3.80%
41 and over	10	5.43%
Total	184	100.00%

Table 3: Age of the respondents (source: own calculation)

Most of the respondents (88.59%) study full-time programs and only 11.41% of respondents are enrolled in part-time programs. Table 5 shows the distribution of received responses sorted by faculties at CULS Prague. The distribution corresponds with the size of the faculties, so the most responses are from FAFNR (28.80%), FES (23.37%) and FEM (19.57%). Whereas the smallest faculty FTAS represents only 8.15% from all the responses.

Residency	Form of the study		
	Full-time	Part-time	Total
Czech & Slovak residents	163	21	184
Share	88.59%	11.41%	100.00%

Table 4: Form of the doctoral studies (source: own calculation)

	Number of responses	Share
FAFNR	53	28.80%
FFWS	22	11.96%
FTAS	15	8.15%
FES	43	23.37%
FEM	36	19.57%
FE	15	8.15%
Total	184	100.00%

Table 5: Number of responses according to faculty (source: own calculation)

Statistics

We use tools of univariate and multivariate statistical analysis of categorical data. The analysis of individual variable values is based on a frequency distribution and calculation of descriptive characteristics. The principles of dependencies of two variables are described on the basis of a contingency table. Chi-square test is chosen to test hypotheses about the independence of two variables. In case of a failure to comply with the basic test requirements, which is linked to the expected frequencies, we logically merge selected answers. Using the chi-square test we test the compliance of observed and expected frequencies. To calculate the test criterion we can use Person´s chi-square statistics (Chambers and Skinner, 2003). In addition Cramer´s V was applied to measure the strength of the proven dependencies.

The significance level $\alpha = 0.05$ was set for testing statistical hypotheses. Statistical software SPSS 2.2 was used for a practical application of statistical tools.

Results

Following detailed description of achieved results is structured according to areas related to research of PhD students at CULS Prague (time allocated to doctoral studies, time allocated to research, involvement in research projects, research outputs and satisfaction with research outputs). In following subsections discussion and detailed explanation of achieved results is provided.

How many hours per week PhD students spend at CULS Prague as a part of their doctoral studies?

This subsection focuses on the amount of time PhD students spend at faculty as a part of their doctoral studies. This analyzes tries to find out differences either between faculties of CULS Prague or between different form of studies (full-time and part-time studies). Therefore, the following hypothesis is tested:

H_0: There is no statistically significant dependence between number of hours PhD students spend at a faculty and the faculty.

Table 6 summarizes both numbers of hours per faculty and calculated statistical characteristics. As a result, H_0 is rejected ($p = 0.0000$), so there is a statistically significant dependence between PhD students and number of hours they spend at a faculty as a part of their doctoral studies. A significant difference between PhD students from FAFNR and the rest of the university, regarding the time they spend at faculty, can be observed from Table 6. Most of the PhD students (57.4%) at FAFNR spend 30 and more hours at the faculty per week. This is significantly much more compared to the other faculties, where the average is only around 9.73 hours. On the other hand, 55.81% of PhD students from FES spend mostly between 0 to 9 hours at the faculty as a part of their doctoral studies. Similar results can be observed for PhD students from FFWS. In addition, Cramer´s V implies to a moderately strong dependence (0.3199).

Faculty	Number of hours					Statistics	
	0-9	10-19	20-29	30-39	40 and more		
FAFNR	9	4	9	13	18	Pearson´s test	75.3314
FFWS	11	5	4	0	2	p-value	0.0000
FTAS	4	3	3	5	0	Cramer´s V	0.3199
FES	24	7	9	2	1		
FEM	9	15	8	3	1		
FE	1	4	6	2	2		
Total	58	38	39	25	24		

Table 6: Number of hours PhD students spend at faculty according to faculty (source: own calculation)

As the second part of this area, following hypothesis is tested:

H_0: There is no statistically significant dependence between PhD students of the full-time and part-time form of study according to number of hours they spend at a faculty.

Table 7 summarizes numbers of hours PhD students of full-time and part-time form of study spend at a faculty as a part of their doctoral studies. Logically, students of full-time form of study spend significantly more hours at their faculties (this is an expected result). Considering the calculated statistical characteristics, H_0 is rejected ($p = 0.0011$), so there is a statistically significant dependence between PhD students of different form of study and number of hours they spend at a faculty. Moreover, Cramer´s V implies to a moderately strong dependence (0.3154).

Type of study	Number of hours					Statistics	
	0-9	10-19	20-29	30-39	40 and more		
Full-time	43	36	37	23	24	Pearson´s test	18.3018
Part-time	15	2	2	2	0	p-value	0.0011
Total	58	38	39	25	24	Cramer´s V	0.3154

Table 7: Number of hours PhD students spend at faculty according to form of study (source: own calculation)

Do PhD students allocate all their working time to their doctoral studies only?

This following subsection tries to find out the proportion of working time allocated to doctoral studies and to work elsewhere (outside a department). Firstly, the differences in responses between faculties of CULS Prague are analyzed. The following hypothesis is tested:

H_0: There is no statistically significant dependence between PhD students´ time allocated to studies and faculties.

In this case, PhD students could answer simply either yes or no. Table 8 summarizes responses from PhD students according to their faculties. In addition, calculated statistical characteristics are also included. H_0 is rejected ($p = 0.0034$), because there is a statistically significant dependence between time allocated to doctoral studies and faculties. Majority of respondents divide their time between doctoral studies and a work outside their department. As in the previous subsection, PhD students at FAFNR represent difference as they allocate their time more often to doctoral studies only. This result is in alignment with the numbers of hours these PhD students spend at their faculty (Table 6).

On the other side, it can be observed that almost all respondents from FE (except one PhD student representing 7.14% from all respondents from FE) devote their time also to other work outside their department. Similarly, only 22.22% PhD students from FFWS, 22.85% PhD students from FES and 24.14% PhD students from FEM allocate their time only to their doctoral studies. It represents approximately each 4th or 5th PhD student focuses only on the doctoral study. Similarly as for the previous testing, Cramer´s V implies to a moderately strong dependence (0.3099).

Faculty	Yes	No	Statistics	
FAFNR	25	28	Pearson´s test	17.6759
FFWS	4	18	p-value	0.0034
FTAS	4	11	Cramer´s V	0.3099
FES	8	35		
FEM	7	29		
FE	1	14		
Total	49	135		

Table 8: Devotion of working time only to doctoral studies according to faculty (source: own calculation)

H_0: There is no statistically significant dependence between PhD students of the full-time and part-time form of study and time allocated to doctoral studies.

Table 9 summarizes responses and calculated statistical characteristics according to form of study and time allocated to doctoral studies. As expected, H_0 is rejected ($p = 0.0160$), so there is a statistically significant dependence between form of study and time allocated to doctoral studies. All PhD students from part-time study forms are supposed to work outside their departments. The one PhD students of part-time study form who stated an allocation of time fully to doctoral studies can represent maternity leave. This, however, cannot be verified from received responses. Cramer´s V implies weak dependence (0.1748) among responses.

Type of study	Yes	No	Statistics	
Full-time	48	115	Pearson´s test	5.8022
Part-time	1	20	p-value	0.0160
Total	49	135	Cramer´s V	0.1748

Table 9: Devotion of working time only to doctoral studies according to form of study (source: own calculation)

Approximately how many hours per week PhD students spend with their doctoral research?

H_0: There is no statistically significant dependence between number of hours PhD students allocate to research and the faculty.

Students´ responses and calculated statistical characteristics are summarized in Table 10. In this case and contrary to the previous results, H_0 is not rejected ($p = 0.0844$), as there is no statistically significant dependence between time allocated to research and faculties to which PhD students belong. Moreover, Cramer´s V implies to a weak dependence among responses (0.1991). At all faculties, PhD student allocate, in most of the cases, approximately 10 - 19 hours per week to their research. FAFNR is not an exception this time and PhD students from this faculty allocate similar proportion of their time to research as, for example, PhD students from FES.

Considering the previous testing (total number of hours spent at faculty in Table 6) many PhD students from FAFNR spend almost half of their time with other activities then research (teaching, administrative work, etc.). This comment is based on the huge changes in time categories comparing Table 6 and Table 10.

Responses of PhD students from FEM indicate that they allocate most of their time to research (there are no significant changes in time categories comparing Table 6 and Table 10). Small inconsistency in responses from PhD students from FES can be observed. In Table 6 there are 24 PhD students that spend approximately 0 – 9 hours per week as a part of their doctoral studies. However, only 11 PhD students allocate 0 – 9 hours to research (Table 10). These PhD students either miscalculated their time allocation or they allocate to research some time beyond their doctoral studies. Few similar inconsistencies in responses from the other faculties can also be observed.

Faculty	Number of hours					Statistics	
	0-9	10-19	20-29	30-39	40 and more		
FAFNR	7	18	15	8	5	Pearson´s test	29.1739
FFWS	8	8	4	2	0	p-value	0.0844
FTAS	4	4	7	0	0	Cramer´s V	0.1991
FES	11	15	10	6	1		
FEM	13	16	5	2	0		
FE	3	9	2	0	1		
Total	46	70	43	18	7		

Table 10: Number of hours allocated to research by PhD students according to faculty (source: own calculation)

H_0: There is no statistically significant dependence between PhD students of full-time and part-time form of study and time allocated to research.

Table 11 summarizes numbers of hours PhD students of both full-time and part-time forms of study allocate to their research as a part of their doctoral studies. Considering the calculated statistical characteristics, H_0 is not rejected ($p = 0.0751$), so there is no statistically significant dependence between form of study and number of hours allocated to research. Possible explanation is that, even though PhD students in part-time programs spend significantly less hours at a faculty (Table 7), it is due to a lower teaching involvement. Research is not affected and students in both forms of studies allocate approximately the same amount of time to research.

Type of study	Number of hours					Statistics	
	0-9	10-19	20-29	30-39	40 and more		
Full-time	36	65	38	18	6	Pearson´s test	8.4919
Part-time	10	5	5	0	1	p-value	0.0751
Total	46	70	43	18	7	Cramer´s V	0.2148

Table 11: Number of hours allocated to research by PhD students according to form of study (source: own calculation)

Are PhD students involved as principal researchers in research projects?

Following two subsections analyze involvement of PhD students in research projects. The questionnaire includes questions related to different types of research projects, such as: university internal grant agency (IGA); university-wide internal agency (CIGA); external projects (such as ESF funds); and external research projects (such as Czech Science Foundation – GACR). However, due to a not sufficient amount of responses, following analysis considers involvement of PhD students only as a principal or associate researcher in general. This subsection focuses on principal researcher. Therefore, the following hypothesis is tested:

H_0: There is no statistically significant dependence between involvement of PhD students as principal researchers in research projects and the faculty.

Table 12 summarizes responses from PhD students and statistical characteristics. In this case, H_0 is rejected ($p = 0.0145$), because there is a statistically significant dependence between responses and particular faculty. Cramer´s V implies to a weak dependence (0.2777). As a result significant differences between faculties can be observed. For example, a majority of PhD students at FES (69.77%) and FE (66.67%) responded that they are involved in research projects as principal researchers. In addition, 50% of PhD students at FFWS declared their involvement as principal researchers in research projects. On the other side, at FTAS only 20% PhD students are involved in research projects as principal researchers. Lower number of principal researchers at FTAS can be related to a lower allocation of time only to doctoral studies (Table 8) and vice versa.

Faculty	Yes	No	Statistics	
FAFNR	24	29	Pearson´s test	14.1898
FFWS	11	11	p-value	0.0145
FTAS	3	12	Cramer´s V	0.2777
FES	30	13		
FEM	17	19		
FE	10	5		
Total	95	89		

Table 12: Involvement in research projects as principal researcher according to faculty (source: own calculation)

H_0: There is no statistically significant dependence between PhD students of full-time and part-time form of study and involvement as principal researchers in research projects.

Similar result is obtained when involvement in research projects is analyzed comparing different form of studies. Again H_0 is rejected ($p = 0.0067$), so there is a statistically significant dependence between responses and form of study (Table 13). As expected, PhD students from full-time form of study are mainly involved as principal researchers (55.21%), whereas part-time PhD students are involved only in 23.81% of cases. Managing research projects require nearly full-time involvement, so full-time form of study is more appropriate. Cramer´s V implies weak dependence (0.1960) among responses.

Type of study	Yes	No	Statistics	
Full-time	90	73	Pearson´s test	7.3471
Part-time	5	16	p-value	0.0067
Total	95	89	Cramer´s V	0.1960

Table 13: Involvement in research projects as principal researcher according to type of study (source: own calculation)

Are PhD students involved as associate researchers in research projects?

Similarly, PhD students´ involvement in research projects in the role of associate researchers can be analyzed. Following hypothesis is tested:

H_0: There is no statistically significant dependence between involvement of PhD students as associate researchers in research projects and the faculty.

Table 14 summarizes responses from PhD students and statistical characteristics. In this case, and contrary to the previous subsection, H_0 is not rejected ($p = 0.4108$), and there is no statistically significant dependence between responses and particular faculty. Therefore, most of the PhD students from all faculties are involved in research projects as associate researchers. In almost all the cases more than 50% of PhD students stated their involvement as associate researches.

Faculty	Yes	No	Statistics	
FAFNR	30	23	Pearson´s test	5.0421
FFWS	13	9	p-value	0.4108
FTAS	10	5	Cramer´s V	0.1655
FES	21	22		
FEM	20	16		
FE	12	3		
Total	106	78		

Table 14: Involvement in research projects as associate researcher according to faculty (source: own calculation)

H_0: There is no statistically significant dependence between PhD students of full-time and part-time form of study and involvement as associate researchers in research projects.

Analysis of involvement in research projects as associate researcher comparing different form of studies, allows rejecting H_0 ($p = 0.042$), thus there is a statistically significant dependence between responses and form of study (Table 15). PhD students from full-time form of study are mainly involved as associate researchers (61.34%) in research projects. On the other hand, PhD students from part-time form of study are involved only in 28.57% of cases. Involvement of part-time PhD students does not depend on a position in research projects. Involvement of these PhD students is low in both cases, i.e. as principal and associate researchers. Cramer´s V implies weak dependence (0.2064) among responses.

Type of study	Yes	No	Statistics	
Full-time	100	63	Pearson´s test	8.1846
Part-time	6	15	p-value	0.0042
Total	106	78	Cramer´s V	0.2064

Table 15: Involvement in research projects as associate researcher according to form of study (source: own calculation)

How many research outputs PhD students publish?

The last part of the analysis is related to research outputs published by PhD students at their faculties. The authors compare research outputs according to the official RIV categories (RVVI, 2013)[2]. In addition, the authors decided to compare only categories of research outputs and not number of research outputs due to a different number of responses between faculties. However, this analysis can still provide sufficient information about research orientation at particular faculty. Following hypothesis is tested:

H_0: There is no statistically significant dependence between categories of research outputs and faculties.

Table 16 summarizes both numbers of research outputs sorted by categories and calculated statistical characteristics. As a result, H_0 is rejected ($p = 0.0380$), thus there is a statistically significant dependence between research output categories and faculties. Differences can be observed between FAFNR, FFWS, FTAS, FES and the rest of CULS Prague, whose PhD students have a lot of research outputs in Jimp and Jneimp categories. More precisely, PhD students at FAFNR publish in Jimp category in 22.73% of cases, at FFWS (31.43%), FTAS (22.22%), and FES (20.29%). On the other hand, PhD students at FEM and FE publish fewer outputs in Jimp category (FEM only 5.8% and FE 8.11%), and publish more in Jneimp, Jrec and D category. Comparison of distribution of research outputs as a whole for CULS Prague reveals, that the distribution is equal between all categories (except proceeding category). Cramer´s V implies to a moderately strong dependence (0.3020).

Faculty	Categories of research outputs					Statistics	
	Jimp	Jneimp	Jrec	D	proceeding		
FAFNR	20	11	17	10	30	Pearson´s test	32.5050
FFWS	11	9	2	1	12	p-value	0.0380
FTAS	6	3	2	6	10	Cramer´s V	0.3020
FES	14	12	14	6	23		
FEM	4	12	14	13	26		
FE	3	10	7	7	10		
Total	58	57	56	43	111		

Table 16: Categories of research outputs according to faculty (source: own calculation)

Difference in research outputs categories regarding form of study is also tested based on following hypothesis:

H_0: There is no statistically significant dependence between categories of research outputs and form of study.

Contrary to the previous result, H_0 is not rejected ($p = 0.7180$), thus there is no statistically significant dependence between research output categories and form of study (Table 17). So even though PhD students of part-time form of study spend significantly less time at faculty (Table 7) and they are less involved in research projects (Table 13 and Table 15), there is no statistically significant difference in research output categories. Different results, however, provides an analysis of total number of publications.

Type of study	Categories of research outputs					Statistics	
	Jimp	Jneimp	Jrec	D	proceeding		
Full-time	50	51	48	35	99	Pearson´s test	2.0960
Part-time	8	6	8	8	12	p-value	0.7180
Total	58	57	56	43	111	Cramer´s V	0.0800

Table 17: Categories of research outputs according to form of study (source: own calculation)

Are PhD students satisfied with the number and categories of their published research outputs?

The last subsection of the results is focused on the level of satisfaction of PhD students with their research outputs. The questionnaire contained of following possible answers; *definitely not*, *not very*, *I do not know*, *quite satisfied*, and *completely satisfied*. The authors decided to merge categories (to *satisfied*, *not satisfied*, and *I do not know*) due to fewer number of responses. Moreover, "I do not know" category was eliminated from the statistical analyses, because in total only 11 responses were obtained and zero responses at FFWS and FE (Table 18). Finally, following hypothesis is tested:

H_0: There is no statistically significant dependence between satisfaction with research outputs and faculties.

Table 18 summarizes calculated statistical characteristics. As a result, H_0 is not rejected ($p = 0.5548$), thus there is no statistically significant dependence between satisfaction with research output and faculties. Surprisingly, most of the PhD students across the faculties are not satisfied with their research outputs (neither categories nor number of published outputs). The average dissatisfaction at CULS Prague reaches a level of 70%! Students at FE represent an exception, when their dissatisfaction is only 53.33%. If responses from FE are excluded, then the dissatisfaction average increases up to 74%.

[2] Article published in a periodical in the Web of Science (Jimp), article published in a periodical registered either in SCOPUS or ERIH (Jneimp), article in a reviewed Czech periodical, which is not registered in WoS, SCOPUS, or ERIH (Jrec), article in proceedings registered in Thomson Reuters (D), and article in proceedings not registered in Thomson Reuters (proceeding).

The reason of high dissatisfaction at FEM can be explained with a low number of research outputs in Jimp category (Table 16). That is in contrary to PhD students from FE who have even fewer Jimp outputs than FEM. However, PhD students at FE are the most satisfied from CULS Prague. Dissatisfaction of PhD students at FAFNR, FFWS, FTAS and FES is quite surprising regarding number of research outputs in Jimp and Jneimp categories. However, dissatisfaction with published research outputs can lie somewhere else. We only make assumption according to the analyzed results in this article. Therefore, further analysis is necessary for finding complex reasons.

Faculty	Satisfied	Not satisfied	Do not know	Statistics	
FAFNR	16	33	4	Pearson´s test	3.9628
FFWS	4	11	0	p-value	0.5548
FTAS	11	29	3	Cramer´s V	0.1513
FES	4	16	2		
FEM	8	26	2		
FE	7	8	0		
Total	50	123	11		

Table 18: Satisfaction of PhD students with their research outputs according to faculty (source: own calculation)

Differences in satisfaction regarding form of study are tested with following hypothesis:

H_0: There is no statistically significant dependence between satisfaction with research outputs and form of study.

In this case, H_0 is not rejected ($p = 0.6327$), so there is no statistically significant dependence between satisfaction with research output and form of study. Dissatisfaction of full-time PhD students is 71.7%, while part-time PhD students reach 66.7%. In both cases the results correspond with average dissatisfaction between faculties.

Faculty	Yes	No	Do not know	Statistics	
Full-time	43	109	11	Pearson´s test	0.2284
Part-time	7	14	0	p-value	0.6327
Total	50	123	11	Cramer´s V	-

Table 19: Satisfaction of PhD students with their research outputs according to form of study (source: own calculation)

Discussion

Responses from PhD students show significant differences in many areas. First of all, the form of study has significant impact on research results of PhD students. Students of part-time form of study spend significantly less time at a faculty. These students divide their time between the time at a faculty and the time outside the faculty. However, the time outside a faculty does not influence the proportion of time allocated to research. PhD students of both full-time and part-time forms spend approximately the same amount of time with research. Therefore, the difference in time allocation to a faculty is most likely linked to other duties at a department. Full-time PhD students probably teach more classes per week and PhD students of part-time form of study are primarily hired for research.

On the other hand, part-time form of study negatively affects involvement in research projects. Therefore, if CULS Prague is to improve its research results, full-time PhD students should be in focus. It is, however, not enough. There should be a tighter connection between supervisor and PhD student. As Barnes and Austin (2009) pointed out, the influence of PhD supervisors plays important role in research results of PhD students. In addition, Pinheiro, Melkers and Youtie (2014) observed that co-authoring with a supervisor is a significant source of publications. Moreover, this co-authoring and mentoring have positive impacts for future research performance. Therefore, proper supervising could lead to diminishing zero research results of PhD students, as Flegl and Vostra Vydrova (2014) observed.

This improvement must go along with a proper PhD students' education. As Lee and Kamler (2008) pointed out, learning how to write and speak in discipline-specific way, how to frame research questions, and how to effectively collaborate are important in science fields. This learning should be provided on a faculty or department basis. This requires PhD students willing to take research-related courses. This can be facilitated by learners-friendly environment at department as well as faculty level.

Secondly, the authors observed significant differences among faculties in many aspects. Obviously, each faculty requires different workload. PhD students at FAFNR spend significantly more time at the faculty (30 and more hours). Moreover, PhD students at FAFNR publish a lot of articles in Jimp and Jneimp categories (similarly as PhD students at FES). This result corresponds with the findings of Flégl, Tichá and Stanislavská Kvasničková (2013). In their study, four PhD specializations from FAFNR and FES reached the highest research performance among all PhD specializations at CULS Prague. This implies the close link between time spent at faculty and research performance.

The last but not least, PhD students at some faculties allocate their time mostly to research. For example, some PhD students at FEM expressed their time allocation to doctoral studies at the same level as time allocation to research. So why FEM does not reach the same level of research outputs as FAFNR or FES? Firstly, there might be possible influence of hardly comparable research fields (social sciences versus natural sciences). Secondly, different teaching workload might also affect the level of research performance. And finally, low level of the students' research experience[3]. More in depth analysis confirming causes of differences is needed in order to design and implement schemes enhancing the level of research performance.

Conclusion

The authors provide analysis of research activity at CULS Prague with focus on doctoral studies. The analysis is a response to an increasing pressure for higher profile research results. The analysis covers areas related to a time allocation to doctoral studies, time allocated to research, involvement in research projects and satisfaction with research outputs. All these areas are analyzed with regard to differences among faculties and forms of doctoral studies at CULS Prague.

The authors found many differences among faculties. For example, 57.4% of PhD students at FAFNR spend significantly more time (30 and more hours) at their faculty in comparison with the other PhD students. The average at CULS Prague is only around 10 hours. In addition, PhD students at FAFNR allocate their time more often to only doctoral studies. Therefore, PhD students from other faculties divide more often their time between doctoral studies and other activities outside their faculties. On the other side, any significant differences between

[3] Other reasons should be taken in an account, such as low scholarship, department´s environment etc. But the influence of these factors is not the main objective of this article.

time allocations to research were found. At all faculties, PhD students allocate approximately 10 - 19 hours per week to their research.

In most of the cases, significant differences between full-time and part-time PhD students were found. For example, part-time PhD students spend significantly less time at their faculty. Furthermore, these PhD students do not allocate their time only to doctoral studies. Part-time form of study negatively influences involvement in research projects. This negative influence has an impact in both types of involvement, i.e. as a principal and as an associate researcher. Form of study does not have a direct impact on categories of research outputs. Thus, both full-time and part-time PhD students publish similar categories. This analysis did not cover the issue of amount of published results.

The last significant area of this analysis is related to a satisfaction with research outputs. Even though differences can be observed among faculties and form of studies in other analyzed areas, all PhD students are dissatisfied with their research results. The average dissatisfaction at CULS Prague reaches a level of 70%! Students at FE expressed the lowest level of dissatisfaction (53.33%). Moreover, this dissatisfaction was expressed by full-time and part-time PhD students similarly.

The disseminated questionnaire covers more areas, but not all could be included in this analysis. Therefore, the future research will analyze other areas such as cooperation with PhD supervisors, satisfaction with doctoral studies or the issue of appropriate remuneration of PhD students. The authors would like to find out the reasons of most of the dissatisfactions. Moreover, the authors would also like to find out the reasons behind better research results of PhD students at some faculties.

References

Barnes, B. J. and Austin, A. E. (2009) 'The role of doctoral advisors: A look at advising from the advisor's perspective', *Innovative Higher Education*, vol. 33, no. 5, pp. 297-315. http://dx.doi.org/10.1007/s10755-008-9084-x.

Chambers, R. L. and Skinner, C. J. (2003) *Analysis of survey data*, Wiley http://dx.doi.org/10.1002/0470867205

CULS (2014) *Science & Research – Doctoral studies*, [online],. Available: http://www.czu.cz/en/?r=6142, [1 Dec 2014].

Dlouhý, M. (2012) ´Efficiency and resource allocation within a hierarchical organization´, *Proceedings of 30th International Conference Mathematical Methods in Economics*, Karviná: School of Business Administration, Silesian University, pp. 112-116.

Flégl, M., Tichá, I. and Stanislavská Kvasničková, L. (2013) ´Innovation of doctoral studies at the FEM CULS Prague´, *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 4, pp. 265-280. http://dx.doi.org/10.7160/eriesj.2013.060405

Flégl, M. and Vltavská, K. (2013) ´Efficiency at Faculties of Economics in the Czech Public Higher Education Institutions: Two Different Approaches´, *International Education Studies*, vol. 6, no. 10, pp. 1-12. http://dx.doi.org/10.5539/ies.v6n10p1

Flegl, M. and Vostra Vydrova, H. (2014) ´Is Pareto´s 80-20 rule applicable in research? A case of CULS Prague´, *Proceedings of 11th International Conference on Efficiency and Responsibility in Education (Erie 2014)*, Prague: Faculty of Economics and Management, Czech University of Life Sciences Prague, pp. 125-131.

Furková, A. (2013) ´Alternative approaches to efficiency evaluation of higher eduation institutions´, *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 3, pp. 167-178. http://dx.doi.org/10.7160/eriesj.2013.060304

Hilmer, M. J. and Hilmer, Ch. E. (2009) ´Fishes, ponds, and productivity: Student-advisor matching and early career publishing success for economics PhDs´, *Economic Inquiry*, vol. 47, no. 2, pp. 290-303. http://dx.doi.org/10.1111/j.1465-7295.2007.00108.x

Jablonský, J. (2014) ´Bibliometric indicators and their comparison on the set of Czech scientists´, *Proceedings of 11th International Conference on Efficiency and Responsibility in Education (Erie 2014)*, Prague: Faculty of Economics and Management, Czech University of Life Sciences Prague, pp. 255-261.

Johnes, J. (2006) ´Data envelopment analysis and its application to the measurement of efficiency in higher education´, *Economics of Education Review*, vol. 25, pp. 273-288. http://dx.doi.org/10.1016/j.econedurev.2005.02.005

Korhonen, P., Tainio, R. and Wallenius, J. (2001) ´Value efficiency analysis of academic research´, *European Journal of Operational Research*, vol. 130, no. 1, pp. 121-132. http://dx.doi.org/10.1016/S0377-2217(00)00050-3

Kyvik, S. and Smeby, J.-Ch. (1994) ´Teaching and research. The relationship between the supervision of graduate students and faculty research performance´, *Higher Education*, vol. 28, no. 2, pp. 227-239.

McMillan, M. L. and Chan, W. H. (2006) ´University efficiency: a comparison and consolidation of results from stochastic and non-stochastic methods´, *Education Economics*, vol. 14, no. 1, pp. 1-30. http://dx.doi.org/10.1080/09645290500481857

MEYS (2014) *Rozpis rozpočtu vysokých* škol *na rok 2014 (in Czech, Schedule of funding for higher education institutions for the year 2014)*, [online], Available: http://www.msmt.cz/vzdelavani/vysoke-skolstvi/rozpis-rozpoctu-vysokych-skol-na-rok-2014 [28 Nov 2014].

Pinheiro, D., Melkers, J. and Youtie, J. (2014) ´Learning to play the game: Student publishing as an indicator of future scholarly success´, *Technological Forecasting and Social Change*, vol. 81, pp. 56-66. http://dx.doi.org/10.1016/j.techfore.2012.09.008

RVVI (2013) *Methodology of Evaluation of Research Organizations and Evaluation of Finished Programmes (valid for years 2013 – 2015)*, [online], Available: http://www.vyzkum.cz/FrontClanek.aspx?idsekce=695512 [25 Nov 2014].

Stevens, P. A. (2005) ´A stochastic frontier analysis of English and Welsh universities´, *Education Economics*, vol. 13, no. 4, pp. 355-374. http://dx.doi.org/10.1080/09645290500251581

Vltavská, K. and Fischer, J. (2013) ´Is It Possible to Estimate Labour Productivity in the Czech Higher Education?´, *Journal on Efficiency and Responsibility in Education and Science*, vol. 6, no. 1, pp. 34-45. http://dx.doi.org/10.7160/eriesj.2013.060104