

FACTORS INFLUENCING KNOWLEDGE TRANSFER FROM FACULTY TO PHD STUDENTS

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ФАКТОРИ КОЈИ УТИЧУ НА ПРЕНОС ЗНАЊА СА УНИВЕРЗИТЕТСКИХ НАСТАВНИКА НА СТУДЕНТЕ ДОКТОРСКИХ СТУДИЈА

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ABSTRACT

A phenomenon that does not quite rise to the level of research misconduct occurs when faculty responsible for assisting PhD students fail to fulfill that role. The factors that may affect readiness of faculty to help PhD students with a methodological issue concerning sampling that was essential for designing a dissertation were revealed in this study – a simulated student-professor interaction study. Of 153 faculty asked to assist, 47% failed to respond and of those who responded, only 21% made an appointment to help the student. Results of our study showed that responsible behavior of university professors in regard to helping PhD students was more likely if the faculty member was younger, had more recently been employed and had higher publication and citation scores.

Key words: University teacher, PhD student, scientific irresponsibility

САЖЕТАК

Појава која се не може назвати неетичним понашањем у образовању али представља значајан проблем настаје када наставници задужени за одржавање наставе на докторским студијама не пружају стручну помоћ када им студенти то затраже. У овој студији, која се бави симулацијом интеракције студената докторских студија са наставницима, испитани су фактори који могу утицати на спремност наставника да студентима разјасне методолошка питања у вези са дизајном њихове будуће докторске тезе. Од 153 наставника којима је тражена помоћ везана за припрему дизајна тезе 47% није уопште одговорило, а од оних који су одговорили само 21% је заказало састанак са студентима. Наша студија је показала да су универзитетски наставници спремнији да помогну студентима докторских студија уколико су млађи, скорије почели да раде на универзитету и ако имају више публикација и већи индекс цитираности.

Кључне речи: универзитетски наставници, студент докторских студија, неодговорно понашање у образовању

INTRODUCTION

Knowledge transfer from faculty to PhD students is vital to both the process of education and to the quality of the dissertations that are produced. Readiness to make open, sincere and complete transfer of necessary knowledge is an ethical responsibility of faculty¹. Is the failure of faculty to fulfill this role a form of scientific misconduct? While all scientific societies and professions consider this a duty of faculty, the passive failure to assist PhD students does not rise to the level of "scientific misconduct." However, many of the faculty do not even recognize that passive or active avoidance of open and sincere knowledge transfer is a form of irresponsible and unethical behavior^{2,3,4,5}, which could partly explain ubiquitous nature of this phenomenon³.

In everyday work, young researchers are exposed to both positive and negative models of behavior in the research community⁶. Those who want to help in formulating ideas and designing dissertations of those who are in the beginning of their research carrier are invaluable to science and to their own institutions^{6,7}. Such teachers are able to enhance development and productivity of young researchers⁸.

Communication between senior and young researchers is also important for the maintenance and promotion of research traditions¹. Experienced researchers are rich with practical ideas for research. Their main tasks are to identify potential of young researchers, stimulate their independent research activity and facilitate their integration into the scientific community^{8,9}. Although importance of interaction and knowledge transfer between faculty and PhD students for appropriate development of young researchers is widely recognized in medical literature^{10,11}, it is surprising that published research on this topic is so scarce. Although it was observed that younger faculty spare less time interacting with undergraduate students¹², we are practically unaware what factors may influence willingness of faculty to openly and without reserve share their knowledge about research design with PhD students and young researchers in general.

The aim of this study was to reveal factors that may affect readiness of faculty to help PhD students with some methodological issues essential for setting up a dissertation. This problem

was easy to study within the Faculty of Medical Sciences, University of Kragujevac, Kragujevac, Serbia, where PhD students do not have specifically formulated committees, but are expected to find and request help from faculty in their specific area of study, and faculty, in turn, are expected to respond helpfully.

METHODS

Study Design

The study was designed as a simulated PhD student - faculty interaction, where the faculty were not aware that they participated in the study. The intervention consisted of previously prepared request for help with calculation of sample size for the future research which would be included in a PhD dissertation. Three PhD students prepared the following letter, and sent it to the faculty of the Faculty of Medical Sciences (FMS), University of Kragujevac, by e-mail, using official e-mail addresses:

„Dear Professor...,

I am a second year PhD student and I need some professional help regarding the design of my future PhD dissertation. In fact, it is the planning of the sample for the dissertation, which is of the case-control study type. After reviewing the list of your publications on the web site of the Faculty of Medical Sciences, I saw that you have a lot of experience in the design of the studies, so please spare some time for me and schedule a meeting in which you will help me to plan the sample size.

Grateful student..."

Each of the PhD students sent the letter in weekly aliquots of 10 e-mails during five weeks in 2013/14 school year. In this way, every member of the FMS' faculty received the letter. If a faculty responded to the letter, the students would start correspondence and then went to a meeting, provided that one was appointed by the faculty. All e-mails exchanged with the faculty have been stored in a database for further analysis.

The study was approved by the Ethics Committee of Faculty of Medical Sciences, University of Kragujevac.

Study Population

Study population consisted of all 153 faculty members (assistant professors, associate professors and full professors) employed at the Faculty

of Medical Sciences, University of Kragujevac, during 2013/14 school year. PhD study program at FMS started in 2005, and was organized according to national legislation, which does not request foundation of specifically formulated committees which would help to PhD students with setting up of their dissertations. There is only one central committee at FMS which approves or disapproves the proposals of dissertations, and in regard to actual design of their dissertations the students depend on the help from faculty in their specific area of study. Only four years ago for each of the PhD students was appointed a tutor, but his/her official responsibility is limited to reporting about activities and progress of a student.

Study Variables

The (dependent variables were the faculty response to the e-mail, time to reply to the e-mail, making appointment, and the type of help (no help, conditioned help, partial help [directing a student to a reference], complete help) to the PhD student.

Possible independent and confounding variables were: gender, research experience of faculty expressed as years of life and duration of employment at university, academic title, research area (preclinical or clinic), teaching surgical or internal diseases subjects, number of publications, number of citations, h-index¹³, number of co-authors, number of citations from 2011 to 2013, and average number of citations per document (according to Scopus¹⁴ and Web of Knowledge databases¹⁵).

Statistical Analysis

The data were primarily statistically described using means and standard deviations for continuous variables and percentages for categorical variables. Normality of the data distribution was checked by Kolmogorov-Smirnov test. If normality was confirmed, Student T-test was used to compare the study groups. Otherwise, the nonparametric Mann Whitney U test was used. Categorical variables were compared by Chi-square test. Binary logistic regression was used to identify variables that are associated with the study outcomes. All calculations were performed by statistical software SPSS, version 18.

Statistical Analysis

The study population consisted of all faculty members employed at FMS: 153 of them, 77 (51.0%) female and 75 (49.0%) male. The average age of study participants was 50.01 ± 7.83 (SD) years. There were 65 (42.5%) associate professors, 49 (32.0%) assistant professors, and 39 (25.5%) full professors. The average duration of total employment at university was 16.90 ± 7.78 (SD) years, and average duration of employment with the current academic title was 4.86 ± 4.26 (SD) years.

In total 72 faculties (47.1%) did not respond at all to the request for help sent by the e-mail. Sixty-five (42.5%) study participants replied to the request after on average 2.42 ± 3.52 (SD) days. Six faculties (3.9%) did not have an available e-mail, while the e-mail addresses of next 10 faculties (6.5%) were not functional (an automatic e-mail reply came back to the investigators stating that such e-mail addresses do not exist). Out of the faculties who replied, 32 (20.9%) of made an appointment with the investigators. Characteristics of the study participants according to their response to the request for knowledge transfer are shown in Table 1.

No help at all was offered by 107 (69.9%) faculties. They either didn't reply to the e-mail or refused to help by e-mail reply or after meeting students. Partial help (referring to literature or statistical software, or referring to another professional, tutor or mentor) was given by 37 (24.2%) subjects: seven (4.6%) of them also offered mentoring or having insight into the research plan. Only 2 (1.3%) gave their complete and unconditional support.

In order to understand which characteristics of the faculty contribute to their positive response to the request of the PhD students, odds ratios for groups which responded to the e-mail, made an appointment and offered help and groups that did not were calculated. Crude odds ratios were compared with odds ratios calculated after adjustment by binary logistic regressions. The results are shown in Tables 2, 3 and 4.

Table 1 Characteristics of the study participants according to their response for the request for help sent by e-mail

| Variables | Teacher's response to the e-mail | | | Making appointment with the PhD students | | | The type of help offered | | |
|---|----------------------------------|------------------|-----------------------------|--|------------------|-----------------------------|--|------------------|-----------------------------|
| | Yes | No | Test, <i>p</i> | Yes | No | Test, <i>p</i> | Yes, (conditioned help, partial help, complete help) | No help | Test, <i>p</i> |
| Sex <i>N</i> (%) | | | | | | | | | |
| Female | 39 (50) | 39 (50) | $\chi^2=3.078$ | 17 (21.5) | 62 (78.5) | $\chi^2=0.000$ | 24 (30.8) | 54 (69.2) | $\chi^2=0.000$ |
| Male | 26 (34.7) | 49 (65.3) | $p=0.079$ | 15 (20.3) | 59 (79.7) | $p=1.000$ | 22 (29.3) | 53 (70.7) | $p=0.986$ |
| Age (years) <i>Mean</i> \pm <i>SD</i> | 48.64 \pm 7.99 | 51.07 \pm 7.58 | $t=1.884$ $p=0.062$ | 47.81 \pm 7.76 | 50.13 \pm 8.73 | $t=1.359$ $p=0.176$ | 47.87 \pm 8.03 | 50.99 \pm 7.58 | $t=2.273$ $p=0.025^*$ |
| Academic title | 21 (42.9) | 28 (57.1) | $\chi^2=7.098$ | 13 (26.5) | 36 (73.5) | $\chi^2=13.966$ | 15 (30.6) | 34 (69.4) | $\chi^2=4.184$ |
| Associate professors | 34 (52.3) | 31 (47.7) | $p=0.029^*$ | 19 (29.2) | 46 (70.8) | $p=0.001^*$ | 24 (36.9) | 41 (63.1) | $p=0.123$ |
| <i>N</i> (%) | 10 (25.6) | 29 (74.4) | | 0 (0) | 39 (100) | | 7 (17.9) | 32 (82.1) | |
| Duration of total employment at university (years) <i>Mean</i> \pm <i>SD</i> | 16.58 \pm 7.58 | 17.14 \pm 7.97 | $t=0.435$ $p=0.664$ | 15.97 \pm 7.58 | 17.15 \pm 8.08 | $t=0.762$ $p=0.447$ | 15.60 \pm 7.02 | 17.45 \pm 8.05 | $t=1.340$ $p=0.182$ |
| Duration of employment with the current academic title (years) <i>Median</i> (<i>Range</i>) | 3.00 (0-22) | 4.00 (0-17) | $U=2198.000$ $p=0.029^*$ | 3.00 (0-11) | 4.00 (0-22) | $U=1372.000$ $p=0.024^*$ | 2.50 (0-22) | 4.00 (0-17) | $U=1623.000$ $p=0.003^*$ |
| Area | 30 (33) | 61 (67) | $\chi^2=7.390$ | 12 (13.2) | 79 (86.8) | $\chi^2=6.997$ | 19 (20.9) | 72 (79.1) | $\chi^2=7.967$ |
| <i>N</i> (%) | 35 (56.5) | 27 (43.5) | $p=0.007^*$ | 20 (32.3) | 42 (67.7) | $p=0.008^*$ | 27 (43.5) | 35 (56.5) | $p=0.005^*$ |
| Area | 11 (25) | 33 (75) | $\chi^2=6.755$ | 5 (11.4) | 39 (88.6) | $\chi^2=2.644$ | 7 (15.9) | 37 (84.1) | $\chi^2=4.979$ |
| <i>N</i> (%) | 54 (49.5) | 55 (50.5) | $p=0.009^*$ | 27 (24.8) | 82 (75.2) | $p=0.104$ | 39 (35.8) | 70 (64.2) | $p=0.026^*$ |
| Number of publications (Scopus) <i>Median</i> (<i>Range</i>) | 14.00 (0-133) | 12.00 (0-137) | $U=2656.000$ $p=0.451$ | 14.00 (2-77) | 12.00 (0-137) | $U=1718.500$ $p=0.329$ | 14.50 (0-133) | 12.00 (0-137) | $U=1967.500$ $p=0.049^*$ |
| Number of citations (Scopus) <i>Median</i> (<i>Range</i>) | 20.00 (0-1084) | 10.50 (0-5683) | $U=2273.500$ $p=0.030^*$ | 24.00 (0-647) | 12.00 (0-5683) | $U=1463.000$ $p=0.034^*$ | 34.00 (0-1084) | 10.00 (0-5683) | $U=1471.500$ $p=0.000^*$ |
| Number of citations from 2011.to2013 (Scopus) <i>Median</i> (<i>Range</i>) | 14.00 (0-465) | 8.00 (0-1964) | $U=2229.500$ $p=0.020^*$ | 19.50 (0-275) | 8.00 (0-1964) | $U=1353.000$ $p=0.009^*$ | 24.50 (0-465) | 7.00 (0-1964) | $U=1463.500$ $p=0.000^*$ |
| Citing articles (Scopus) <i>Median</i> (<i>Range</i>) | 17.00 (0-906) | 10.50 (0-4420) | $U=2293.500$ $p=0.036^*$ | 21.50 (0-614) | 12.00 (0-4420) | $U=1459.500$ $p=0.032^*$ | 27.50 (0-906) | 9.00 (0-4420) | $U=1504.000$ $p=0.000^*$ |

| | | | | | | | | | |
|--|-------------------|-------------------|------------------------|-------------------|-------------------|------------------------|-------------------|-------------------|------------------------|
| Number of co-authors in all published articles (Scopus) <i>Median (Range)</i> | 35.00 (0-150) | 33.00 (0-150) | U=2540.500 p=0.238 | 40.00 (0-137) | 34.00 (0-150) | U=1650.000 p=0.200 | 42.00 (0-150) | 31.00 (0-150) | U=1869.500 p=0.018* |
| H index (Scopus) <i>Median (Range)</i> | 2.00 (0-17) | 2.00 (0-41) | U=2559.500 p=0.254 | 2.00 (0-8) | 2.00 (0-41) | U=1496.500 p=0.043* | 2.00 (0-17) | 2.00 (0-41) | U=1765.000 p=0.004* |
| Number of publications (WOS) <i>Median (Range)</i> | 6.00 (0-48) | 5.00 (0-58) | U=2413.000 p=0.098 | 6.50 (0-27) | 5.00 (0-58) | U=1549.500 p=0.082 | 7.00 (0-48) | 5.00 (0-58) | U=1752.500 p=0.005* |
| Number of citations (WOS) <i>Mediana (Range)</i> | 6.00 (0-212) | 3.50 (0-1447) | U=2242.000 p=0.022* | 11.00 (0-151) | 4.00 (0-1447) | U=1323.000 p=0.006* | 9.50 (0-212) | 4.00 (0-1447) | U=1631.000 p=0.001* |
| Citing articles (WOS) <i>Median (Range)</i> | 6.00 (0-166) | 3.50 (0-1323) | U=2262.000 p=0.026* | 10.00 (0-143) | 4.00 (0-1323) | U=1337.000 p=0.007* | 9.50 (0-166) | 3.00 (0-1323) | U=1623.500 p=0.001* |
| H index (WOS) <i>Median (Range)</i> | 1.00 (0-10) | 1.00 (0-19) | U=2424.500 p=0.094 | 2.00 (0-8) | 1.00 (0-19) | U=1438.500 p=0.020* | 2.00 (0-10) | 1.00 (0-19) | U=1752.500 p=0.003* |
| Average number of citations per document (WOS) <i>Median (Range)</i> | 1.00 (0-18.00) | 0.75 (0-24.95) | U=2389.500 p=0.081 | 1.65 (0-18.00) | 0.75 (0-24.95) | U=1380.500 p=0.012* | 1.25 (0-18.00) | 0.75 (0-24.95) | U=1816.000 p=0.010* |

*p < 0.05 (significant difference), SD- Standard deviations, WOS- Web of Science

Table 2. Crude and adjusted odds ratios for the university teachers who replied to the e-mail vs. those who did not reply¹.

| Variables | p | Crude odds ratio (95% CI) | p | Adjusted* odds ratio (95% CI) |
|---|---------------|------------------------------|---------------|----------------------------------|
| Duration of employment with the current academic title | 0.097 | 0.933 (0.859-1.013) | 0.041* | 0.896 (0.806-0.996) |
| Area (disciplines in internal medicine or surgical disciplines) | 0.007* | 2.946 (1.352-6.418) | 0.026* | 2.846 (1.135-7.139) |
| Area (preclinical or clinic) | 0.004* | 2.636 (1.355-5.128) | 0.357 | 1.473 (0.646-3.357) |
| Number of publications (WOS) | 0.134 | 1.033 (0.990-1.078) | 0.040* | 1.149 (1.007-1.312) |
| Average number of citations per document (WOS) | 0.148 | 1.084 (0.972-1.209) | 0.024* | 1.517 (1.056-2.180) |

Adjusted* for duration of employment with the current academic title, area (surgical disciplines or disciplines in internal medicine), area (preclinical or clinic), number of publications (Scopus), number of citations (Scopus), number of citations from 2011 to 2013 (Scopus), Citing articles (Scopus), Number of co-authors in all published articles (Scopus), H index (Scopus), Number of publications (WOS), Number of citations (WOS), Citing articles (WOS), H index (WOS) and Average number of citations per document (WOS). CI- Confidence interval, p* < 0.005 (significant difference), WOS- Web of Science.

¹ For the sake of clarity, values of ODDS ratios for variables without significant influence were omitted.

Table 3. Crude and adjusted odds ratios for the university teachers who made an appointment with the PhD students vs. those who did not.

| Variables | p | Crude odds ratio (95% CI) | p | Adjusted odds ratio* (95% CI) |
|--|---------------|------------------------------|---------------|----------------------------------|
| Duration of employment with the current academic title | 0.011* | 0.836 (0.727-0.960) | 0.016* | 0.782 (0.641-0.955) |
| Area (preclinical or clinic) | 0.006* | 3.135 (1.398-7.030) | 0.037* | 3.194 (1.074-9.498) |

Adjusted* for sex, age (years), duration of employment with the current academic title, area (surgical disciplines or disciplines in internal medicine), area (preclinical or clinic), number of publications (Scopus), number of citations (Scopus), number of citations from 2011 to 2013 (Scopus), Citing articles (Scopus), Number of co-authors in all published articles (Scopus), H index (Scopus), Number of publications (WOS), Number of citations (WOS), Citing articles (WOS), H index (WOS) and Average number of citations per document (WOS). CI- Confidence interval, p* < 0.005 (significant difference), WOS- Web of Science.

¹ For the sake of clarity, values of ODDS ratios for variables without significant influence were omitted.

Table 4. Crude and adjusted odds ratios for the university teachers who actually helped to the PhD student vs. those who did not

| Variables | p | Crude odds ratio (95% CI) | p | Adjusted odds ratio* (95% CI) |
|---|---------------|------------------------------|---------------|----------------------------------|
| Age (years) | 0.027* | 0.948 (0.905-0.994) | 0.616 | 1.019 (0.947-1.097) |
| Duration of employment with the current academic title | 0.015* | 0.876 (0.787-0.974) | 0.013* | 0.784 (0.647-0.950) |
| Area (disciplines in internal medicine or surgical disciplines) | 0.018* | 2.945 (1.200-7.227) | 0.147 | 2.409 (0.734-7.901) |
| Area (preclinical or clinic) | 0.003* | 2.923 (1.434-5.960) | 0.353 | 1.608 (0.591-4.376) |
| Number of publications (WOS) | 0.020* | 1.056 (1.009-1.106) | 0.022* | 1.192 (1.026-1.386) |
| Average number of citations per document (WOS) | 0.036* | 1.131 (1.008-1.270) | 0.058 | 1.506 (0.986-2.300) |

Adjusted* for sex, age (years), duration of employment with the current academic title, area (surgical disciplines or disciplines in internal medicine), area (preclinical or clinic), number of publications (Scopus), number of citations (Scopus), number of citations from 2011 to 2013 (Scopus), Citing articles (Scopus), Number of co-authors in all published articles (Scopus), H index (Scopus), Number of publications (WOS), Number of citations (WOS), Citing articles (WOS), H index (WOS) and Average number of citations per document (WOS). CI- Confidence interval, $p < 0.005$ (significant difference), WOS- Web of Science.

¹ For the sake of clarity, values of ODDS ratios for variables without significant influence were omitted.

DISCUSSION

Our study revealed influence of a few factors on willingness to offer help among the faculty, and most of them were associated with research activities and results. While sex of the faculty was not important factor, the results showed that younger professors were more ready to help to PhD students (Table 1). Only a handful of Full Professors responded to the e-mail, compared to the Associate Professors and Assistant Professors. Not a single Full Professor made an appointment with the PhD students (Table 1), and they responded to the e-mail much less frequently than Associate and Assistant Professors. Faculty who had more recently been employed at the current academic position were more ready to interact with the PhD students (Tables 1, 2, 3 and 4). Another study showed low total response rate to undergraduate students' requests for additional explanations, but on the contrary to our results, younger teachers were less will-

ing to help, possibly because of high burden of overall university duties¹².

An interesting finding in our study was that faculties who are teaching students in preclinical disciplines were more ready to help than professors of clinical disciplines. It was found that professors of preclinical disciplines were 2.5 times more likely to respond to e-mails, over 3 times more likely to schedule appointments and about 3 times more likely to provide some form of help to the PhD students, compared to the professors who are teaching clinical disciplines. In the same time, professors of preclinical disciplines had better research performance with higher publication and citation scores. Although in clinical disciplines, higher academic grade is usually associated with higher research performance and publication rate¹⁷; in our study it was the opposite, since faculty from preclinical disciplines, who were having lower academic positions, had higher publication and citation scores than the faculties from clinical disciplines. Therefore,

higher research experience of preclinical faculties was probably responsible for greater willingness to help to the PhD students with methodological advice.

Faculties of internal diseases disciplines in our study were about 3 times more likely to respond to e-mail of the PhD students and to provide assistance, compared with professors of surgical disciplines. Other studies also showed lower involvement rate of professors of surgical disciplines in teaching activities¹⁸, which could partly be explained by their high burden of clinical work and more stressful working conditions.

Actually, the strongest predictors of high willingness to help and transfer knowledge in our study were publication and citation scores, including H index calculated from both Scopus and WOS databases. Although average value of H index for our study participants was low (H index from 5 to 9- well established publication record; from 10 to 14 excellent publication record; H index over 15- exceptional publication record)¹⁹, it still determined their attitude toward the students, showing that in a way it is linked also with personal ethics.

The study participants with greater number of co-authors in all their published articles (Scopus) helped the PhD students more frequently, compared with a group of professors with smaller number of co-authors (Table 1). It seems that ability to work in a team and organize people is also associated with higher personal ethical standards: it was shown that positive attitude towards the teamwork was linked with higher knowledge of medical ethics²⁰.

One possible limitation of our study was that the outcome of the request for help could depend on how a PhD student presented or explained what kind of help he or she needed, both within the e-mail correspondence and while meeting a professor. For example, some of the professors ended the conversation after finding out that assistance from their specialized field of work was not required, although the request was centered on basic research methodology, common to all fields.

Our study showed that responsible behavior of faculty in regard to knowledge transfer to PhD students is associated with younger age, shorter employment at university and with higher publication and citation scores. It seems that an advanced research environment and higher academic achievements positively influence development of awareness about teaching responsibilities among the faculty. Universities should adopt and publicize a code of conduct of researchers which clarifies expectations of helping students, which then should be publicly available.

Awareness of other, less frequent forms of misbehavior, should also be investigated. This will require innovative research methods, like simulation of roles of PhD students or other kinds of researchers. The results of this study could be used in the process of teaching ethics at PhD studies, as a case study. This would help to make PhD students more aware of their rights.

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