

Tatiane Teixeira,* Claudia Tania Picinin,* Luiz Alberto Pilatti*

Factors influencing professors' performance in graduate programs in the Engineering III area

Factores que influyen en el desempeño de los profesores en los programas de posgrado en el área de Ingeniería III

Abstract | The purpose of this paper is to present the factors that influence the professors' performance of postgraduate programs classified with notes 6 and 7 by Capes (Coordination for the Improvement of Higher Education Personnel) in the areas of Engineering III in Brazil. Notes 6 and 7 indicate performance equivalent to the high international standard. Data collection was carried out through a questionnaire and data analysis was performed using the Statistical Package for the Social Sciences SPSS software, version 23, including independent T test by two groups (men and women), correlation studies and qualitative analysis. The results present a framework indicating the factors mapped in the literature combined with the factors that, in the perception of professors of postgraduate courses, influence professors' performance, as well as an explanatory chart that details all categories of factors identified. It is evident that scientific production is a factor that impacts the professors' performance, but personal profile and availability of resources interfere more significantly.

Keywords | graduate programs | professor | performance.

Resumen | El propósito de este trabajo es presentar los factores que influyen en el desempeño de los profesores de los programas de posgrado clasificados con los grados 6 y 7 por Capes (Coordinación para el Perfeccionamiento del Personal de Educación Superior) en las áreas de Ingeniería III en Brasil. Las notas 6 y 7 indican un rendimiento equivalente al alto estándar internacional. La recolección de datos se realizó a través de un cuestionario y el análisis de los datos se realizó mediante el *software* Statistical Package for the Social Sciences SPSS, versión 23, que incluye prueba T independiente por dos grupos (hombres y mujeres), estudios de correlación y análisis cualitativo. Los resultados presentan un marco

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* Universidade Tecnológica Federal do Paraná – UTFPR.

Correos electrónicos: tteixeira888@gmail.com | claudiapicinin@utfpr.edu.br | lapilatti@utfpr.edu.br

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que indica los factores mapeados en la literatura combinados con los factores que, en la percepción de los profesores de posgrado, influyen en el desempeño de los profesores, así como un cuadro explicativo que detalla todas las categorías de factores identificados. Es evidente que la producción científica es un factor que impacta en el desempeño de los profesores, pero el perfil personal y la disponibilidad de recursos interfieren de manera más significativa.

Palabras clave | programas de posgrado | profesor | desempeño.

Introduction

STRICTO SENSU Graduate Programs in Brazil are evaluated by the Coordination of Improvement of Higher Education Personnel (CAPES) aiming at determining whether these courses present the minimum level of quality required to be kept active (Nigro *et al.* 2015). The programs are evaluated and scored from 1 to 7: (i) 1 and 2 have their course authorization cancelled as well as the recognition of the master's or doctorate courses offered. (ii) 3 means a regular performance; (iii) 4 is considered a good performance; (iv) 5 is the maximum rating for Master's programs. Ratings 6 and 7 indicate a performance that is equivalent to international standards (Capes 2018a).

In this evaluation carried out by Capes, the criterion 'teaching team' has a great influence on the other items of the evaluation, mainly regarding the information in the curriculum lattes of these professors (Maccari *et al.* 2008). The four-year evaluation form, presented by Capes (2018b), shows that 20% of the rating given to graduate programs is related to the teaching team, while 35% corresponds to the intellectual production, which refers to qualified publications by the permanent group of professors, followed by 35% referring to the students, thesis, dissertations and 10% refers to social insertion.

Publications represent a significant factor in the performance of professors working in post-graduation programs. This can be observed in studies that present publication productivity analyses, understood as the number of articles published and other works that offer the comparison of article production between departments (Hargens 2012, Herculano and Norberto 2012; Iriart *et al.* 2015; Danesh, Fattahi and Dayani 2017). These publications are also approached in studies related to the productivity grant; post-doctorate internship and professors' accreditation (Coauthor *et al.* 2016; Marshall *et al.* 2009; De Castro *et al.* 2013; De Castro and Porto 2008; Calvosa *et al.* 2010; Sánchez and Sánchez 2010).

The fact that professors' performance is evaluated from the standpoint of publications, which in this paper is a factor related to the scientific production category (categories that refer to the gathering of articles that address the same theme), other factors are seen to influence professors' performance. These are

grouped into the categories: professors' education, knowledge management, teaching methods, students' perspective and health.

The category professors' education addresses factors such as motivation (willpower), ability (know-how) and opportunity (having the chance of doing something), which influence professors' performance (Marx *et al.* 2016) as well as motivation to teach and illustrate the theory with practical examples (De Fátima Joaquim, Boas and De Pádua Carrieri 2012). To these factors, we add the value given to education (Triviño *et al.* 2014), and the proper use of teaching materials and experimentation in laboratories as ways of linking theory and practice (Grassi *et al.* 2016).

Knowledge management is a factor that influences professors' performance, since according to a study carried out in Thailand, when there is mass retirement and newly-graduate personnel is hired, having to act without the guidance of more experienced professionals, they face difficulties for not having this support at the beginning of their careers. A knowledge management system based on mentoring is proposed as a tool for the development of personnel that have recently obtained their doctorate degrees (Sriwichai *et al.* 2014).

Studies have shown that teaching methods, such as support material and participative methods used by professors, such as power point presentations, development of good rapport in the group, demonstration of the benefit of what is being taught for the professional future of the students, professor's leadership style, and the assignment of tasks that lead to the consolidation of knowledge, are factors that influence professors' performance (Valcárcel, Vidal Ledo and Olite 2013; Viñas Pérez 2015; Cerda Suárez and Hernández 2012; Bolívar 2008; Inoue-Smith 2016).

Some studies present factors that influence professors' performance, under the students' perspective, such as: professor's rapport, clarifying doubts, suitability of the content in relation to personal needs and professional education, link between theory and practical activities, providing students with coherent information, use of current teaching methods, effective use of time, provoking students' entrepreneur and researcher profile, promoting interpersonal relationships, practicing oratory and teaching problem-solution methods (De Souza Alves, Bohomol and Kowal Olm Cunha 2015; Drule *et al.* 2014; De Oliveira Nepomuceno, Costa and Shimoda 2010).

Finally, the literature also presents the health factor, which influences professors' performance. According to Borsoi and Pereira (2012 and 2013), studies have demonstrated that the number of activities in the academic environment have led professor to get ill. Among the complaints related to poor health, psycho-emotional and/or psychosomatic disorders outstand. The need for medical and/or psychological help has been more frequent among professors in the post-graduation programs, mainly women that have larger numbers of advisees.

In such context, other factors have been observed to influence the post-graduation professors' performance, in addition to the written academic production (publications), therefore, the research problem presented is: What are the factors influencing professors' performance in the perception of professors working in post-graduation rated 6 and 7 by Capes, in the area of Engineering III in Brazil?

Methodology

To carry out this study, a questionnaire by Borsoi and Pereira (2013) was adapted and a link sent to each professor's email (235 professors). Sixty-one questionnaires were returned, which corresponds to 25.96% of the questionnaires sent. The questions were grouped in nine blocks: (1) socio-demographic characteristics; (2) professional characterization; (3) working hours; (4) teaching job; (5) time outside work; (6) feelings in relation to work; (7) health situation; (8) general impressions of the university, work and future, and (9) factors influencing professors' performance.

Two questions were added to the original questionnaire by Borsoi and Pereira (2013): (i) In your opinion, which factors influence post-graduation professors' performance? And (ii) What is the rate given by Capes to the post-graduation program you work in?

The research application was made through a questionnaire sent to 235 professors from ten universities, in which five graduate programs present rating 6: ITA (39 professors), UFRJ (12 professors), PUC/PR (12 professors), UFSC (43 professors), UFRGS (30 professors), and five programs present rating 7: UFPE (13 professors), UFRGS (16 professors), PUC/RIO (18 professors), UFU (27 professors) and UFRJ (26 professors), according to consultation held in July 2018 (Capes 2018c). 61 responses were obtained, which are about 25,96% of the questionnaires sent. The data analysis was made through the Statistical Package for the Social Sciences SPSS software, version 23, contemplating attendance analysis, T-test independent through two groups (men and women), studies of correlation and qualitative analysis.

Categories *versus* factors – literature review

By mapping the literature in the Scopus and Web of Science databases, 37 articles were identified that deal professors' performance in graduate program. Among these articles, it was identified that there were authors who addressed different researches, but with the same theme. Thus, articles that had the same theme were allocated into eight categories, as shown in chart 1.

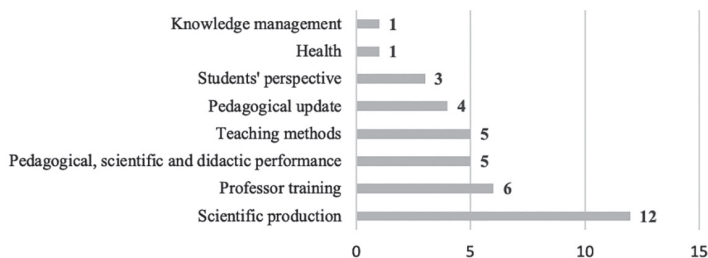
Chart 1. Category versus themes.

Category	Theme
Scientific production	Publication productivity, scientific productivity, number of published articles, articles publication, scientific production from researchers recipient of CNPq productivity grants, post-doctoral stage, characteristics for professor's accreditation.
Professor training	Teaching skills significance, lack of professor training, classroom experience, relationship between theory and practice, market experience, relevant use of didactical resources.
Pedagogical, scientific and didactical performance	Requirements that demonstrate professors' performance, for instance didactic, communication, scientific research, dialectical relationship between theory and practice, indicators of professors' evaluation.
Teaching method	Classroom support materials, participative methods, blended-learning teaching method, PowerPoint use.
Pedagogical update	Lack of knowledge about the teaching methodological regulation, inappropriate pedagogical preparation, heterogeneous criteria for classes and evaluations, lack of pedagogical evaluation to get in the professor career.
Students' perspective	Professor reception, doubts clarification, course substance adjustment to each student need, consistent information supply, modern teaching methods use, efficient use of time, activities that motivate students' professional and personal development.
Health	Illness.
Knowledge management	Knowledge management system based on mentoring.

Source: The authors (2018).

The articles in the categories presented in the chart 1 provide influential factors (categories subitems) on professors' performance and are related to the graduate. There is a trend to characterize the professors' performance based on scientific production, due to the highest incidence of articles in this category and the lowest in the others, according to the figure 1.

Figure 1. Number of articles in each category.



Source: The authors (2018).

The scientific production, professor training, pedagogical, scientific and didactical performance and teaching methods categories have the highest concentration of studies.

The chart 2 gathers in categories the influential factors on professors' performance mapped in the articles.

Chart 2. Influential factors on graduate professors' performance.

Categories	Authors	Factors
Pedagogical, scientific and didactical performance	Alagarsamy and Ramalingam (2017) / Caballero, Morales and Oquendo (2015) / Escobar (2017) / Embiruçu, Fontes and Almeida (2010) / Vásquez-Rizo and Gabalán-Coello (2012)	<ol style="list-style-type: none"> 1. Pedagogical performance (didactic, scientific-investigative and communicative). 2. Relationship between theory and practice. 3. No. of leave months (for training or illness). 4. Academic management. 5. Extension activities. 6. Additional recognition for scientific production merit. 7. Graduate completion rate. 8. Planning. 9. Methodology. 10. Assessment. 11. Interpersonal relationship. 12. Experience. 13. Educational qualification. 14. Participation in projects. 15. Publications. 16. Participation in academic events.
Professor training	Álvarez, Álvarez and Álvarez (2016) / Marx <i>et al.</i> (2016) / Triviño, X. <i>et al.</i> (2014) / Joaquim, Vilas Boas and Carrieri (2012) / Marrero, Suárez and García (2011) / Grassi <i>et al.</i> (2016)	<ol style="list-style-type: none"> 17. Medical area professors must be trained in the "health promotion" dimension. 18. Motivation ("willingness"). 19. Ability ("can do"). 20. Opportunity ("have the change to do"). 21. Value given to education and to professor training. 22. Teaching skills significance. 23. Educational contribution for professional role. 24. Contribution for personal development. 25. Academic community strengthening. 26. Motivation. 27. Scientific texts production. 28. Relevant use of didactical resources. 29. Link theory and practice.
Teaching methods	Morejón <i>et al.</i> (2015) / Díaz and González (2015) / Galindo-Cárdenas <i>et al.</i> (2015) / Pinilla-Roa, Moncada-Álvarez and López-Páez (2010)	<ol style="list-style-type: none"> 30. Support materials. 31. Development of the emotional group atmosphere. 32. Benefit to professional performance. 33. Participative methods. 34. Professors' leadership style. 35. Blended-learning learning modality. 36. Fare assessment based on criteria agreed with students. 37. Communication.

Continue ►

Chart 2. Influential factors on graduate professors' performance (continuation).

Categories	Authors	Factors
		38. Professional aspects and personal attributes. 39. External noise. 40. Classroom without air conditioner. 41. Lack of exercises to consolidate learning. 42. Lack of forums monitoring. 43. PowerPoint use.
Pedagogical update	Morejón <i>et al.</i> (2015) / Díaz and González (2015) / Galindo-Cárdenas <i>et al.</i> (2015) / Pinilla-Roa, Moncada-Álvarez and López-Páez (2010)	44. Increase the professors' pedagogical skills. 45. Gaps in the didactical field. 46. Improvement in the professor-student communication. 47. Quality of the teaching-learning process. 48. Inappropriate pedagogical preparation. 49. Heterogeneous criteria for classes and graduate students' assessment. 50. Lack of pedagogical development. 51. Lack of an university hospital (medicine area).
Health	Borsoi and Pereira (2013)	52. Illness
Knowledge management	Sriwichai <i>et al.</i> (2014)	53. Massive retirement generates hiring of new graduates who need to act without guidance from senior ones. 54. Knowledge management.
Students' perspective	Alves, Bohomol and Cunha (2015) / Drule <i>et al.</i> (2014) / Nepomuceno, Costa and Shimoda (2010)	55. Professors' reception. 56. Doubts clarification. 57. Course substance adjustment to each students' need. 58. Professional training. 59. Theory and practice link. 60. Consistent information supply. 61. Modern teaching methods use. 62. Efficient use of time. 63. Motivate the entrepreneurial and researcher profile, oratory, expression ability, interpersonal relationship and problems resolution.
Scientific production	Herculano and Norberto (2011) / Herculano and Norberto (2012) / Iriart <i>et al.</i> (2015) / Calvosa, Repossi and Castro (2011) / Castro, Porto and Júnior (2013) / Danesh, Fattahi and Dayani (2017) / Zou and Peterson (2016) / Hargens (2012) / Marshall <i>et al.</i> (2009) / Castro and Porto (2008) / Author <i>et al.</i> (2016) / Sánchez and Sánchez (2011)	64. Number of publications. 65. Years as recipient of post-doctoral grant. 66. Productivity grants received. 67. Number of courses given. 68. Research and publication abilities. 69. Academic community visibility. 70. Titration. 71. Guidance quality. 72. Contribution for the program development. 73. Insertion in the undergraduate. 74. Number of guidance in progress and/or concluded. 75. English proficiency. 76. Publication in journals. 77. Work/ study in influent educational institutions. 78. Zp-index indicator. 79. Post-doctoral stage.

Source: The authors (2018).

These 79 factors mapped in the literature represent impacting criteria on graduate professors' performance. The scientific production category presented the highest number of articles, highlighting the publications significance on professors' performance. However, it was observed through this literature review, besides the scientific production, factors regarding the students' perspective, the professor training, the teaching method, the pedagogical update, the knowledge management and even the health. This mapping presented in the chart 2 contributes to understand that professors' performance is evaluated through different perspectives, as the authors cited and reinforce the several responsibilities and attributions assumed by the professors.

Results and discussions

Having received 61 answered questionnaires from the professors working in the graduate programs, with ratings 6 and 7, of the Engineering III area in Brazil, the number of returns corresponds to 25.96% of the questionnaires sent, being 35 (57%) from professors in programs with rating 6, and 26 (43%) from professors in programs with rating 7.

The 61 respondents are predominantly men, aged between 50 and 60 years old, catholic, married and with two children. Most professors (68.33%) work in the Mechanical Engineering department, this is due to the fact that out of the 10 courses rated 6 and 7 in the Engineering III area in Brazil, 6 are Mechanical Engineering courses (Plataforma Sucupira, 2018). As for titles, 36 (59%) professors have a post-doctorate, 25 (41%) professors hold the title of Doctor, 68.85% receive productivity grants from CNPq and 42.62% of these professors do not carry out administrative functions.

An expressive number of professors (82%) work in the exclusive dedication regime (thus, full time), but only 27 (44%) professors coordinate extension programs or projects. This result is Silva and Resende's (2017) research theme, who studied the main impediments for professors in higher education to effectively reconcile teaching, doing research and extension projects, since this principle of inseparability is defined as the responsibility of universities (Brazil 1988). Silva and Resende (2017) concluded that the main impediments are: lack of structure, insufficient funding, inadequate teacher training, non-existent didactic training, devaluation of the profession and the overloading of tasks, as well as lack of student interest, who have little or no understanding of the importance of linking teaching to research and social practice.

It has been identified in this research that 78.69% of professors work over 8 hours a day, similar results are identified in the study by Boas *et al.* (2018) with professors of higher education federal institutions, which reported that 75.5% of

these professionals work over 8 hours a day. Likewise, Lim and de Oliveira Lima-Filho (2009) identified the existence of excess working hours in a study with 189 professors from the Federal University of Mato Grosso do Sul. Most of the professors dedicate between half an hour and two hours to read and reply emails and 75.4% of the respondents stated that they work on holidays and on weekends, similar result was found in Borsoi study (2012)'s, who found that 81.3% of professors also work on holidays and weekends. Just as Lima and Lima (2009) have shown that because of work overload, professors work on weekends and in periods institutionally destined to rest and leisure.

A significant number of respondents, 21 (48%) professors, explain that overworking and the impossibility of carrying out all activities during normal working hours are the reasons for working on weekends and holidays, followed by 14 (32 %) of respondents, who dedicate themselves to class preparation, essay writing and correction of dissertations, thesis and articles.

These professors usually teach two or three subjects, they work between 8 and 13 class/hours a week, they advise between 5 and 12 post-graduation students, 55.7% of the professors do not advise students in the undergraduate internship, only two professors have been supervising a group in the Tutorial Education Program (PET, Brazilian acronym) for ten years, 80.3% of the respondents have between one and eight registered studies, 62.3% of the professors receive an academic grant, either form CNPq or another funding agency and 70.5% of the professors have scientific education students receiving scholarship.

The 61 respondents stated that they have published papers, one of the participants outstood with 67 papers published in journals in the last two years (2017-2018), from which 27 papers have JCR. Another participant published 20 papers, 19 with JCR and one respondent had 15 published papers all with JCR.

An expressive number of professors (90.2%) took part in scientific congresses as presenters and all respondents (n = 61) took part in four to ten boards of qualification or presentation of dissertations and thesis in the last 2 years (2017-2018).

Respondents rated their work conditions as "good", as mentioned by 22 (36.06%), "excellent", "great" and "satisfactory" as mentioned by 13.11% of professors, and 17 (27.9%) used the terms "leaves to be desired", "reasonable" and "poor".

In the time off work, 43 (70.5%) professors usually watch TV, where the preference for newspapers and news prevails in 22 (36.06%) respondents, and 14 (22.9%) professors prefer to watch movies. On vacation, 38 professors (62.29%) travel, 3 professors (4.91%) said they work during vacations, and 2 (3.3%) professors mentioned not going on vacation.

The independent T-test carried out to verify the difference between the average of men and women (regarding working hours, number of subjects, number of advisees, number of boards, etc.) showed statistically similar results in all cas-

es, except for the average of hours dedicated to reading papers, books, journals, which revealed that men read more than women, with a 4.9-hour average for men and 2.56 for women.

Borsoi and Pereira (2011) show that the means among professors surveyed are different; the average daily working time reported by participants is nine hours for men and 10.1 for women. However, when it comes to maximum daily working time, the journey can reach 12 hours in the male group and 15 in the female group.

Borges (2014) conducted a study with professors from two federal universities (UFRJ and UFMA) and obtained similar results for the average number of courses, according to table 1. The graduate majors selected for this research were Dentistry, Science of Health, Electrical Engineering, Physics, Social Sciences, Public Policies and Collective Health.

Table 1. Average number of courses (UFMA and UFRJ).

Institution	Sex	Courses in undergraduate level	Courses in graduate level
UFMA	M	1.78	1.01
	W	1.49	0.96
UFRJ	M	1.51	1.97
	W	1.77	1.83

Source: Borges (2014).

Similar results were found by Borges (2014), as it can be seen in table 2.

Table 2. Undergraduate and Graduate Orientations (UFMA and UFRJ).

Institution	Sex	Monograph orientations	Master orientations	Doctoral orientations
UFMA	M	1.49	1.62	0.13
	W	1.57	1.39	0.21
UFRJ	M	0.51	1.59	1.59
	W	0.63	1.23	1.24

Source: Borges (2014).

The average number of undergraduate and graduate orientations between men and women shows minor differences. It is significant the difference in the number of undergraduate and doctoral orientations among universities.

In the study of Coauthor *et al.* (2016), the productivity fellows presented a number of doctoral orientations superior to that of other professors of the graduate programs and a smaller number of orientations to students in undergraduate programs, while the number of orientations for master's and scientific initiation were equivalent.

Similar results were found by Borges (2014), as it can be seen in table 3.

Table 3. Average number of research projects and number of boards.

Institution	Sex	Number of research projects	Number of boards
UFMA	M	1.56	0.91
	W	1.7	0.89
UFRJ	M	1.8	1.8
	W	2.0	1.59

Source: Borges (2014).

Similar results were found by Gauche and Verdinelli (2016) in a study about master's and doctoral professors in Southern Brazil. The study shows that in the triennium (2010-2012), considering the average production by gender and by year, among the 15 graduate programs studied, there were differences between the male and female production, but the T-tests for comparison of means show that they were statistically the same.

Gauche and Verdinelli (2016) presented the same result, statistically equal averages, for books and chapters published between men and women. There was also a decrease in the average of production per year and professor since the beginning of the career, related to the triennium studied.

Men read more than women, averaging 4.91 hours per week for men and 2.56 hours per week for women.

On the other hand, according to Rasteli's (2013) research in the State of São Paulo, specifically in the municipal public libraries, the female individuals read more than the male individuals. The Southeast region leads the ranking of Brazilian readers in the country. According to the Research Reading Portraits (2015), 43% of respondents do not read due to lack of time, according to the 5,012 interviews conducted at the national level.

Using the Spearman correlation analysis, the highest correlation coefficient identified (0.928) showed that the higher the number of papers published, the higher the number of papers published with JCR, suggesting that the more papers are published, the higher the probability of publishing articles with JCR.

The Kolmogorov-Smirnov test was used to evaluate the normality of the data, since it is the method indicated for $n > 30$ (sample greater than 30 cases), considering that this research includes the analysis of the responses of 61 respondents.

It was defined for analysis the questions related to category 3 (Workday), category 4 (Teaching Work) and category 5 (Time out of work) of the research instrument adapted from Borsoi and Pereira (2013).

In the analysis performed for this research, these are non-normal distributions and, therefore, the type of correlation is Spearman. shows only the cases that presented a strong correlation, that is, the correlation coefficient presents results between 0.7 and 0.9.

It is observed that there is a strong correlation between (i) number of courses and number of classes, (ii) number of classes and number of class-hours. This result is a reflection of what happens in the day-to-day of teaching, since the increase in one of the variables generates as a consequence the increase of the other variable.

The highest correlation coefficient (0.928) shows that the higher the total number of articles published, the greater the number of articles published with JCR. Thus, it is concluded that the more articles published, the greater the likelihood of publishing articles with JCR shows only the cases that presented moderate correlation, that is, the correlation coefficient presents results between 0.4 and 0.6.

It is highlighted two cases of moderate negative correlation: hours working at home and total working hours, which indicates that if the number of total working hours increases, it decreases the number of hours working at home, and; the other case is supervision of undergraduate interns and hours working at home, which indicates that if the number of hours working at home increases, the number of supervisions of undergraduate interns decreases.

If the number of hours working at home increases, the number of supervisions of undergraduate interns decreases. It is proved by means of this research that the professors who answered doing part of their working journey at university and part at home and that answered that they do not supervise undergraduate internships, work from home an average of 20 hours per week. In contrast, professors who supervise undergraduate internships, work at home on average 12 hours a week. That is, it is confirmed that the fewer hours working from home, the more undergraduate intern supervisions the professors are responsible for.

This research with the professors of the graduate programs rated 6 and 7 allows to verify that the professors who affirmed working on an exclusive dedication regime, work from home, on average, 16 hours a week, and those who answered having a regime of 40 hours, work from home, on average, 24 hours a week. In this way,

the result of the correlation test is proven, since the professors who have the longest working hours, work fewer hours at home.

Regarding professors' feelings in relation to their work, 77% of the participants stated to feel that they influence positively other people's lives through their work, 70% of the respondents considered that they have done important things as professors and 69% of the professors felt productive in the last two years (2017-2018).

Out of the 61 respondents, 43% feel that the teaching job is not socially valued, 39% of them evaluate that they are working too much at the university and 39% consider that their work has not been financially rewarded.

As in regard to their health, most respondents were found to sleep between six (36.10%) and seven (41%) hours a night. A study with professors from the health, human and exact sciences areas at the Federal University of Rio de Janeiro presented similar results, an average of 6.2-hour sleep at night (Borges and Lauxen 2016). In the last two years, 36 (59%) professors resorted to medical and/or psychological attendance. The use of medicine was reported by 33 (54.1%) of the respondents.

Considering the perception of 54 professors, 97 factors that influenced the post-graduation professors' performance were mapped and distributed into 24 categories: scientific production, professors' initial education, teaching methods, students perspective, health, knowledge management, program evaluation, ability to attract students, structure of the city, professors' welcoming in the program, co-operation with industry, national scenery, feedback, excess work, students' quality, salary, research environment, international experience, availability of resources, challenge/novelty, professional profile, job satisfaction, administrative support to the professors and team work. Chart 3 demonstrate in detail the factors allocated in each category.

Chart 3. Categories versus factors.

Category	Factor description
Health	1. Health.
Professors' education	2. Teaching quality.
	3. Proper training/education.
	4. Good level of colleague researchers.
	5. Lack of training in people management.
	6. Good people education.
	7. Professors' education background. If the initial education was faulty, they will face difficulties in developing their careers.

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Chart 3. Categories *versus* factors (continuation).

Category	Factor description
Administrative support to professors	8. Technical and administrative personnel to support the teaching work.
Team work	9. Team work.
	10. Team.
Knowledge management	11. Initial education (professors' advisors when they were students, for example).
Students' perspective	12. Students' feedback.
Scientific production	13. Number of advisees.
	14. Papers published.
	15. Advice given.
	16. Prioritization of activities linked to research.
	17. Prioritization of post-graduation when compared to other activities.
	18. Certain pressure for performance.
	19. Certain pressure of deadlines regarding dissertations/theses presentations.
	20. "Publishing is what we have to do. The agencies (CAPES, Cnpq) require that and we need to meet the requirements".
Teaching methods	21. Work conditions at university.
	22. Well-equipped laboratories.
	23. Infrastructure.
	24. Conditions of facilities.
	25. Conditions of teaching material available.
Program evaluation	26. Pressure regarding charges in the evaluation.
	27. Lack of evaluation of the professors' production.
	28. CAPES and University evaluations of the programs.
Ability to attract students	29. Ability to attract qualified students for post-graduation programs.
Structure of the city	30. Standard of living in the city where they are.
Welcoming to professors	31. The way the professors are received in the graduate program where they work.
Co-operation with the industry	32. Opportunity to have partnerships with the industry.
National scenery	33. Lack of a national project.
	34. National scenery.
	35. Future perspectives.
Feedback	36. Colleagues' feedback.

Continue ►

Chart 3. Categories *versus* factors (continuation).

Category	Factor description
Excess work	37. Workload in the classroom.
	38. Number of subjects to teach.
	39. Excess work.
	40. Having to develop administrative activities.
Students' quality	41. Candidates' interest /Students' quality. "Great students generate great results".
Salary	42. Recognition/remuneration.
	43. Financial reward.
	44. Stability.
	45. Salary.
Research environment	46. Availability / Time for research.
	47. Peacefulness to dedicate to the research.
	48. Research environment.
	49. Research infrastructure.
International experience	50. International experience.
	51. International contacts/co-operation.
	52. National and international interchange.
	53. Participation in events abroad.
Resources availability	54. Partnership in research at an international level.
	55. Lack of resources.
	56. Funding.
	57. Resources for research projects.
	58. Frequency of prospection and funding.
	59. Approval of research projects. "Without resources there is no research or participation in congresses, etc.".
	60. Resources.
	61. Research support.
	62. Support to take part in events.
	63. Increasing difficulty to get funds for research.
	64. Scholarship for students. "It's important that the students can get grants, otherwise they lose focus".
	65. Institution's counterpart in the administration of research projects, rendering of financial accounts.
	66. Incentive from the institution.
	67. Financial resources.
	68. Institutional support.

Continue ►

Chart 3. Categories *versus* factors (continuation).

Category	Factor description
Challenge / novelty	69. Taste for challenge.
	70. Research on challenging themes.
	71. Search for new challenges.
	72. Search for innovation.
	73. Novelty.
Personal profile (attitudes, abilities, initiatives)	74. Willingness.
	75. Enthusiasm.
	76. Organization.
	77. Personal motivation for professional growth/Self-motivation.
	78. Dedication.
	79. Determination.
	80. Competence to do the job.
	81. Persistence.
	82. Liking research.
	83. Humbleness to know that one is always learning.
	84. Will power.
	85. Creativity.
	86. Perseverance.
	87. Honesty in research.
	88. Effort.
89. Professors' interest in submitting projects that enable them to 'develop' their research simultaneously with their teaching activity.	
90. Emotional resilience and perception of their own potential as transforming agents in their working environment. "If the professor is too dependent on other people's opinions, he/she will have difficulties since it's a job in which they are highly exposed.	
91. Commitment.	
Job satisfaction	92. Pleasurable work.
	93. Liking to interact with people.
	94. Liking what they do.
	95. Feeling useful.
	96. Feeling admired by the students.
	97. Being happy to work and help the students to become better than their professors.

Source: Authors (2018).

Table 4 presents the percentage of professors who mentioned each category that influences the graduate teaching performance. It should be noted that the same professor might have mentioned more than one category.

Table 4. Categories *versus* respondents.

Category	% Respondents per category
Personal profile (attitudes, skills, initiative)	27.9%
Provision of resources	24.6%
Scientific production	14.8%
Teaching methods	11.5%
Teacher training	9.8%
Environment for research	9.8%
Quality of students	8.2%
International experiences	8.2%
Evaluation of the program	6.6%
Remuneration	6.6%
Challenges/novelty	6.6%
Job satisfaction	6.6%
Excess of work	4.9%
Team work	3.3%
Ability to attract students	3.3%
National Scenery	3.3%
Health	1.6%
Administrative support to teachers	1.6%
Knowledge management	1.6%
Students' perspective	1.6%
Structure of the city	1.6%
Professors' welcoming in the program	1.6%
Collaboration with industry	1.6%
Feedback	1.6%

Source: Authors (2018).

The factors more frequently mentioned by the professors were categorized as follows: personal profile, cited by 27.9% of them, followed by availability of resources (24.6% of the participants), scientific production (14.8% of the respondents) and teaching methods (11.5% of the professors).

This research presents a contradiction between the theory and the perception of the teachers, due to several studies to show that the category of scientific pro-

duction is a factor that influences the teaching performance of the graduate students. In this paper, we present the results of a study by Martins *et al.* (2009). In the perception of the respondents, the category that stands out most is the personal profile, followed by the availability of resources and only third is the scientific production.

In this way, it is understood that there are two viewpoints:

- (i) professors consider that the personal profile category influences the professors' performance in all its dimensions (teaching, extension and even research) and the provision of resources allows a structure that supports the professor to obtain a better performance, or
- (ii) the personal profile and the provision of resources are the means to obtain scientific production, since in order to succeed in high-impact publications, people with a committed and dedicated profile are needed, as well as the provision of resources for publications and research.

Capes is responsible for the accreditation, evaluation and financing of the Brazilian graduate education system, therefore it defines the rules and punishments, as for example, it can increase or reduce the rating of a program, as well as disqualify it, if it does not achieve, at least, rating 3 in its concept. However, it is possible that the professor considered to be unproductive be de-accredited from the program before Capes disqualifies the program (Ferreira 2015). Therefore, from the point of view that the category of scientific production is the factor that most influences the teaching performance in the literature, it can be attributed to the pressure exerted from the Capes evaluation.

In Lessa's (2016) study on the Capes evaluation, the emotional impact caused on professors in the education area after being de-accredited from the program, due to the fact that the evaluation disregarded the previous contributions and the involvement of the professors in the history of the program; that is, the evaluation is carried out based on quantitative criteria, revealing a punitive and excluding character (Lessa 2016).

The categories 'Professors' welcoming in the program' and 'feedback' were only mentioned by professors in programs rated 6. While the categories 'ability to attract students, co-operation with the industry, structure of the city, feedback, knowledge management and health' were only mentioned by professors in programs rated 7. The remaining categories were mentioned by professors in both types of programs.

Chart 4 presents the categories relating them to the grades of the graduate programs.

Chart 4. Categories versus program rating.

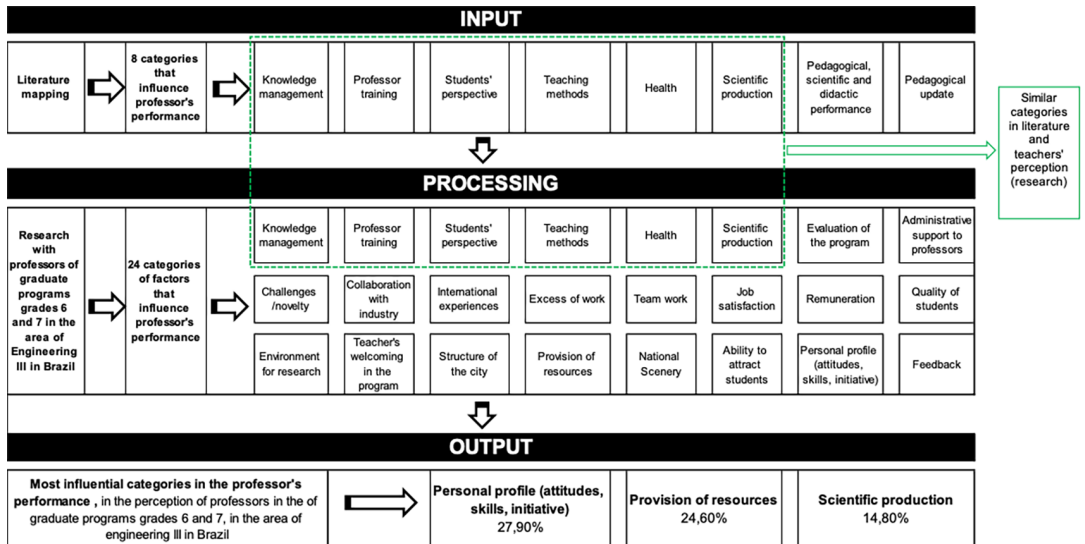
N°	Category	Program's grade	
		Grade 6	Grade 7
1	Teacher's welcoming in the program	X	
2	Environment for research	X	X
3	Administrative support to professors	X	
4	Evaluation of the program	X	X
5	Ability to attract students		X
6	National scenery	X	X
7	Collaboration with industry		X
8	Challenges/novelty	X	X
9	Provision of resources	X	X
10	Structure of the city		X
11	Excess of work	X	X
12	International experiences	X	X
13	Feedback	X	
14	Professor training	X	X
15	Knowledge management		X
16	Teaching methods	X	X
17	Personal profile (attitudes, skills, initiative)	X	X
18	Students' perspective	X	
19	Scientific production	X	X
20	Quality of students	X	X
21	Remuneration	X	X
22	Job satisfaction	X	X
23	Health		X
24	Team work	X	X

Source: Authors (2018).

In the Capes evaluation, the criterion 'publications' has strong influence on the other requirements in the professors' evaluation. On the other hand, in the perception of the professors in the programs rated 6 and 7 of the Engineering III area, the personal profile category, translated into attitudes, skills and initiatives, has a significant weight for the graduate teaching performance to be satisfactory.

Figure 2 represents the synthesis of this work, bringing together the factors mapped in the literature with the factors identified in the research with professors' graduate programs in the courses with grades 6 and 7 (Capes–Brazil).

Figure 2. Framework of the factors that influence the professors' performance.



Source: Authors (2018).

In the perception of professors, the graduate programs with grades 6 and 7 in the area of Engineering III in Brazil, other factors were pointed out, in addition to those mapped in the literature, therefore, this research shows different results than what was perceived in the literature, contributing with the research carried out on this topic, highlighting that personal profile and availability of resources, are factors that influence professors' performance.

Conclusions

The objective of this paper, which was to identify which factors influence professors' performance in the perception of professors who work in post-graduation programs that were rated 6 and 7 by Capes, in the Engineering III area in Brazil, was achieved. The respondents contributed to the mapping of 98 factors that influence the post-graduation professors' performance, which were organized into 24 categories.

It seems relevant to highlight the importance of making research resources available through the competent agencies for the post-graduation professors' performance. In situations of lack of resources, other incentives should be promoted and there should be indication of strategies to gather resources without necessarily depending on public agencies, such as partnerships between universities and private companies.

The personal profile (attitudes, abilities and initiatives) of the professors who work in post-graduation programs is a factor that deserves attention from those responsible for the management and hiring of new professors, through strategies that promote the use of this personal profile as an evaluation criterion, since this was a factor emphasized by the participants of this research.

Two limitations were identified in this research, the first limitation is the small percentage of questionnaires returned (25.96% returns), which does not allow the results of this research to be generalized for the entire population, however, by means of the answers obtained it is possible to have a perspective of the scenario of the Engineering III area. The second limitation is the lack of identification of professors who work in more than one graduate program, since Capes allows to act as a permanent professor in a maximum of three (3) graduate programs.

For future research, it is proposed to evaluate the relationship of these factors identified in this research, with the active methodologies used by the teachers who work in the undergraduate and graduate programs.

This research can be replicated with post-graduation professors of other areas of knowledge or even for all areas of Engineering III (including those rated 3, 4 and 5 by Capes) with the purpose of verifying similarities in the patterns found. **■**

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