

# **A look at the Postgraduation *Stricto Sensu* Scientific Production of Teachers in a Brazilian Federal Teaching Institution**

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## **Abstract**

*This article aimed to investigate the areas of research interest developed in a Brazilian federal education institution, CEFET-MG. In order to do so, we analyzed the academic production carried out by teachers who work in the Postgraduation *stricto sensu* in this institution, verifying in which areas of knowledge their research has been carried out, based on the analysis of Lattes Curricula of its teachers between the years 2005 and 2016. It was chosen a qualitative, exploratory and descriptive research. Regarding to technical procedures, documentary research was adopted. The results showed that the teachers who had their Lattes Curricula analyzed come from different areas of knowledge and, therefore, their areas of activity and research are also diversified, mostly the researches developed in the Engineering and Exact Sciences, showing the strong technological character of CEFET-MG. This characteristic is also noticed in the distribution of the Research Groups by big Area of Knowledge and by the projects carried out by teachers and managed by Cefetminas Foundation.*

**Key words:** Research; Scientific Production; Post-Graduation *Stricto Sensu*; CEFET-MG.

## **1. Introduction**

According to the Aurelio (Ferreira, 1986:1320) dictionary, research means: "inquiry or thorough search that meets the reality; investigation, inquiry ". The act of researching is part of the daily life of all people,

whether to discover the lowest price of a product, the best hotel to spend the holidays or the address of a restaurant, people are always researching. However, in this study the focus of interest is the scientific research having as an aim the discovery of new knowledge in a certain area, carried out in educational institutions.

Therefore, scientific research is one of the pillars of university activity and requires a set of actions or procedures to be performed. It is a process of investigation that demands a methodological rigor for the solution of the problems. And in the words of Coutinho & Cunha (2004):

The research implies a disciplined process of actions with a view to the construction of a new knowledge or to the revision of some knowledge already constructed in some specific area. In this perspective, the research is a systematized collection of information regarding some particular event or phenomenon for the purpose of its exploration, its description and its explanation. It is the establishment of relationships between information transformed into data, so it might be explored, understood and incorporated into a theoretical system (Coutinho & Cunha, 2004: 39).

Moreover, Ohira (1998: 66) points out that the knowledge acquired by researches must be disseminated, "which will only be achieved if communication is reached, thus requiring properly conditions to the dissemination of intellectual production". Following this reasoning, Witter (1989) argues:

Scientific production is related to the performance of postgraduate courses, both for their scientific work and for their role in the training of teachers and researchers who will work in other entities, university or not. Its product is relevant, including as a vehicle for the change from dependency to scientific and technological independence and, consequently, economic and political independence (Witter, 1989: 29).

Therefore, the importance of Post-Graduate courses in doing research and publicizing their results in Brazil, the Coordination of Improvement of Higher Education Personnel (CAPES), a foundation of the Ministry of Education (MEC), is the body responsible for the expansion and consolidation of Post-Graduation *stricto sensu* in all Brazilian states. Then, only the master's degree programs (professional and academic) and doctorates evaluated with a grade of three or more are recommended, as well as the renewal and recognition of on-going courses, by CAPES through the National Education Council (CNE / MEC). It is important to note that, according to CAPES, only the courses recognized by this Council are authorized to issue diplomas in master and / or doctoral degrees with national validity (CAPES, 2008).

According to information available on the Sucupira platform, a CAPES tool for the collection of information and procedures on Post-Graduation, there are currently in Brazil 4,256 Postgraduate Programs, belonging to 49 areas of evaluation, divided as follows: Academic, 78 doctorate, 745 professional master's and 2,115 academic master's and doctoral degrees. Most of these programs are located in educational institutions in the Southeast (44.97%), followed by the South Region (21.22%), the Northeast region accounts for (20.23%), % of programs and lastly the North region with 5.45%.

The *sucupira* platform also provides the data quantitative of postgraduate courses belonging to the same 49 evaluation areas. There are a total of 6,370 courses divided as follows: 3,433 academic masters, 2,192 doctorates and 745 professional masters. When verifying the geographical distribution of these courses, it is realized that they follow the same proportion of the Programs: firstly the southeast region (47.47% of the courses are in universities of that region), followed by the south region (21.27%), In the northeast region, there is 18.58% of the courses, followed by the center-west region with 7.8% and, lastly, the northern region with 4.88%.

Among the institutions of education in the Southeast, the Federal Center for Technological Education of Minas Gerais (CEFET-MG) has been a focus of investigation in this study, due to its 108-years of tradition in professional technical education, offering a vertical education: starting with the technical education integrated to the secondary level, passing through undergraduate, postgraduation *lato sensu*, postgraduation *stricto sensu* and even the doctorate.

At CEFET-MG, it is highlighted the concern with scientific research as a contribution to the advancement of science and the discovery of new knowledge by encouraging research, through the activities of scientific initiation in projects developed by secondary students (BIC Junior Program) and the Institutional Program of Scientific Initiation Grants (PIBIC) for undergraduate students. Add to this the expansion of its postgraduation *stricto sensu* courses, which is clearly mentioned in the Report of Institutional Self-Evaluation, Research and Postgraduation - Base Year 2015, carried out by the Research and Post-Graduate School Board of that Federal Center:

The development of such activities in CEFET-MG, as in the rest of the world, is closely linked to the performance and evolution of its research groups and Programs and Postgraduation Courses *stricto sensu*, composing and thus a binomial whose developments have contributed strongly to the achievement of the goals and aims established in the Institutional Development Plan (PDI) and also to improve the quality of Higher Education and Professional Technical Education offered at the institution (CEFET-MG, 2016: 5).

According to the report of Institutional Self-Evaluation Research and Post-Graduation - Base Year 2015:

In its history, CEFET-MG has been consolidating itself as an institution of recognized excellence, a center for the technological training of professionals who work especially in the productive sector, applied research and training of technological teaching. The Institution's role goes beyond professional training and carries out a critical and constructive dialogue with society to generate knowledge and new technologies. Thus, Research and Postgraduate Studies are developed at CEFET-MG through projects that result in the strengthening and improvement of the institution's general Technological Education Program (CEFET-MG, 2016: 5).

Before of this reality, it was chosen to develop a study that investigated the areas of interest of research done at a Brazilian federal education institution, at CEFET-MG. For that, an analysis was made of the

academic production done by the teachers of this institution who work in the Post-Graduate *stricto sensu* courses, verifying in which areas of knowledge their researches have been carried out, from the analysis of Lattes Curricula of their professor-researchers between the years of 2005 and 2016.

## **2. Theoretical Bases**

### **The Scientific research**

It is not only in the research pillar of universities that research-related activities take place. These are also always being carried out in teaching activities, because it is through the research that is taught and learned. Also the extension pillar of universities has a strong interface with research, due to its social function of bringing knowledge built in university to society, ie the results of research have to be used by society. Therefore, academic practices interconnect through the three university pillars as explained by the National Plan for University Extension of the MEC (2007). The university extension is constituted of a set of activity that are:

Academic practices that interconnect the university and the community in their teaching and research activities, providing the training of the citizen professional through the constant search for the balance between social demands and the innovations that emerge from the academic work (MEC, 2007: online).

Following that understanding, the analysis of Severino (1996) is extremely pertinent:

In the University, teaching, research and extension effectively articulate, but from research, that is, one only learns, one only teaches, one researches; Services are only provided to the community if such services were born from the research. Teacher needs the practice of research, to teach effectively; the student needs it, to learn effectively and meaningfully; the community needs the research, to be able to have knowledge products; and the University needs research to be a mediator of education (Severino, 1996: 63).

This dialogue between university activities to the principle of inseparability, as provided for in article 207 of the Federal Constitution of 1988, and that is how the university stands on its three pillars. Therefore, it is reinforced here, that research runs through all the pillars. However, it is important to note that each pillar is related to a type of research (Figure 1). Basic research is scientific research that aims to generate new knowledge and thus contribute to the advancement of science. Applied research, on the other hand, uses scientific research for practical applications aimed at solving specific problems involving local truths and interests (Córdova & Peixoto, 2009).

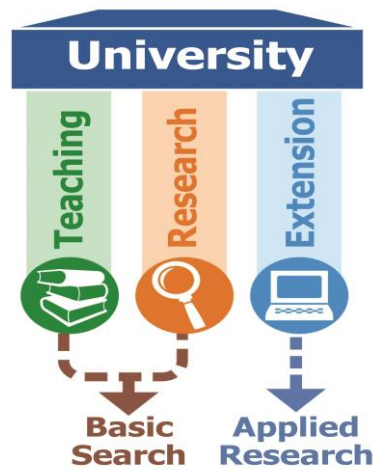


Figure 1. The pillars of the University and its researches.

Source: Prepared by the authors

In order to carrying out the research, it is fundamental that research groups, created by the National Council for Scientific and Technological Development (CNPq) in 1992, have the function of stimulating the construction of knowledge through studies and debates on an area of knowledge and /or dialogue between different areas. It was from these debates on that the concerns and ideas of research appeared, and these groups are responsible for most of the investigations carried out today and also for the training of a huge group of researchers (Marafon, 2006).

The research groups have representatives, students and teachers, from all levels of education, from undergraduate to doctorate. The research carried out within these groups has awakened in students the investigative sense and provided them the appropriation of knowledge. The results of researches conducted at universities ought to be known by academic area and society. This is usually done through the scientific articles, the course completion works (TCC) which are carried out at the undergraduate level, the monographs (Post-Graduation Programs lato sensu), master's dissertations and doctoral theses (Post-Graduation stricto sensu), which are the materialization of research results.

Thus, for a study to become a scientific publication, an academic rigor is necessary in its elaboration, as Erdmann (2011) explains, it is necessary to write in appropriate language, pleasant, precise and clear, to bring possibilities of success of accepting the article for publishing. The Figure 2 shows the materialization of the research results, in which the link with the research groups might be noticed.

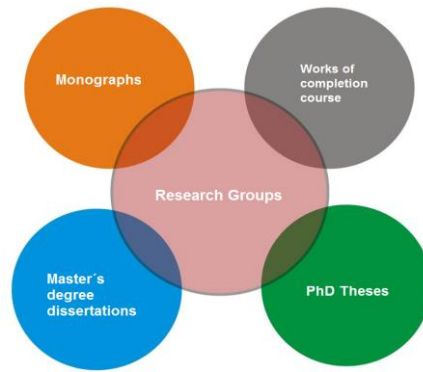


Figure 2. Search for Undergraduate and Postgraduate.

Source: Prepared by the authors

The incentive to research also happens through the training of researchers, through the granting of scholarships at all levels of training, such as:

1. Scholarships for Scientific Initiation of fomentation agencies (financial and non-bank institutions) of the States, such as the foundations of support for state research, in the case of Minas Gerais, FAPEMIG.
2. Institutional Program of Scientific Initiation Scholarships (PIBIC) of CNPq.
3. Young Talents Program for Science CAPES.
4. Financing of Studies and Projects (FINEP).
5. Resources from the own institution.
6. Research grants from private and public companies.

#### *Support Foundations in the context of universities*

Support foundations of the Federal Institutions of Higher Education (IFES) are non-profit, private law organizations. Some also have the title of Civil Society Organization of Public Interest (OSCIP) and are recognized as a foundation of fund by the Ministries of Education and Science and Technology and are governed by the Brazilian Civil Code. They fund extension and research activities and enable integration actions with public agencies, development agencies or private companies. According to (Rocha, 2016):

In general, the academic community has perceived funding foundations as effective tools for managing human and material resources for university projects and programs without the traditional bureaucracy of the public sector. Undoubtely, this is an important role of the funding foundation that usually supports the work of teachers and academics through project management (Rocha, 2016: online).

Thus, the support foundations in the context of the IFES have a fundamental role, mainly because it can meet the needs of the institution supported, having agility, flexibility , administrative and financial autonomy, which in many cases is a lack in the universities. Therefore, "the field of teaching and research

is one of the most likely and fertile to the foundational performance" (Paes, 2010: 260).

The Figure 3 shows that support foundations, universities and development agencies and / or companies (public or private) are interlinked for research and development. Each of these three institutions has its rules, functions and responsibilities: in universities, research projects are developed by teachers and students; the development agencies and / or the companies financially support the projects and the funding foundations run the financial and administrative management of the projects as well as their accountability. Thus, all of them are contributing to the scientific and technological development of the country.

It is key to be emphasized the partnership between these three institutions is firm through contracts or agreements, "with a waiver of bidding to manage institutional projects, yet subject to the limits of the legislation as a way to avoid the distortion of this partnership of great importance for public universities" (Pinto, 2013:09).

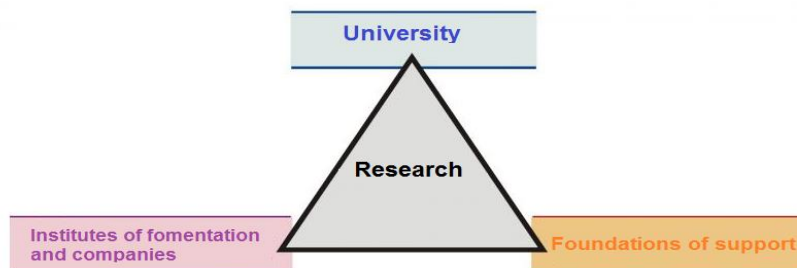


Figure 3. Institutions that support research in universities

Source: Prepared by the authors

In this research, the foundation that supports the institution of teachers who had their productions analyzed was the Foundation for Support to Education and Technological Development of Minas Gerais - Cefetminas Foundation (FCM), which is a private law organization, non-profitable, federal OSCIP and recognized as a foundation of support by the Ministries of Education and Science and Technology. The FCM has been operating for 22 years and has supported extension and research activities, as well as enabling integration actions with public and development agencies or private companies.

The activities of Postgraduation *stricto sensu* at CEFET-MG began in the late 1980s with the creation of the Advisory Office for Research, Graduate and Extension (AEPEX). The course started in 1987/1988 with an experimental group resulting from an agreement between CEFET-MG and the University of Loughborough in England. In addition, in 1991 it was offered the first regular group of Master studies in Technology. And, because it integrated two major areas, Education and Technology, the conception of research within this Master was very broad. With regard to training for research, Sales & Santos (1997) point out that the Master in Technology involved:

Education for Technology and Technology for Education or Technology in the service of human



formation, progress and well-being of the humans, in other words, training of the master's degree in the light of the purpose of the areas of Technological Education and Integrated Manufacturing by Computers as technical areas to meet the practical demands placed by the scientific-technological evolution of Education and Technology (Sales & Santos, 1997: 99).

The institution continued its trajectory and, in 2005, the Postgraduation *Stricto Sensu* began at CEFET-MG, with the approval/recommendation by CAPES of two new master's courses: Technological Education, and Mathematical and Computational Modeling. At that time, AEPEX was extinguished and the establishment created the Direction of Research and Postgraduation. Since then, new Masters and PhD courses have been created in the institution, as shown in Chart 1.

Chart 1. Trajectory of Postgraduation *stricto sensu* courses in CEFET-MG.

Course starting and situation	Programs/ Courses	Nr. of Professors		Concentration Areas	Concluded Dissertations
		Permanent	Contributors		
1991 – 2005	Master in Technology	-	-	1) Technological Education. 2) Integrated Manufacturing by Computer	198
2005 – on going	Master in Technological Education	17	0	1) Technological Education	280
2005 – on going	Master in Maths and Computational Modeling (PPGMMC)	22	3	1) Maths and Computational Modeling	220
2007 – on going	Master in Civil Engineering	12	2	1) Civil Construction 2) Structures	58
2008 – on going	Master in Engineering of Energy	17	1	1) Engineering of Energy	51
2009 – on going	Master in Electric Engineering	21	0	1) Electric Systems 2) Modeling and Systems Control	45
2009 – on	Master in	18	2	1) Technology	111



going	Language Studies (POSLING)			and Discursive Processes	
2010 going	Master in Engineering of Materials	17	0	1)Science and Material Development	72
2013 going	Doctorate in Maths and Computational Modeling	The same professors for master in PPGMMC		1)Maths and Computational Modeling	1
2015 - on going	Master in Administration	12	3	1)Process and decision-making systems	0
2015 going	Doctorate in Language Studies	The same professor for master in POSLING		1)Technology and Discursive Processes	0
2016 going	Master in Multicentric Chemistry	7	0	Chemistry	0

Source: Prepared by the Authors.

It is important to highlight the MSc in Multicentric Chemistry does not yet have a dissertation concluded, since the course began to be offered in the year of this research, 2016. However, it is necessary to clarify that the data were collected until October 2016. It is also worth noting that during the conduct of this research, CAPES approved the doctorate in civil engineering at CEFET-MG, and the expectation is that the first selection document for this doctoral degree will be published in early 2017, and the area of concentration is the sustainable construction with two lines of research: Sustainable building materials and Construction components and building processes.

In order to complete Chart 1 data were collected from the information on CEFET-MG website, and also contacted the coordinators of all the courses by telephone to check the information, since the body of teachers acting in the postgraduate courses depends on the accreditation and the re-accreditation of teachers, and depending on the academic production of each teacher he or she does not remain in the teaching staff.

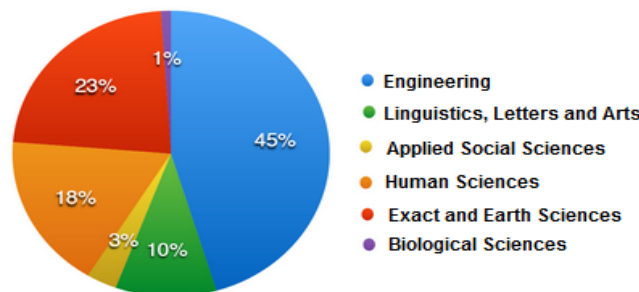
Following the data presented in Chart 1, it might be seen that in the period from 1991 to 2016, 1,035 master's dissertations and a doctoral thesis were defended, that is, 1,036 scientific studies carried out from many researches, are scientific discoveries that contributed to the strengthening of their areas, but also brought benefits to society in general. Another point verified was that, during the data collection period, none of the courses had the presence of visiting professors, only the permanent ones and contributors.

Since CEFET-MG offers a master's degree in Electrical Engineering in association with the Federal University of São João del Rei (UFSJ), the body of teachers in this course is organized as follows: 17 professors are from CEFET-MG and 9 belong to UFSJ. The same happens to the master's degree in Engineering of Energy that is held in association with the UFSJ, therefore, it is composed of 11 are professors of CEFET-MG and 8 belong to the board of professors of UFSJ, adding to this board of professors one who belongs to the Federal University of Viçosa.

All of these teachers participate in research activities, which take place within the research groups, organized around one or more lines of research in a field of knowledge. The groups are registered in the Directory of Research Groups of CNPq and certified by the educational institution.

The first research groups of CEFET-MG began their activities in the 90's and nine research groups were formed, which in 2015 had 95 research groups registered in the Directory of Research Groups in Brazil, managed by CNPq. "This increase indicates the correct direction that was taken to consolidate the policy of encouraging the formation of research groups and valuing the researcher in the Institution" (CEFET-MG, 2016). Graph 1 shows the Distribution of Research Groups by Large Area of Knowledge. It is noticed that the Large Area of Knowledge in Engineering is predominant, with 45% of the total, followed by the Great Area of Knowledge Exact Sciences and the Earth (23%). This result was already to be expected, since CEFET-MG has a strong technological character.

Graph 1. Distribution of Research Groups by Big Area of Knowledge.



Source: Research and graduate direction of CEFET-MG

(<http://www.posgraduacao.cefetmg.br/dppg/index.php/pt/grupos-de-pesquisa>)

### 3 Methodology

In this study, we opted for qualitative scientific research. As for the type of research, it was exploratory and descriptive. Regarding the technical procedures, documentary research was adopted, which according to Vergara (2009) is a study done in documents found in public or private agencies, which in this case was the database of the Lattes Platform of CNPq, As well as data from the archive of FCM projects. This research was divided into two stages:

1<sup>st</sup> stage: In the second semester of 2016, a curricula consultation was made to the Lattes Platform of the CEFET-MG professors who work in the Postgraduation *stricto sensu*. We analyzed 154 curricula. For each of the curricula analyzed, the following variables were raised:

- a) Profile of teachers.
- b) Area of knowledge in which the doctorate was held.
- c) Areas and major areas of knowledge in which doctoral research was developed.
- d) Scientific production of teachers.

2<sup>nd</sup> stage: In the second semester of 2016, a consultation was done on the data of the projects managed by FCM on the projects developed by CEFET-MG teachers. The following variables were investigated: development agencies and companies (public and private) financing the projects and the areas of knowledge in which the projects were developed.

## 4. Results and data analysis

Presentation and result analysis of the research stages:

### *1st stage*

a) Profile of teachers: Of the 154 professors who work in the Postgraduation Programs stricto sensu of CEFET-MG, the majority (137) did their doctorates in Brazil and 17 abroad. This might be explained by several reasons, such as: the improvement of the quality of universities in Brazil that have academic programs as good as those of universities abroad; The teacher does not need to obtain funding for staying abroad; The professor is confident on the recognition of his/her doctorate by CAPES (which is not always the case when the doctorate is done abroad). Already 57 of these professors did postdoctoral studies, 70% were attended in Brazil and 30% abroad.

In relation to the gender distribution, the majority are male (105) representing 68.2% of the total number of teachers, while female teachers represent 31.8%, and in the Civil Engineering course a tie was found in this relation. In the other seven programs, the number of teachers was higher than that of teachers. This result may be related to the strong technological character of CEFET-MG, and confirm the Brazilian reality in which, until now, the exact areas are preferred by men, while women prefer the human or health areas, as shown by the Census of Higher Education 2012, published by the National Institute of Studies and Educational Research Anísio Teixeira (Inep): one-third of the men who graduated opted for courses related to engineering.

b) Area of knowledge in which the doctorate was held: When investigating this item, it was noticed that all of the Postgraduation Programs stricto sensu of CEFET-MG, there are teachers who work in different areas of knowledge. It was verified by the area in which the professors defended their doctoral or postdoctoral research. In Table 1 we can observe this diversity of areas by Program, highlighting the Postgraduate Program in Civil Engineering that has teachers from 11 different areas. In the first column of this table the total number of teachers of each program is in parentheses and in the second column, the number of teachers referring to each maximum degree is in parentheses. In those who do not have a number, they consider themselves a teacher.

Table 1. Knowledge area in which the teachers who work in the Postgraduation programs of CEFET-MG held their doctorates.

<b>Programs</b>	<b>Maximum Titles</b>
Administration (15)	Administration (8); Production Engineering (2); Civil Engineering; Electrical Engineering; Physics; Science and Tecnology Policy Studies; Sciences of management.
Civil Engineering (14)	Civil Engineering (4); Structural Engineering (4); Architecture and Urbanism; Earth Sciences; Aeronautical and Mechanical Engineering; Mechanical Engineering; Material Engineering; Chemistry; Sanitation, Environment and Water Resouces.
Energy Engineering (18)	Mechanical Engineering (14); Civil Engineering; Electric Engineering; Chemistry Engineering; Energy Engineering.
Material Engineering (17)	Metalurgical and Mining Engineering (10); Mechanical Engineering (4); Material Engineering (2); Transport Infra-Structure; Chemistry.
Electric Engineering (21)	Electric Engineering (20); Computational Modeling.
Language Studies (20)	Pos-Doctorate in Linguistics, Letters (9); Pos-Doctorate in Human Scienc (1); Pos-Doctorate in Social Sciences (1); Doctorate in Linguistics (3); Doctorate in Literary Studies (3); Doctorate in Letters (4); Doctorate in Education (1).
Technological Education (17)	Pos- Doctorate in Human Sciences(7); Doctorate in Philosophy (1); Doctorate in Mathematics and Sciences Teaching (1); Doctorate in Urban Education (1); Doctorate in Management and Public Policies (1); Doctorate in Information Science (1); Doctorate in Education (6)
Mathematical and Computational Modeling (25)	Pos-Doctorate in Physics (3); Pos-Doctorate in Engineering (2); Pos-Doctorate in Exact and Earth Sciences (2); Doctorate in Computing and Systems Engineering (2); Doctorate in Physics (2); Doctorate in Computing Science (2); Doctorate in Electric Engineering (1)
Chemistry (7)	Chemistry (4); Theoretical Chemistry (2); Chemistry Sciences.

Source: Research Data.

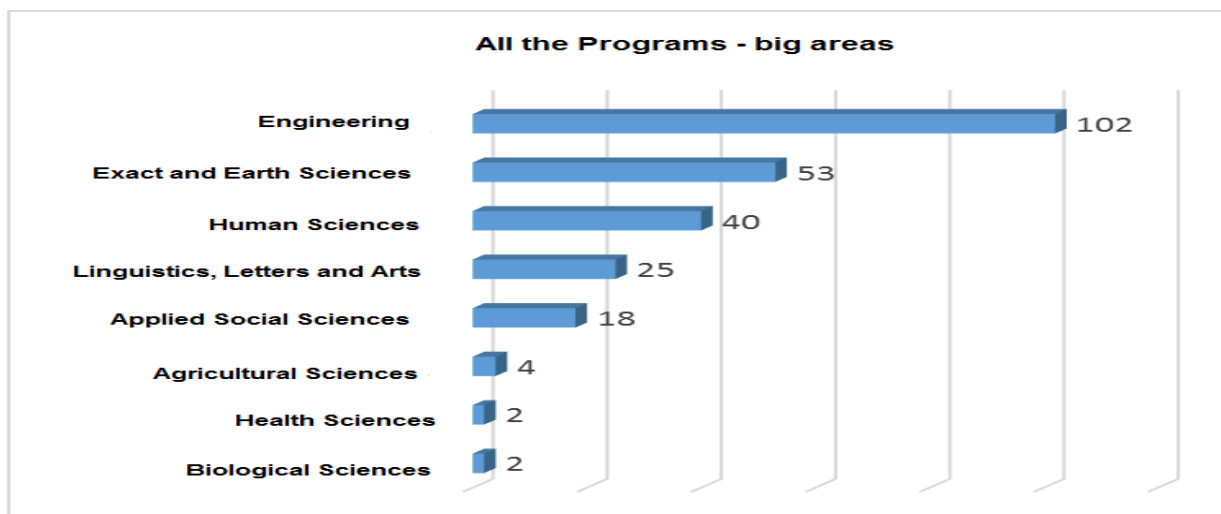
Thus, the results obtained evidenced the interaction between the knowledge of different areas of knowledge in the postgraduate programs of CEFET-MG, which contributes to the enrichment of the paths of a research and promotes the global integration of sciences and the scientific advance As Piaget (1981) points out in defending the idea of breaking the boundaries between disciplines.

c) Areas and big areas of knowledge in which the doctoral research was developed: It is important to note that the teacher, when selecting in his curriculum Lattes, his area of activity is indicating in which area his research is developed. However, it should be considered that a teacher can select one or more areas and big areas of action. Therefore, when analyzing the 154 Lattes Curricula of teachers, we identified 246

Major Areas of Practice, as can be seen in Figure 2.

The data in chart 2 indicate that although CEFET-MG has teachers working in different areas of knowledge, most of them work in the big area of Engineering, followed by Exact Sciences and Earth, which reinforces the conclusion obtained in figure 1 which is the strongest technological character of CEFET-MG.

Graph 2. The Major Teacher Performance Areas in all the Postragduation stricto sensu Programs of CEFET-MG.

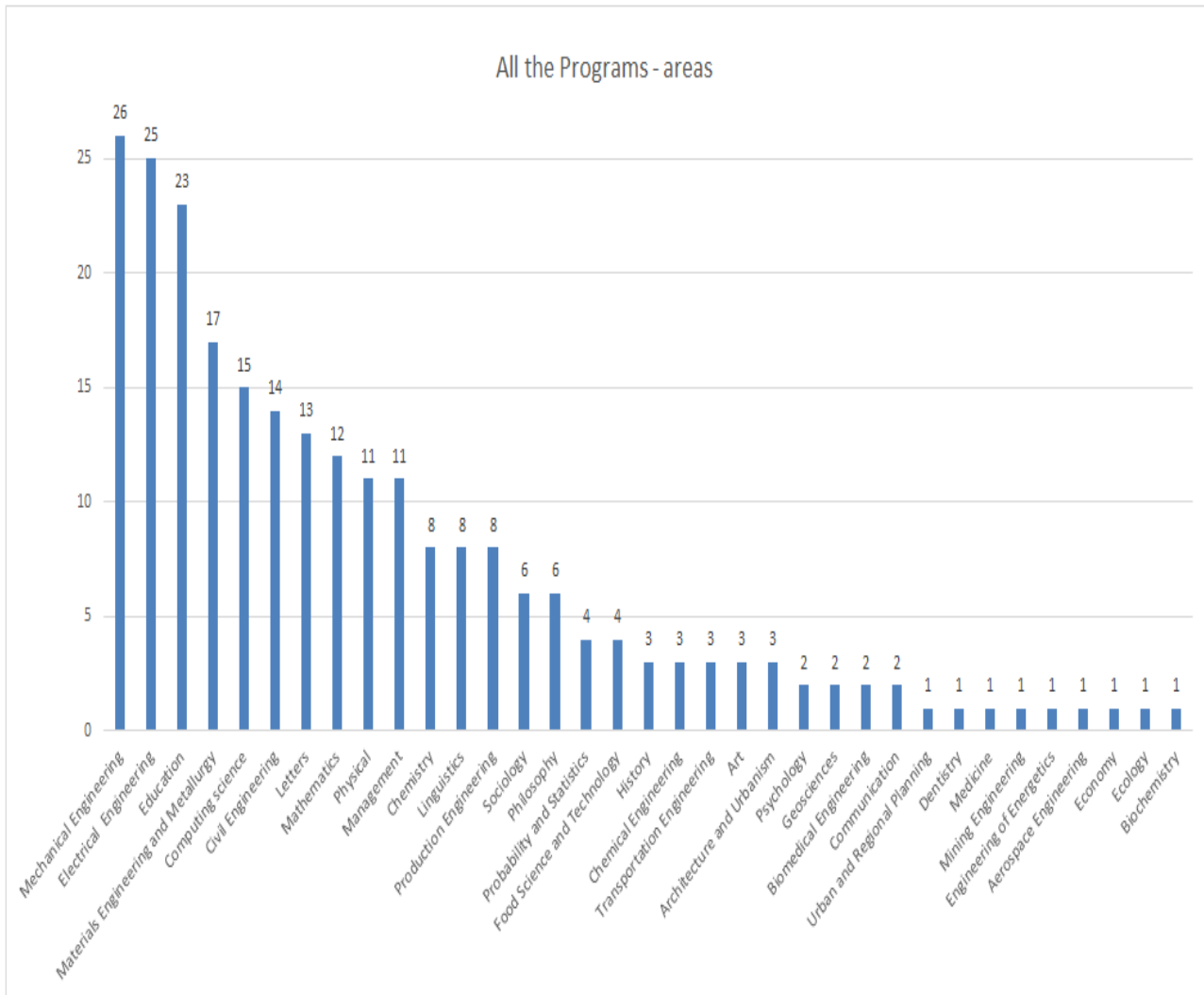


Source: Research Data

In Figure 4 the charts with the information on this item by program are presented. When looking at this figure, we can see the diversity of areas of knowledge per program, which was also proven in the item on the areas of knowledge in which the doctorate of each teacher was developed. It is worth highlighting here the Mathematical and Computational Modeling Program, with six different areas of activity. Once again the Great Area of Engineering and Exact Sciences and Earth are the majority.

Similar conclusions were obtained when analyzing the actions of the teachers by area of knowledge, Graph 3: the great diversity of areas (35) in which the professors develop their researches and, once again the highlight for the technological areas (54% of activity areas). However, it is necessary to consider that a teacher can select, in his Lattes curriculum, more than one area of activity.

Graph 3 - The areas of teachers' performance in all the Postgraduation stricto sensu Programs of CEFET-MG.



Source: Research Data.

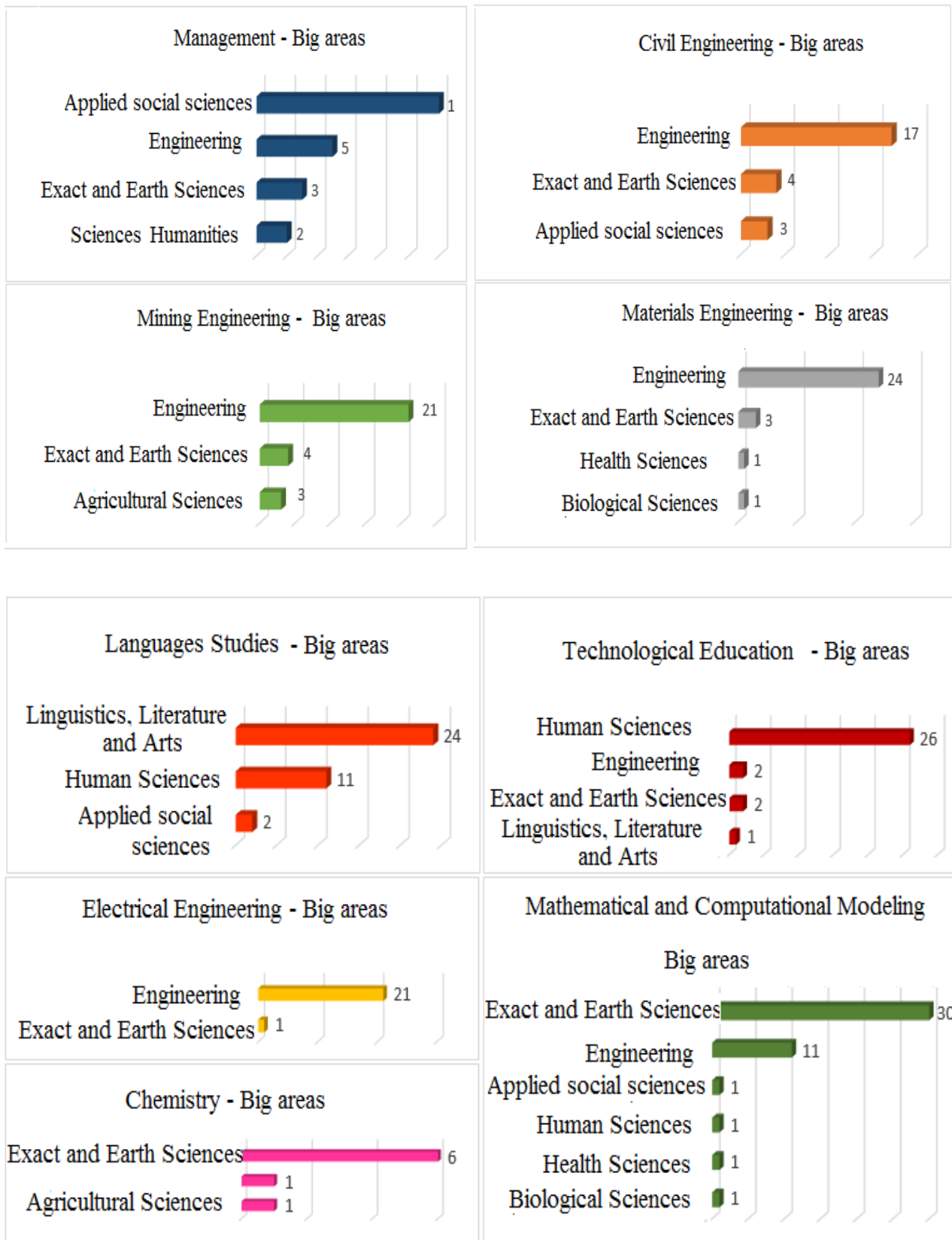


Figure 4. Graphs that represent the Postgraduation Stricto Senseu Programs of CEFET-MG and the Areas and the Great Areas of teachers' performance.

Source: Research Data



About scientific production of teachers: It is through the publication of the teachers' studies, whether in the form of four categories of publication: periodicals, book chapters, complete books or published articles in annals of events, that the findings of their researches are transmitted to the Scientific community and society as a whole. It is the socialization of knowledge. And as Erdmann emphasizes (2001) it is important to recognize the contribution of a journal to the advancement of an area, promoting scientific development. At this stage the bibliographical productions that the professors declared in their Lattes Curricula were raised, but only the complete articles published in periodicals, the books, the chapters of books and the works published in annals of events were only interested in research.

Before presenting the results, it is necessary to point out that each postgraduation program has its specificity and characteristics, which influences the place where its publications are most important. Thus, between 2005 and 2016, professors of the CEFET-MG Post-Graduation courses published 6344 scientific studies, Table 2. It is noticed that most of this publication was done in papers published in annals of events (63.14%), followed by full articles published in journals (28.78%). The category in which the CEFET-MG teachers published the least, was in complete books.

It is also noticeable that only the professors of the courses of Chemistry and Technological Education published their searches more in complete articles than in another category. In the other courses, the largest number of publications was made in annals of events. Another finding is that the programs that have published most of their researches are: Mathematical and Computational Modeling and Electrical Engineering. Emphasizing the Chemistry course had its first class in the year of this research, in 2016, which justifies a smaller number of publications of its teachers.

Table 2. Quantities of scientific publications produced by the professors of the Postgraduation Programs of CEFET-MG from 2005 to 2016.

Programs	Publication Categories				Total of publications by programs
	Complete articles published in periodicals	Works published in Event Annals	Books	Book Chapters	
Administration	246	306	6	23	581
Civil Engineering	149	270	1	9	429
Energy Engineering	147	435	3	19	604
Material Engineering	151	503	2	6	662
Electric Engineering	245	831	2	10	1.088
Language Studies	212	482	47	138	879
Technological Education	192	182	48	145	567
Mathematical and Computational Modeling	355	930	6	46	1.337
Chemistry	129	67	0	1	197

Total	1.826	4.006	115	397	6.344
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Source: Research Data

Comparing the data of Chat 1 (number of teachers per program) with the data of Table 2, it is possible to verify the relation of published research by teachers. The programs that present the major relationships are: Mathematical and Computational Modeling with 53.48 publications per teacher and Electrical Engineering with a ratio of 51.8. These results reveal the profile of the research carried out at CEFET-MG, where publications in the Major areas of Engineering and Exact and Earth Science dominate.

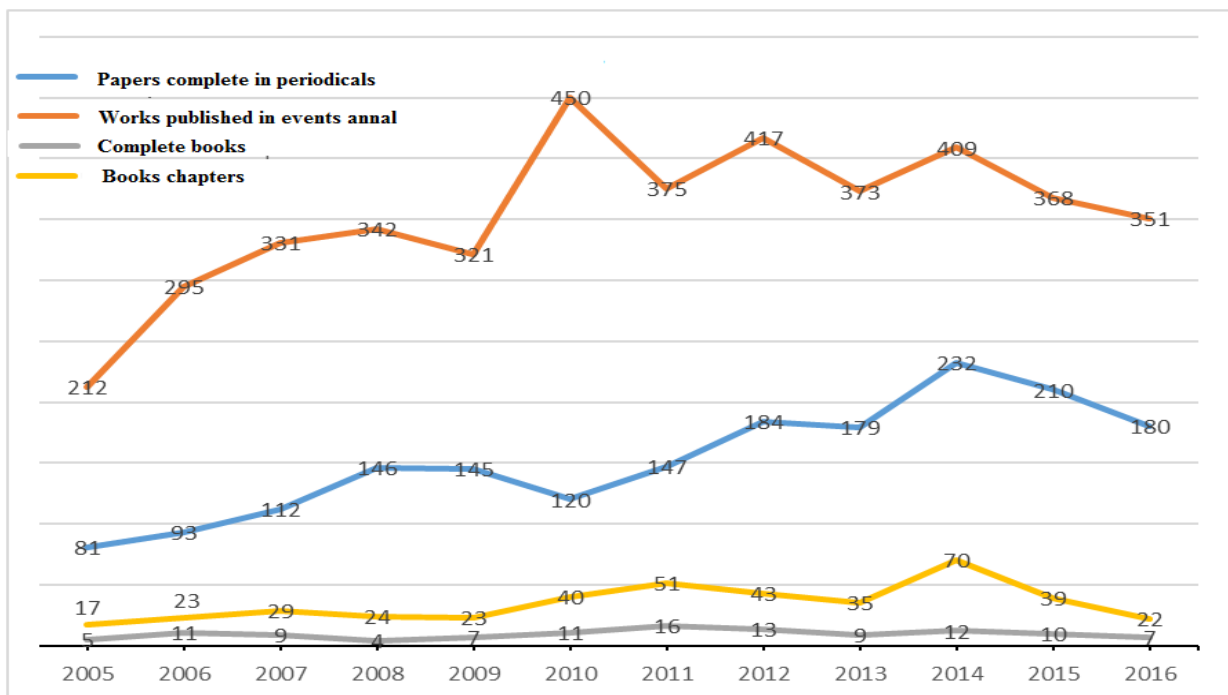
The Graph 4 shows the evolution of the publications of the teachers by category of publication over 12 years, period of investigation of this research. It might be seen that the publications of the full articles in annals of events presented a gradual increase between the years of 2005 and 2008 and after a decline in 2009 there was a great jump in the number of these publications in 2010, which was the highest point. However, from that point on, it showed oscillations in its curve, and in the last year of analysis it ended with a number of smaller publications of the last five years.

The curve representing the number of papers published in periodicals, shows a growth between the years 2005 to 2009, between 2009 and 2010 it presents a decrease in the number of publications and, from then on it begins to grow and in 2014 has its greater peak and from year to year the number of publications falls. Publications in book chapters and in complete books present curves with few fluctuations of increase or decrease, indicating a flow in the number of publications.

One aspect that needs reflection is: in all four categories the year 2016 had the lowest number of publications in relation to most of the analyzed years. Although the reasons for this fact were not investigated in this study, one observation is important: it was found that in many curricula analyzed, in-press articles were declared that have not yet been published. It is believed that in 2017 they will be published with the year 2016 and thus the reality presented in figure 4 may improve.

Other reasons may also be related to this fact: Curricula Lattes not updated and even with problems in filling it; Teachers with high production who are retiring; Newly accredited professors in the Graduate programs; Recently created programs (two in 2015 and one in 2016); Difficulty in getting a publication, the number of articles submitted have grown more than the number of new journals; and lack of stimulus given to researchers. But one detail caught the attention: in the curricula Lattes of the teachers were found many articles accepted for publication.

Graph 4. Evolution of teachers' publications by publishing category.



Source: Research Data

2nd Stage

During the study period (2005-2016) FCM managed 212 projects coordinated by CEFET-MG teachers, and the funding institutions were: FAPEMIG (with 177 projects); FINEP (with seven projects); FAT VITAE (with four projects), and 24 projects supported by companies: Cemig, Petrobrás, Acellor Mittal Brasil, Orteng, Belgo Bekaert Arames, MMX Mineração e Metálicos, Porto Real, Senergy, RNP and Metal Cycle. The importance of the development agencies, specifically FAPEMIG and FINEP, as well as the support for the research and production of knowledge of CEFET-MG, is perceived here. These projects were developed in the different areas of knowledge (Table 3).

Table 3. Distribution of projects managed by FCM and coordinated by CEFET-MG teachers by area of knowledge.

Major Areas of Knowledge	Quantity
Engineering	129
Human Sciences	27
Exact and Earth Sciences and Mathematics	29
Linguistics, Letters and Arts	15
Applied Social Sciences	7
Biological Sciences	5
Total	212

Source: Research Data

These data reaffirm the realities presented in Graphs 1, 2 and 3: most of the projects developed by CEFET-MG professors are related to the technological area (74.53%), adding the Big Knowledge Areas: Engineering and Exact Sciences and Earth.

## **5. Final considerations**

The results found in this research showed that the teachers who had their Lattes Curricula analyzed come from different areas of knowledge and, therefore, their areas of acting and research are also diversified. However, predominantly the researchers developed in the Engineering and Exact Sciences, which proves the strong technological character of the CEFET-MG.

Reinforcing this technological character, the data also showed that most of the projects carried out with funding from the development agencies and managed by the support foundation come from the Engineering and Exact Sciences.

Another conclusion that deserves to be highlighted is where the results of the research carried out at CEFET-MG are published. It can be inferred that most of this publication was made in works published in annals of events and by the complete articles published in periodicals, the category in which CEFET-MG professors least published was in books. In relation to published researches by teachers, the programs that present the greatest relationships were: Mathematical and Computational Modeling and Electrical Engineering. Once again, these results reveal the profile of the research carried out at CEFET-MG, where publications in the Large Fields of Engineering and Exact Science and Earth dominate.

Although there are 95 CEFET-MG research groups registered in the Directory of Research Groups managed by CNPq, which is a stimulus to the development of research produced in the academic field, the year 2016 presented the lowest number of academic publications of its professors. This fact is worrying, since in Brazil the researches are linked to Postgraduation *Stricto Sensu* programs, and one of the ways of disseminating the knowledge resulting from the researches carried out in the scope of the masters is through the scientific publication.

Therefore, in order to improve this reality, it is necessary to increase the number of professors with a doctorate degree, to strengthen the partnership between the university and the development agencies, to increase research grants, to value research activities such as: orientation; Participation in research groups; Participation in commission board and in scientific events and to review scientific works, in didactic tasks. Recalling that academic publishing is the result of research, that requires time, funding and that each area of knowledge has its own characteristics and rhythms.

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