

Teacher capacitation at the Federal Institute of São Paulo through Social Network Analysis -SNA.

Márcio Teixeira Oliveira¹, Samuel Carvalho de Aragão¹, Suellen Moreira de Oliveira¹, Douglas Francisquini Toledo¹, Renno de Abreu Araújo², Anderson Sanita³

¹Data Science, Multimedia and Development Laboratory, Department of Computer Science, Federal Institute of Education, Science and Technology of Mato Grosso do Sul – IFMS - Três Lagoas - College, Brazil

²Federal Institute of Education, Science and Technology of Pará – IFPA - Paragominas - College, Brazil

³Federal Institute of Education, Science and Technology of Paraná – IFPR, Brazil

Corresponding author: marcio.oliveira@ifms.edu.br

Received: 01 Apr 2021;

Received in revised form:

18 May 2021;

Accepted: 05 Jun 2021;

Available online: 17 Jun 2021

©2021 The Author(s). Published by AI
Publication. This is an open access article
under the CC BY license
(<https://creativecommons.org/licenses/by/4.0/>).

Keywords— *Social Network Analysis, IFSP, capacitation, employees, teacher.*

Abstract— *In Brazil, there are numerous decrees, laws and regulations that promote the training of personnel, aiming at the improvement of public services provided. However, there is a difficulty in mapping which trainings are being carried out by employees of Federal Education Institutions and through Social Network Analysis it is possible to solve this issue. The objective of this study was to characterize the training of teachers at the Federal Institute of São Paulo through Social Network Analysis. For this, teachers enrolled in master's and doctoral programs were selected. With this, it was possible to identify the college with teachers in training and their respective training courses. The data were separated by level and course and through gephi software it was possible to build networks of graphs. The values of Social Network Analysis for teachers enrolled in the Master's program indicated that the São João da Boa Vista and Presidente Epitácio colleges have the highest number of teachers and the most popular courses: Education, Mechanical Engineering and Mathematics. As for the doctorate, São Carlos and São João da Boa Vista have the largest number of employees in training and the courses in Electrical Engineering, Education and Computer Science are in greatest demand. We can conclude that the Social Network Analysis indicated a great demand for training courses in the exact sciences area (Mechanical Engineering, Electrical Engineering and Computer Science), moreover Education has a great impact on teachers who seek Master's training.*

I INTRODUCTION

Professional training is one of the main pillars for improving processes and high productivity in public and private initiatives. In several countries, teachers have constantly invested in training to provide quality public education.

In Brazil, federal employees, especially those in education, are governed by laws 8.112/1990 [1] and 12.272/2012 [2]. Law 8.112, which regulates the legal regime of civil servants of the Union and of autarchies, in its art. 87 details the possibility of dismissal of employees with remuneration every five years, for a maximum period of 3 months.

Already in article 96, in turn, deals with paid leave for postgraduate courses, masters up to 24 months, doctorate up to 48 months and postdoctoral up to 12 months.

However, Federal Educational Institutions (FEIs) don't have any control over the courses that their employees seek to train, much less the level of training intended. A major gap pointed out by managers (Deans, Deans and General Directors) is to indicate the level of course and training to be offered.

For Cavalcante [3], training is an important labor qualification mechanism used in the private sector. However, for some years now, the public sector has adopted strategies to improve the knowledge of its public servants.

A. Training in the Federal Education Network

According to the Nilo Peçanha platform [4], in 2019, the Federal Education Network (formed by the Federal Institutes of Education, Science and Technology, Federal Technological University of Paraná - UTFPR, Federal Centers of Technological Education Celso Suckow da Fonseca in Rio de Janeiro - Cefet -RJ and Minas Gerais - Cefet-MG, Technical Schools linked to Federal Universities and Pedro II High Schools), had about 46.688 teachers distributed in 6 levels of training (Basic Education, Graduation, Improvement, Specialization, Master's Degree and Doctorate Degree), in which 67.97% of the teaching staff have academic qualifications up to a master's degree.

For an effective and efficient public service, there must be investments in training at its various levels in order to promote the improvement of services provided [5].

In Brazil, the Coordination for the Improvement of Higher Education Personnel – CAPES is the government agency that regulates training programs at Masters and Doctoral levels. According to CAPES, in 2020, there are approximately 2.186 Master's and Doctoral programs across the country. In the Federal Education Network there are several *stricto sensu* training programs (Academics and professionals)

To implement training programs within the federal public administration, the government has used its National Personnel Development Policy (NPDP). In this context, Pantoja et al. [6] report that the NPDP brings new perspectives of training and allowing a change in the competency-disciplined management model

B. Social Network Analysis – SNA

The Social Network Analysis has been used in studies in several areas such as: Computer Science, Information Science, Social Sciences, Health and Education [7].

Oliveira et. al [8], used the technique to characterize the training of employees of the Federal Institute of Education, Science and Technology of Santa Catarina - IFSC through Social Network Analysis.

In Medical Informatics, Oliveira and Gouveia [9] used the technique to measure the displacement of people in the northern region of Brazil to perform X-Ray and Bone Densitometry exams.

C. The Federal Institute of Education, Science and Technology of São Paulo – IFSP.

In 2008, through Law nº 11.892 [10], the Federal Institute of Education, Science and Technology of São Paulo – IFSP was created. The IFSP is composed of 37 college, 3 of which have an unity advanced - small college structure (from 20 to 40 professors), 1 college under implementation, 1 rectory and 32 college (from 70 to 90 professors). According to the Nilo Peçanha platform, in 2017, there were about 2.481 effective teaching staff at the institution. Thus, the aim of this study was to characterize the training of teachers at the Federal Institute of São Paulo through the Analysis of Social Networks -SNA.

The Federal Institute of São Paulo, is a century-old technical school in Brazil, originated from the School of Apprentice Artifices (SAA) of São Paulo, had its creation through Federal Decree 7.566 [11] of September 23, 1909, signed by the then President Nilo Peçanha.

Over the years, the SAA were transformed into Industrial Schools through Federal Law nº 378/1937 [12], which were later transformed and named Industrial and Technical Schools by means of Decree-Law No. 4.127/1942 [13]. In 1.959, the Federal Technical Schools (FTS) were established and became autarchies through Federal Law nº. 3.552/1959 [14] and, over the years, through Federal Law nº. 6.545/1978 [15] converts the Etes of Minas Gerais, Paraná and Rio de Janeiro in the Federal Technological Education Centers (Cefet), an organization that Efe de São Paulo acquired with the enactment of Law No. 8.948/2004 [16], which lasted until its transformation into a Federal Institute in 2008.

Inaugurated as President of the Republic of Brazil in 1909 Nilo Peçanha had in mind that only professional and technological education could change the whole reality of this country, so in just 3 months of his government he created the Schools of Apprentices and Craftsmen (EAA) originating what we have today the Federal Network of Professional, Scientific and Technological Education, a centenary network with hundreds of campuses installed in Brazil with more than 1 million enrolled students, Nilo Peçanha is the patron and creator of the Federal Network.

In honor of the patron and creator of the Federal Network, the Nilo Peçanha Platform was created, where all the information of the Federal Network is included in this platform, available for public consultation. Location where all the academic and management information that was achieved each year is available for consultation. Also a place for data collection, validation, and dissemination of official statistics from the Federal Education Network. It also aims to gather data related to the faculty, students, administrative technicians and financial expenses of each unit of the Federal Education Network.

The objective of this study was to characterize the training of teachers at the Federal Institute of São Paulo through Social Network Analysis.

II METHODOLOGY

In this study, the teaching staff of the Federal Institute of São Paulo - IFSP, who were enrolled in *stricto sensu* postgraduate programs (Masters or Doctorate), in 2017 were selected.

With this, data from public employees in training were consulted through the service bulletin available on the portal of the Federal Institute of São Paulo. Then, the teaching staff were separated by staffing unit and their respective level of training (Masters and Doctorate).

Through the Lattes platform [17], the teacher's course was obtained and with this it was possible to build the network of graphs (Social Network Analysis)

Data were separated by level and graduate course, with this, the gephi software was used to project graph networks.

In the study, the Degree and PageRank algorithms were used to verify the relationship between professors and postgraduate courses and also the influence of the course on the qualification of professors.

III RESULTS AND DISCUSSION

The values obtained from the Social Network Analysis (Degree) for professors enrolled in master's programs indicated that the São João da Boa Vista and Presidente Epitácio college have the largest number of employees in training. When analyzing the Nilo Peçanha 2020 Platform (base year 2019) we observed that the Presidente Epitácio college has 82 professors, and of these, 28% are doctors and 49% have master's degrees. Which confirms the result of the Analysis Networks study.

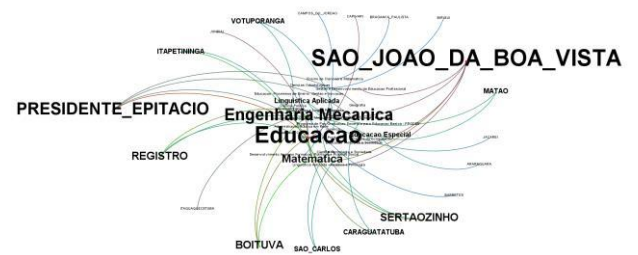


Fig.1: Degree Network graph of teachers registers on Master's degree.

Regarding the courses most sought after by IFSP professors, it is observed that Education, Mechanical Engineering and Mathematics are the most sought-after courses (Figure 2).

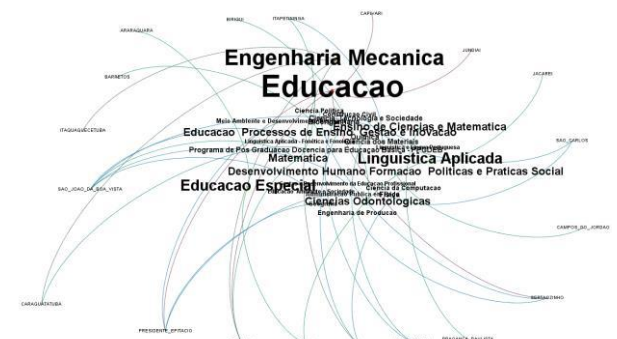


Fig.2: Page Rank network graph of teachers registers on Master's degree.

With regard to professors who attended a doctorate, the values calculated by the Analysis of Social Networks demonstrate that the São Carlos and São João da Boa Vista colleges have the largest number of employees in training. When analyzing the Nilo Peçanha Platform 2020 (base year 2019) he observed that the São Carlos campus has 80 professors, of which 59% have a doctorate and 34% have a master's degree. A lower situation was observed on the São João da Boa Vista college, which has 83 professors, of which 41% have a doctorate and 44% a master's degree.

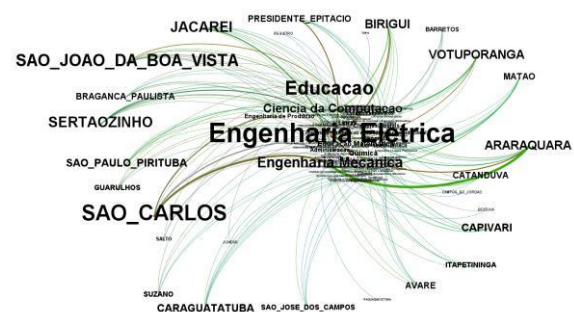


Fig.3: Degree network graph of teachers registers on Doctorate degree.

As shown in Figure 2, the courses most requested by IFSP professors, it appears that Electrical Engineering, Education and Computer Science are the programs most sought after by professors.

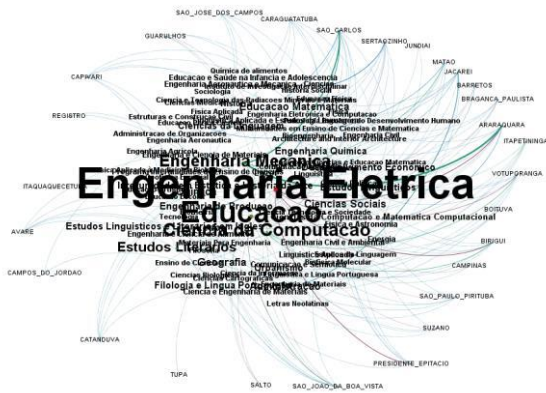


Fig.4: Page Rank network graph of teachers registers on Doctorate degree

The public service in general has gone through several changes in its structure, mainly the reduction of bureaucracy in the states. Mello and Amâncio Filho (2010) show that training through competency management is undoubtedly the best way for institutions to develop competencies

Teixeira Filho et al. [18] reports that one of the legal frameworks of managerial models in the management of people in the Brazilian public administration was established through Decree n°. 5707/2006, which is a policy focused on the development of employees through training. This policy, with a focus on competency-based management, established the Policy and Guidelines for the Development of Personnel (PGDP) of the direct, autonomous and foundational federal public administration, in accordance with the provisions of Law No. 8112/1990 [19].

According to Appugliese [20], through Decree No. 5.707/2006 [21], it was possible to create the National Policy for Personal Development, whose objectives were: to improve the efficiency, effectiveness and quality of public services provided to the citizen, so a permanent development of the public servants. The author adds that training is investing in public servants, as it allows for improvements in individual and institutional work processes.

This decree was later revoked and replaced by Decree n°. 9.991/2019 [22] with some changes. Fostering the training and development of people allows the professionalization of civil servants, obtaining greater organizational performance in the public service, enabling

the achievement of the Education Institution's objectives and goals.

At the federal institutes, Sakamoto et. al. report that there are some initiatives for the development of people, aimed at improving the services provided by IFE.

Mello, Melo and Mello Filho [23], on the other hand, identified that structural problems and accumulation of service are decisive factors for the implementation of training through competency management.

In training, Oliveira et. al. (2019) [8], carried out a study of Analysis and Social Networks of teachers in training at the Federal Institute of Santa Catarina. In this study, the authors concluded that the Linguistics, Computer Science and Letters courses were the most requested by the professors, contrary to the results of this study, which demonstrated Mechanical Engineering, Education, Electrical Engineering and Computer Science. What explains these differences found are the courses offered by each Federal Educational Institution, with their teachers being directly linked to these areas.

IV CONCLUSION

In this study, we can conclude that the Social Network Analysis showed a search for courses in several areas, with an emphasis on *stricto sensu* courses in the exact sciences (Mechanical Engineering, Electrical Engineering and Computer Science). a great impact on professors seeking master's training.

REFERENCES

- [1] BRAZIL, (1990). Lei nº8.112, de 11 de dezembro de 1.990. Estabelece o Regime Jurídico dos Servidores Públicos Civis da União. Official Diary of the Union – Brazil.
- [2] BRAZIL, (2012). Lei nº 12.272, de 28 de dezembro de 2012. Dispõe sobre a estruturação do Plano de Carreiras e Cargos de Magistério Federal; sobre a Carreira do Magistério Superior. Official Diary of the Union – Brazil.
- [3] Cavalcante, J.C.A. et al. (2016). Capacitação de servidores públicos: uma análise dos eixos da política implantada na UFAL. In: Congresso Nacional de Mestrados Profissionais em Administração Pública, Curitiba. Anais. Curitiba, 2016.
- [4] BRAZIL, (2021). Nilo Peçanha Platform. <http://plataformanilopeçanha.mec.gov.br/>
- [5] Bresser-Pereira, L. C., (1998). Reforma do Estado e Administração Pública Gerencial. Rio de Janeiro: Editora Fundação Getúlio Vargas: 21-38.
- [6] Pantoja, M. J., Iglesias, M., Benevenuto, R., & Paula, A. D. (2012). Política Nacional de Desenvolvimento de Pessoal na Administração Pública Federal: uma caracterização da capacitação por competências na administração pública federal.

- [7] Wasserman, S., & Faust, K. (1994). Social network analysis: Methods and applications (Vol. 8). Cambridge university press.
- [8] Oliveira et. al. (2019). Social Network Analysis (SNA) and the Training Process of the Employees of the Federal Institute of Santa Catarina. *International Journal of Advanced Engineering Research and Science*. V.6, Issue-11
- [9] Oliveira & Gouveia (2019). The characterization of population displacement for early diagnosis of osteoporosis: a study on the performance of X-ray and DXA exams in northern Brazil. *Journal of Advanced Engineering Research and Science*. V.6, Issue-11
- [10] BRAZIL, (2008). Lei nº 11.892, de 29 de Dezembro de 2.008 que Institui a Rede Federal de Educação Profissional, Científica e Tecnológica, cria os Institutos Federais de Educação, Ciência e Tecnologia, e dá outras providências.
- [11] BRAZIL. (1909). Dispõe sobre a criação de Escolas de Aprendizes e Artífices, para o ensino profissional primário e gratuito. *Official Diary of the Union - Brazil*. <https://www2.camara.leg.br/legin/fed/decret/1900-1909/decreto-7566-23-setembro-1909-525411-publicacaooriginal-1-pe.html>
- [12] BRAZIL. (1937). Dá nova organização ao Ministério da educação e Saúde Pública.. *Official Diary of the Union - Brazil*. <https://www2.camara.leg.br/legin/fed/lei/1930-1939/lei-378-13-janeiro-1937-398059-publicacaooriginal-1-pl.html>
- [13] BRAZIL. (1942). Estabelece as bases de organização da rede federal de estabelecimentos de ensino industrial... *Official Diary of the Union - Brazil*. <https://www2.camara.leg.br/legin/fed/declei/1940-1949/decreto-lei-4127-25-fevereiro-1942-414123-publicacaooriginal-1-pe.html>
- [14] BRAZIL. (1959). Dispõe sobre nova organização escolar e administrativa dos estabelecimentos de ensino industrial do Ministério da Educação e Cultura, e dá outras providências. *Official Diary of the Union - Brazil*. http://www.planalto.gov.br/ccivil_03/leis/L3552.htm
- [15] BRAZIL. (1978). Estabelece as bases de organização da rede federal de estabelecimentos de ensino industrial... *Official Diary of the Union - Brazil*. Dispõe sobre a transformação das Escolas Técnicas Federais de Minas Gerais, do Paraná e Celso Suckow da Fonseca em Centros Federais de Educação Tecnológica e dá outras providências
- [16] BRAZIL. (1994). Dispõe sobre a instituição do Sistema Nacional de Educação Tecnológica e dá outras providências. *Official Diary of the Union - Brazil*. http://www.planalto.gov.br/ccivil_03/leis/18948.htm
- [17] Lattes. (2021). Plataforma Lattes. Conselho Nacional de Desenvolvimento Científico e Tecnológico. <http://lattes.cnpq.br/>
- [18] Teixeira Filho, A.R.C., De Almeida, D.R., De Almeida, L.R. & De Almeida, S.M.V., (2017), Capacitação no setor público: analisando o processo de uma IFES. *RACE - Revista de Administração, Contabilidade e Economia*.
- [19] Bregalda, A., Tosta, H. T., Dalmau, M. B. L., (2014). A política nacional de desenvolvimento de pessoas e sua implantação em duas instituições federais de ensino brasileiras. XIV Colóquio Internacional de Gestão Universitária.
- [20] Appugliese, M. M. E., (2010) Capacitação dos servidores visando eficácia dos serviços públicos: um estudo de caso do Instituto Federal de Educação, Ciência e Tecnologia de São Paulo-Campus Cubatão (IFESP).
- [21] BRAZIL. (2006). Institui a Política e as Diretrizes para o Desenvolvimento de Pessoal da administração pública federal direta, autárquica e fundacional, e regulamenta dispositivos da Lei no 8.112, de 11 de dezembro de 1990. *Official Diary of the Union - Brazil*. http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2006/decreto/d5707.htm
- [22] BRAZIL. (2019). Dispõe sobre a Política Nacional de Desenvolvimento de Pessoas da administração pública federal direta, autárquica e fundacional, e regulamenta dispositivos da Lei nº 8.112, de 11 de dezembro de 1990, quanto a licenças e afastamentos para ações de desenvolvimento. http://www.planalto.gov.br/ccivil_03/_ato2019-2022/2019/decreto/D9991.htm
- [23] De Mello, S.P.T., De Melo, P.A., Melo Filho, R. T., Competências Gerenciais Evidenciadas e Desejadas dos Integrantes do Fórum de Gestão de Pessoas da Rede Federal de Educação Profissional, Científica e Tecnológica. *RACE: Revista de Administração, Contabilidade e Economia*. *Race*, V. 15, n. 1, p. 349-374, jan./abr. 2015