

# COLLABORATION IN PRODUCTION OF ARTICLES OF TEACHERS OF THE GRADUATE STUDIES PROGRAM IN HUMAN MOVEMENT SCIENCE OF THE ESEF OF THE UFRGS BETWEEN 2007 AND 2009: SOCIAL NETWORK ANALYSIS

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**Abstract:** The lone researcher is a figure distant from contemporaneity. Collaborative work in the scientific community expanded enormously in the twentieth century supported by information technology. The use of electronic resources and intense competition in the academic means and other organizations contributed to this outcome. Network collaboration strengthens ties between researchers and institutions, which thus generate resources and interdisciplinary research activities and contribute to mutual support in the construction of scientific knowledge. This article aims to contribute to the identification of collaborative networks of teachers in the Graduate Studies Program in Human Movement Science (PPGCMH) of the UFRGS, in the period 2007-2009, covering the last triennial valuation of the Coordination of Personnel Training (CAPES). 204 articles and 280 authors in published articles were identified. The results point towards a collaborative network under construction, with few links between teachers and more among research groups. This article contributes to studies in the scientific production field of physical education, and as a tool to research activities and opportunities for institutional exchange.

**Keywords:** Indicator of collaboration. Researchers. Physical Education. Social Network Analysis (SNA)

## 1 INTRODUCTION

The role of scientific communication, according to Le Coadic (1996, p 33), is to “[...] ensure exchange of information on work in progress, putting scientists in touch with each other.” It is represented by two types of channels: the formal and informal ones. The one considered informal consists of oral communication, which occurs in congresses and conferences, besides the human networks – meetings among scientists, e-mail, mailing lists, and so on. (MEADOWS, 1999). This type of communication has the advantage of being quick, up-to-date, and agile. But if it is not registered, it will be in danger of volatilizing, getting lost over time, and complicating the confirmation of data. Registration

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is given with the notification. It has pre-defined patterns, employing rigor, a language and criteria for submission of data and concepts of scientific research, including itself in this type of communication, the use of journals and books. Markedly the cumulative nature of science has been obtained for publication of scientific articles. Since the seventeenth century, the standardization of scientific papers has the role of formal communication channel for research, initially in paper form and now in digital and electronic media.

These, according to Moreno and Márdero Arellano (2005), have an important role in the process of transferring and sharing scientific and technical information. The spread within the scientific community depends on the communication network established, consisting of the information flow of an organization. To obtain financial support and prestige, the authors to seek recognized channels and partnerships, and follow the methodological rules of knowledge production.

We note, in electronic publications, a formatting that is similar to the traditional format, but with the advantage of providing resources for access and management (hypertext and multimedia). With these resources, the way scientists communicate changed. Crespo says:

[...] the trend of use of information resources in electronic media has been identified for some time in other channels and also in processes of science communication. It can be found in the dissemination of scientific research results in electronic formats such as conference proceedings available through the internet (CRESPO, 2005, p. 22).

Researching, producing and publishing scientific breakthroughs cause recognition and credibility since there is an effective communication that depends on the product and also on the process of diffusion of scientific activity. According to Mendes and Marziale (2002, p. 259) “[...] scientists and analysts of technology and science already know this; they claim that for science to exist there must be communication”.

## **2 SCIENTIFIC PRODUCTION**

We can define the scientific literature as “[...] measure of the volume of books, book chapters, journal articles and other forms of print, digital or electronic production containing the results of scientific research of authors, institutions, regions, countries or themes.” (Lara, 2006, p. 408). This volume of information is stored, propagated and disseminated in the form of documents. Thus, the forms of documents predetermine their type and receive a classification, such as scientific articles, technical reports, dissertations, books, patents, etc. it has traditional settings established by usage, which are subject to formal requirements and appropriate standards for their production and placement.

To investigate the volume of information from the collaborative activities in scientific production, bibliometric techniques are used, which, among many others, makes the analysis of co-authors who evaluate indicators of collaboration among researchers.

In the academic environment, the formation of formal or informal cooperation networks constitutes a cornerstone of scientific development. For Pisciotta (2006, p. 117), “[...] the company operates through a network composed of sub-networks that are entangled in an endless relationship among peers.”

### 3 NETWORKS FOR COLLABORATION

Costa (2011) refers to Fritjof Capra to explain that social network analysis (SNA) works primarily from the systemic approach, in a world as one interconnected system, in a network (network pattern), it is one of the most basic patterns of organization of all living systems at all levels of life. Social networks are primarily “[...] communication networks involving the symbolic language, cultural boundaries, power relations, and so on” (CAPRA, 2002<sup>1</sup> apud COSTA, 2011).

In the settings of the networks, the actors are described by their relationships rather than their attributes, the subjects are the “nodes” – moorings – and the “ties” are the relations among us. The details of the analysis are for understanding the nodes in the network and their respective ties.

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<sup>1</sup> CAPRA, Fritjof. **The Hidden Connections**: A Science for Sustainable Living. Portuguese translation by Marcelo Brandão Cipolla. São Paulo: Cultrix, 2002.

When subjects are teachers and researchers, the connection between them is set to publish in common, which can be an article, book, or other document. The social network nodes are measured according to the degree of centrality in the network, i.e. “nodal degree”. The nodal degree is equivalent to the number of connections that the subject has received, for example: if, in a network, the teacher has ten links, their degree centrality is ten. (FREITAS, 2007)

The study of social networks intends to contribute to the scientific research examining how this system behaves and connections amongst the subjects involved in this network. As defined by Marteleto e Silva,

The social network analysis is of interest to researchers in various fields of knowledge that, in an attempt to understand their impact on social life, gave rise to various methods of analysis that are based on relationships between individuals in a network-shaped structure (MARTELETO; SILVA, 2004, p. 41).

To Balancieri *et al.* (2005), social networks contribute to the scientific community because they offer an exchange of information and bring together researchers from the same area and same interests. It is also an important source of support in order to improve the outcome and maximize the potential of scientific production.

Moreover, the shared work saves time, money, and materials, so it is encouraged by funding agencies. Meadows (1999) says that the rapid growth and specialization of science make it difficult to work individually and they often need to conduct an experiment to bring together knowledge from many disciplines, in addition to financial resources, making it difficult for one person to be able to run it.

The analysis of social networks has been frequently addressed in literature. Studies such as Balancieri (2004), Maia (2006), and Vanz (2009), who analyzed co-authoring networks, point to the importance of studying these networks and their formation, to understand scientific collaboration amongst peers, the products generated from those, which can be: patents, scientific articles, books, etc. These employees share both the credits and the responsibilities for scientific production.

Given this brief introductory outline, such as thinking operationally of co-authoring networks, the proposal of this study is to analyze the SNA in the area of physical education in the PPGCMH.

#### **4 PHYSICAL EDUCATION**

We can imagine areas of knowledge as large networks connected and, as they are creating strong and weak ties, the nodes amongst subjects get stronger beside the other areas.

Some milestones are important for the recognition of an area, such as the creation of courses in institutions of higher education, publication of scientific journals, existence of an entity representing the bodies, and events that bring together representatives of this community.

In recent decades, with the creation of career education in physical education, its institutionalization has become a reality, from middle to higher education professional training (Licentiate Degree and Bachelor Degree), housed in university courses in various colleges and universities.

In 1932, the first periodical in physical education was published: Journal of Physical Education (by the Army), from the School of Physical Education of the Brazilian Army, in Rio de Janeiro. Despite not having a totally scientific character, it remains current and under the responsibility of the Research Institute of Physical Training of the Army.<sup>2</sup>

There are about 30 Brazilian journals being published in the area of physical education and sports, although with some failures in schedule. According to the CAPES Qualis evaluation, none of the national titles has the A concept, and the majority of titles are distributed in strata B and a small part in C. We will discuss this matter later in the paper.

Currently, the Brazilian College of Sports Sciences (BCSS) is probably the organization that brings together industry professionals and promotes the largest national gathering of the area: the Brazilian Congress of Sports Science (Conbrace), which is held every two years.

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<sup>2</sup> <http://www.revistadeeducacaofisica.com.br/paginas/indice30.htm>

The Physical Education area is called Area 21, according to the classification of the CNPq, and consists of 38 graduate programs in the professional areas of physical education, physiotherapy, occupational therapy, and speech therapy.

In physical education in Brazil, there are about 800 courses, 12 doctoral programs and 198 specialization courses, and, according to the Lattes Platform, 10,560 doctors have registered their CVs on the subject of Physical Education.<sup>3</sup>

Brazilian scientific research is conducted primarily in academic institutions. It can be argued that research in the School of Physical Education at the UFRGS started even in an incipient way, years before the creation of the Graduate Studies Course, held in 1989.

The Research Laboratory of Exercise (LAPEX), established in 1973, was the first milestone in the practice of research at the ESEF and the origin of the PPGCMH. With this initiative, the ESEF has been characterized as an institution of knowledge production, adding scientific aspects required for an academic education to the curriculum of their teachers. With a diverse curriculum, the PPGCMH includes courses in several areas, from biological, educational, and social arrays, and production of its researchers reflects this diversity and multidisciplinary.

In 1989, the Graduate Studies Program in Human Movement Science was created, initially with the master's degree course and, as of 2000, the doctoral course. Today, the CAPES gives it a grade 5.

There are two areas of concentration of the PPGCMH: Human movement, culture, and education and Human movement, health, and performance. Together, they have six lines of research at the master's degree and doctoral levels.

Human movement, culture, and education with two lines of research:

a) social representations of human movement: it includes research projects developed from research problems dealing with relationships of human movement and social representations;

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<sup>3</sup> Available at: <http://buscatextual.cnpq.br/buscatextual/busca.do?metodo=apresentar>. Retrieved: Feb.10<sup>th</sup>, 2011.

b) teacher training and pedagogical practice: it includes research projects developed from research problems dealing with the pedagogical and non-school education.

Human movement, health and performance with four lines of research:

a) physical activity and health: it includes research projects with developments in relations between human movement and their rehabilitation and preventive effects on diseases related to physical activities;

b) physical activity and performance: it includes research projects in development, learning, training, and motor performance;

c) neuromechanics of human movement: it includes research projects related to the principles and/or mechanisms responsible for structural movement in its biomechanical aspects;

d) developing coordination and motor control: it includes research projects studying the processes of acquisition and maintenance of motor skills, as well as coordinative and motion control process in typical people and people with special needs.

Below is a table showing the number of teachers involved in each line of research:

<b>AREA OF CONCENTRATION</b>	<b>LINES OF RESEARCH</b>	<b>PROFESSORS INVOLVED</b>
Human movement, health and performance	Physical activity and health	4
	Physical activity and performance	8
	Neuromechanics of the human movement	4
	Development of coordination and motor control	2
Human movement, culture and education	Social representation of human movement	7
	Teacher training and pedagogical practice	3

**Figure 1** – Table of teachers and research lines of the PPGCMH.  
Source: the PPGCMH website

By the table above, it is observed that, in the six research lines, divided into two areas of concentration, the first area, Human movement, health and performance concentrates a greater number of teachers to meet its four lines of research. The second area, Human movement, culture and education has fewer teachers because they are two lines of research. The sum is not indicated in the table because there are teachers who work in more than one line of research.

The academic training of teachers in the PPGCMH is important information to clarify the basis of its interdisciplinarity, and to the establishment of the theoretical course. Data were obtained through the Lattes Platform.

Most teachers (82%) have their degree in physical education and four (18%) in the following areas: pharmacy (1), mechanical engineering (1), electrical engineering (1), and medicine (1). The same index is given in relation to specialization courses that were held in various areas related to sports, education, health, etc., where most took their specialization course to enhance their physical education degree.

Only two teachers did not take the master's degree and all attended the doctoral course. As for the areas chosen, the distribution of courses is quite heterogeneous but followed the areas of specific training of the teachers' education, such as human movement (in physical education), engineering, medicine, and life sciences.

Postdoctoral courses were attended by a minority, but in order for teachers to move away from their studies within a predictability that does not compromise the academic term, it is assumed that the majority will.

As for the source location of master's degree classes, most teachers (81%) took them in Brazilian institutions. The doctoral degree was taken by 52% of teachers in Brazil and other courses comprise a wide number of choices in the following countries: Portugal, England, Spain, Germany, United States, and Canada.



In the PPGCMH, graduates receive a master's degree and/or PhD in Human Movement Science. The PPGCMH, in the last three years, from 2007 to 2009, according to statistics from the CAPES, defended 24 theses and 84 dissertations.<sup>4</sup>

The ESEF is responsible for publishing the *Movimento* journal (ISSN: 0104-754x, e-ISSN: 1982-8918), started in 1994, on a quarterly basis, specializing in physical education in its interface with the Humanities and Social Science in its educational, historical, political, and cultural aspects. So far, it has published 17 volumes, 33 issues, and 482 articles. It is indexed in the most prestigious international databases: Scopus, ISI (Thomson Reuters), Sport Discus, Latindex, Redalyc, and Lilacs.

## 5 METHODOLOGICAL PROCEDURES

For this analysis, the research was delimited to articles published in journals and related publications in the documents of the Triennial Evaluation of the CAPES, from 2007 to 2009. The research is qualitative and quantitative as it seeks, through analysis of reality, to establish generalities, not generalizations, of the factors responsible for the formation of collaboration among its teachers with assistance bibliometric techniques and social network analysis.

The subjects are 22 teachers belonging to the *strictu sensu* Program of the PPGCMH of the UFRGS, in the period from 2007 to 2009.

The main instrument for data collection used was the Notebook of Indicators of the CAPES, 2009, physical education area, literature production: "The information completed annually by the programs and submitted to the Capes through the Data Collection form is handled and allow the issue of Notebooks of Indicators, which are the reports used in the evaluation process."<sup>5</sup>

The following documents were used as secondary sources of data collection:

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<sup>4</sup> Available at:

[http://www.capes.gov.br/images/stories/download/avaliacaotrienal/planilhascomparativastrienal2010/Educacao\\_Fisica.xls](http://www.capes.gov.br/images/stories/download/avaliacaotrienal/planilhascomparativastrienal2010/Educacao_Fisica.xls). Retrieved: Feb. 5<sup>th</sup>, 2010.

<sup>5</sup> Available at:

[http://conteudoweb.capes.gov.br/conteudoweb/CadernoAvaliacaoServlet?acao=filtraArquivo&ano=2009&codigo\\_ies=ufrgs&area=21](http://conteudoweb.capes.gov.br/conteudoweb/CadernoAvaliacaoServlet?acao=filtraArquivo&ano=2009&codigo_ies=ufrgs&area=21). Retrieved: Jan.10<sup>th</sup>, 2011

- the PPGCMH website: identification and profile of teachers, research lines;<sup>6</sup>
- CNPq website for information on the Lattes Curriculum and Directory of Research Groups in Brazil: For complete information about research groups and academic background.<sup>7</sup>

For each item, we identified: authors, title and language of the article, title, format, Qualis concept, city and year of publication of the periodical. As for the authorship, we identified if each item had individual, dual or multiple authors, and whether or not the first author is a teacher of the PPGCMH.

The data were put into a spreadsheet, then creating a matrix – the basic document for network analysis and graph generation through the Ucinet program.

The survey was developed from the formulation of the following propositions regarding expected trends in scientific production of the PPGCMH in the last triennium evaluated by the CAPES:

Is there institutional collaboration among teachers of the PPGCMH evidenced by the network study?

If there is collaboration, does it present itself among teachers in the same area or line of research or in different areas and lines?

Is there a group with more outstanding collaboration and productivity? Do these two groups coincide?

Based on these questions, we performed analyses to achieve the results below.

Prior to that, it is important to note that the entire production of Area 21, which includes physical education, physiotherapy, and occupational therapy should be considered, taking into account the fact that it is a new science in Brazil. Whereas the oldest PPG of the area, currently with a grade 6 was recommended for three decades, most

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<sup>6</sup> Available at: <http://www.esef.ufrgs.br/pos/>. Retrieved: Jan.10<sup>th</sup>, 2011.

<sup>7</sup> Available at: <http://buscatextual.cnpq.br/buscatextual/busca.do?metodo=apresentar>. Retrieved: Jan.10<sup>th</sup>, 2011.

of the PPG was implemented in the last three study periods, and approximately half of these PPG displays grade three.” (CAPES, 2009b, p. 1)

## 6 ANALYSIS AND RESULTS

The following presents the analysis of data obtained in the production of the PPGCMH in the triennium from 2007 to 2009, with the aim to confirm or reject the proposals. The study period includes the participation of 280 authors in the production of 238 articles. During the tabulation process, 34 items were discarded, which represent 14.28% of the total, articles in which teachers have not participated, in a total of 204 articles.

**Table 1 – Average Number of Papers Published by Teachers per Year of Bond Studied (2007-2009)**

<b>Cod e</b>	<b>Auth or</b>	<b>Years of continuous bond in the triennium</b>	<b>Average number of articles per year of the triennium</b>
P1	10	3	3.33
P2	2	1	2
P3	6	3	2
P4	8	3	2.66
P5	16	3	5.33
P6	7	3	2.33
P7	35	3	11.66
P8	21	3	7
P9	8	3	2.66
P10	12	3	4
P11	32	3	10.66
P12	5	3	1.66
P13	16	3	5.33
P14	5	3	1.66
P15	2	3	0.66
P16	2	3	0.66
P17	4	3	1.33
P18	3	3	1
P19	3	3	1
P20	2	1	2
P21	10	3	3.33
P22	7	3	2.33
<b>Tot</b>	<b>216</b>		<b>81.58</b>

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**Source:** elaborated by the authors.

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## 6.1 ANALYSIS UNIT 2: SCIENTIFIC PRODUCTION IN ARTICLES

The overall total of scientific production was 499 (four hundred and ninety-nine) items throughout the triennium. Table 2 presents the total production in this period.

**Table 2 – Publication by Typology in the Period (2007-2009)**

<b>Year</b>	<b>Book Chap.</b>	<b>Paper</b>	<b>Jour. / Per.</b>	<b>Annals</b>	<b>Articles</b>
2007	23	3	0	22	40
2008	37	0	8	1	107
2009	55	1	4	107	91
<b>Total</b>	<b>115</b>	<b>4</b>	<b>12</b>	<b>130</b>	<b>238</b>

**Source:** elaborated by the authors.

This table shows that teachers of the program tend to publish their output in scientific journals. However, we must emphasize that, during this triennium, they modified their primary source of publication, as they increased publication in conference annals, which may point to a new path of choice for scientific publication.

In total, we have 238 articles published by the PPGCMH, but this analysis is the study of articles published by professors of the Program, and thirty-four articles were published without the participation of at least one teacher. Therefore, we will publish 204 published articles. There are 280 authors and co-authors who published their papers in 81 journals of which three have Qualis A1 and two have Qualis A2, with the publication mostly in periodicals with Qualis B1 and B2.

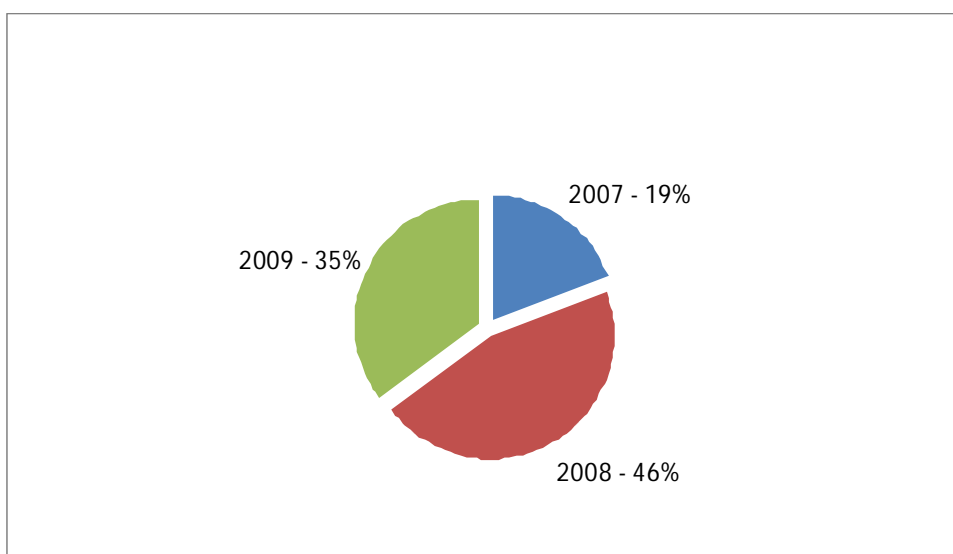
Qualis represents the set of procedures used by Capes for the stratification of the quality of intellectual production of post-graduation programs. It is based on information from the Data Collection that the PPG should meet every three years. The result is a list with the classification of vehicles used by graduate studies programs for the dissemination of its production, usually comprising scientific journals. The classification of journals is undertaken by a committee of the respective assessment areas and goes through the annual update. These vehicles are classified in strata indicating quality, ranging from A1, the highest, through the intermediate A2; B1; B2; B3; B4; B5. to C. with zero weight.

The same journal, when classified in two or more distinct areas, can receive different assessments. This is not an inconsistency, but expresses the value assigned in each area to the relevance of the content published. This list can be checked on WebQualis.

Since 2009, there is validation for production of books because, in several areas of knowledge, they are the main means of propagation of artistic, technological, and scientific productions.

The committee of Area 21 established, as stratification parameter, the 'fator de impacto' (impact factor) calculated by the Journal Citation Report (JCR) of Thomson and Reuters and the 'índice H' (index H). Roughly speaking, journals in these bases will be A1, A2, or B1. If they are in Medline and/or Scielo, they belong to stratum B2. For intermediate strata, B3 to B5, the journals should be indexed in the bases Lilacs, Cinahl, Embase, Eric, Sport Discus, and Latindex, which have more flexible criteria for indexing and, finally, stratum C for journals that have not been indexed in more recognized bases. For each stratum, there are a maximum percentage of journals and the final score takes into account the sum of these criteria. (DOCUMENTS ..., 2009, p. 2-4).

Figure 2 shows the percentage distribution of the 204 articles published by the teachers of the Program in the triennium studied, divided by the number of annual publication.



**Figure 2** – Distribution of the 204 articles published by teachers of the Program in the triennium

It is observed that in this studied triennium, the lowest production was the 2007 one, the highest was the 2008 one, in 2009, it is declining, which may point to a different preference to disseminate its scientific output.

Table 3 shows the relationship of journals with their respective Qualis and number of articles published in the period studied.

**Table 3 – List of Periodicals Published, Frequency of articles and Qualis (2007-2009)**

<b>Title of Periodical</b>	<b>Frequency of articles</b>	<b>Qualis</b>
Revista Brasileira de Cineantropometria & Desempenho Humano	12	B2
Revista Brasileira de Medicina do Esporte	12	B1
Movimento (the UFRGS)	11	B1
Lecturas Educación Física y Deportes	11	B4
Revista Brasileira de Ciências do Esporte	9	B2
Revista Brasileira de Fisioterapia	8	B1
Coleção Pesquisa em Educação Física	6	B5
Brazilian Journal of Biomotricity	6	B4
Revista Brasileira de Educação Física e Esporte	6	B2
Revista Portuguesa de Ciências do Desporto	6	B1
Journal of Strength and Conditioning Research	6	A2
International Journal of Aquatic Research and Education	5	B5
Revista Brasileira de Fisiologia do Exercício	5	B5
Revista da Educação Física/UEM	4	B2
Advances in Physiology Education	4	B1
Arquivos em Movimento (UFRJ)	3	B4
Revista de Educação Física - Escola de Educação Física do Exército	3	B4
Revista Brasileira de Biomecânica	3	B3
Gazzetta Medica Italiana. Archivio per le Scienze Mediche	3	B2
Journal of Sports Medicine and Physical Fitness	3	B1
Corpo em Movimento (ULBRA)	2	B5
Nutrição em Pauta	2	B5
Recorde - Revista de História do Esporte	2	B5
REFELD. Revista Brasileira de Educação Física, Esporte, Lazer e Dança	2	B5
Pensar a Prática (UFG)	2	B3
Arquivos Brasileiros de Endocrinologia & Metabologia	2	B2
Motriz (Rio Claro)	2	B2
Revista Latino-Americana de Enfermagem (USP. Ribeirão Preto)	2	B2

Journal of Applied Biomechanics	2	B1
Journal of Exercise Physiology Online	2	B1
Motriz : Revista de Educação Física (Online)	2	B1
Pediatric Exercise Science	2	B1
Physical Therapy in Sport	2	B1
Brazilian Journal of Medical and Biological Research	2	A2
Atherosclerosis (Amsterdam)	2	A1
British Journal of Sports Medicine	2	A1
Journal of Sports Sciences	2	A1
Arquivos Sanny de Pesquisa em Saúde	1	B5
Diálogo (Canoas)	1	B5
Gênero	1	B5
International Journal of Managerial Finance	1	B5
Revista Brasileira de Prescrição e Fisiologia do Exercício	1	B5
Revista Digital Universitária	1	B5
Revista do Centro de Ciências da Saúde (UFSM) Cont.Saúde (Santa Maria)	1	B5
Biomechanics (Rockville)	1	B4
Brazilian Journal Of Motor Behavior	1	B4
Ciências & Cognição (UFRJ)	1	B4
Journal of Olympic History	1	B4
The FIEP Bulletin	1	B4
Acta Fisiátrica (USP)	1	B3
Licere (Belo Horizonte)	1	B3
Revista Brasileira de Geriatria e Gerontologia (UnATI)	1	B3
Temas sobre Desenvolvimento	1	B3
Ciência & Saúde Coletiva (Online)	1	B2
Educação e Realidade	1	B2
Educação em Revista (UFMG)	1	B2
Ex aequo	1	B2
Fisioterapia e Pesquisa	1	B2
Fisioterapia em Movimento (PUCPR)	1	B2
Interface. Comunicação, Saúde e Educação	1	B2
Jornal Brasileiro de Psiquiatria (UFRJ)	1	B2
Opción (Maracaibo)	1	B2
RBM. Revista Brasileira de Medicina (Rio de Janeiro)	1	B2
Revista Brasileira de Ciência e Movimento	1	B2
Revista Estudos Feministas (UFSC)	1	B2
Biology of Sport	1	B1
Cell Biochemistry and Function	1	B1
Clinical and Applied Thrombosis/Hemostasis	1	B1
Journal of Bodywork and Movement Therapies	1	B1
Revista Brasileira de Saúde Materno Infantil	1	B1

Canadian Journal of Physiology and Pharmacology (Online)	1	A2
Clinical Science (1979)	1	A2
Journal of Science and Medicine in Sport	1	A2
American Journal of Respiratory and Critical Care Medicine	1	A1
Biochemical Pharmacology	1	A1
Experimental Brain Research	1	A1
Journal of Electromyography and Kinesiology	1	A1
Physical Therapy	1	A1
Revista Brasileira de Docência, Ensino e Pesquisa em Educação Física	1	----
Sports Biomechanics	1	A2
The Journal of Sexual Medicine	1	A1

This study found that during the triennium 2007-2009, the teachers used 81 journals to publish their articles as part of their scientific production. The journals are distributed among the Qualis concepts as shown in Figure 3

Qualis Concept	Title Frequency	%
A1	9	11.2
A2	6	7.4
B1	16	19.4
B2	20	24.8
B3	6	7.4
B4	9	11.2
B5	14	17.3
No Qualis	1	1.3
<b>Total</b>	<b>81</b>	<b>100</b>

**Figure 3** – Selected Journals and distribution by Qualis concept

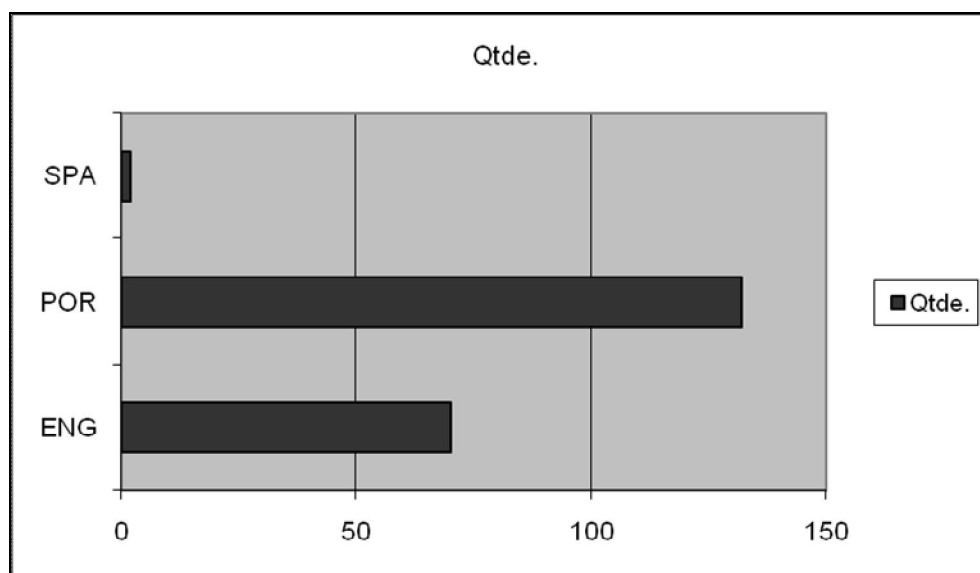
Only 15 article titles have the Qualis A, and most of the journals chosen by the PPGCMH to publish its articles are in stratum B, especially B2, which is an excellent concept for national periodicals. Three periodicals with the largest number of articles published stand out: *Revista Brasileira de Medicina do Esporte* (Brazilian Journal of Sports Medicine), which is published by the Brazilian Society of Sports Medicine, in São Paulo, (B1), *Movimento da Escola de Educação Física* (Movement of the Physical Education School) of the UFRGS (B1), *Revista Brasileira de Cineantropometria & Desempenho Humano* (Brazilian Journal of Kinanthropometry and Human Performance), published by the Federal University of Santa Catarina in Florianópolis (B2). The *Movimento* periodical, published by the institution of the PPGCMH, stands out as the third



most used by teachers of the program. The preference for *Lecturas Educación Física y Deportes* (Buenos Aires) also stands out, with 11 published articles and B4 concept, the stratum which identifies low-indexing journals in databases, and that does not meet other criteria, such as not having a peer review, or other type of quality assessment, discrediting it as essentially scientific journal. It would be important to move these articles to other periodicals that use the peer review system.

The researcher's choice on where to publish is crucial. He or she should take into account the visibility of his or her choices and the fact that the more the journal is indexed in databases, the more exposed its text will be, which will gratefully result in notoriety for the author and publication. Moreover, language is a barrier for publication in foreign journals, because it may not be read in their country, but, if written in Portuguese, it may not be read by peers abroad, so there are circumstances beyond the control of the author.

The following graph shows, according to the number of articles published, the languages used for publishing articles on this studied triennium.

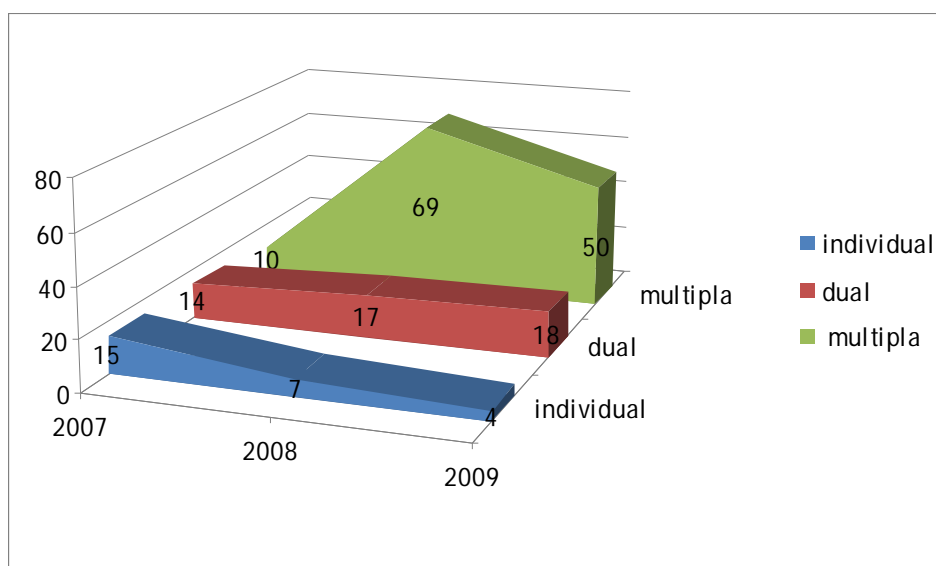


**Figure 4** – Languages present in the published articles

Based on Figure 4, we note the three languages used by teachers to compose their articles. It is noteworthy that the authors prefer to publish in their native language –

Portuguese – as it is the most common language in articles of journal published between years 2007 and 2009, representing almost twice the number of articles published in the second most used language – in this case, the English language.

As for the authorship, we can say that individual authorship is disappearing, i.e. collaboration has increased in the preparation of articles, as well as the frequency of articles per year, as shown in Figure 5.



**Figure 5** - Type and frequency of authorship of articles in the period from 2007 to 2009

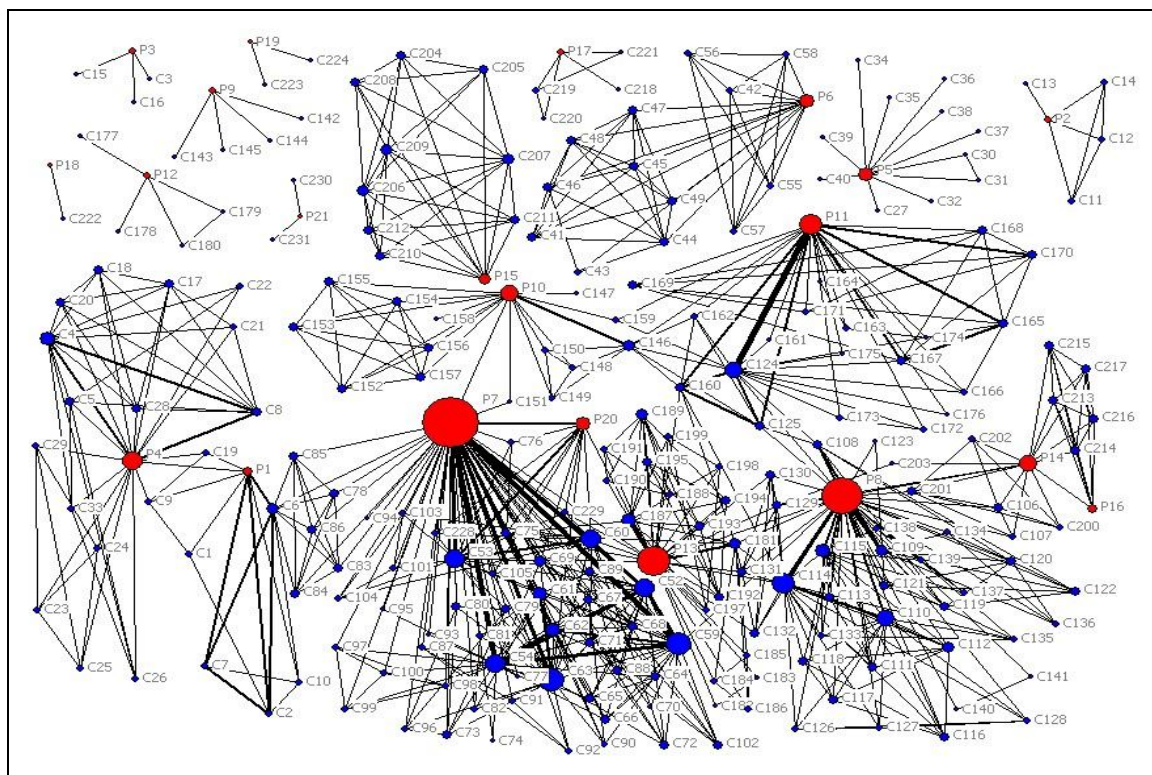
Moreover, we conclude that in the first year of the triennium (2007), the individual and dual authorship prevailed. Unlike what occurred in other years (2008 and 2009), in which multiple authorship prevailed and increased considerably, indicating greater productivity and collaboration in the teaching community of the PPGCMH in the triennium.

## 6.2 ANALYSIS UNIT 3 – CO-AUTHORSHIP NETWORKS

The focus of this study is co-authorship networks built by teachers of the PPGCMH, so this analysis was based on scientific papers published with the authorship of at least one teacher in the Program. In all, during the study period, 204 scientific articles were

analyzed, with a total of 280 authors. 22 are teachers of the PPGCMH, while others are collaborators who may be students of the program, students of research groups, or external participants. The figures show teachers of the PPGCMH represented with the letter P and collaborators, students and participants external to the PPGCMH with the letter C.

Figure 6 shows the reproduction of collaborative networks among all authors of the PPGCMH. In red, we have highlighted teachers of the PPGCMH and, in blue, the other authors who are considered collaborators.



**Figure 6** – Collaboration networks among researchers in the PPGCMH

When observing Figure 6, we noted that the considerable amount of related rows from the authors of the network shows that there is an intense collaboration with regard to the authorship of articles in scientific journals. We conclude that, in the period covered, there was an abundant communication among the authors of articles. It is also pointed out

that some teachers do not collaborate directly with each other and we have an example: P1 to P7 – this is one of the most collaborative of the PPGCMH teachers, as we shall discuss below. We can even cite teachers who do not have any co-authorship relation, for example, P3, P9, P15, and P19, who have formed their collaborative networks without involving the other teachers in the program. It is noteworthy that P18 collaborated with only one author.

According to an analysis of the studied triennium, teachers found to be more productive in journal articles of the PPGCMH are: P5, P7, P8, P11, and P13. We point out that other publications were not accounted, such as books, book chapters, and other materials published by teachers of the PPGCMH. However, even though they comprise partial findings, these data suggest, probably, that these are the most productive teachers of the PPGCMH.

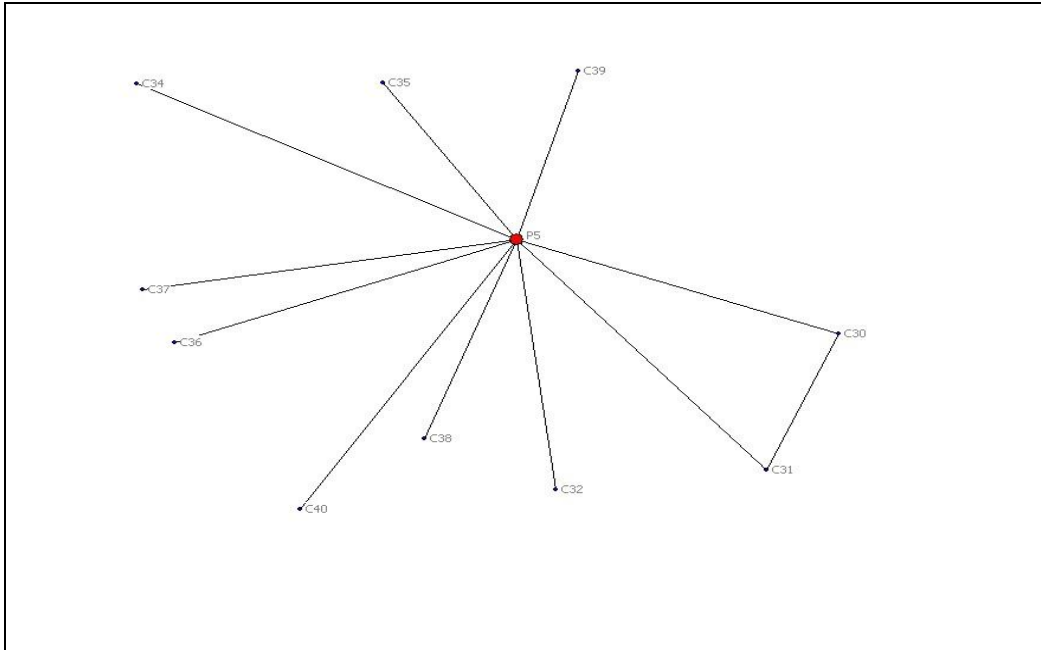
To estimate the size of the elite of a given population of authors, we used the Law of Elitism, according to Price (*apud* GUSMÃO, 1978, p. 27)<sup>8</sup>: “In a population of size  $N$ , there is an elite group of size  $\sqrt{N}$ , which corresponds to half of the total production of articles.” Given that in this analysis, we have 22 authors, and the square root of 22 is about five, our elite is composed of five authors. The total of articles published is 204, so the five most productive authors should publish 102 articles (half of 204). One can state, according to data from Table 1, that authors P5, P7, P8, P11 and P13 are the most productive and total 120 items. This demonstrates that the production of the PPGCMH teachers have a productive elite group, because its production is above the estimated by the Law of Elitism.

Authors P5, P7, P8, P11 and P13 were analyzed separately according to their relations from Figure 7 to Figure 11, based on the collaboration network formed by them.

Figure 7 shows the collaboration network formed by P5.

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<sup>8</sup> PRICE, D.J. de S. Some remarks on elitism in Information and the invisible college phenomenon in science. **JASIS**, Washington, v. 22, n. 2, p. 74-75, Mar./Apr. 1971.

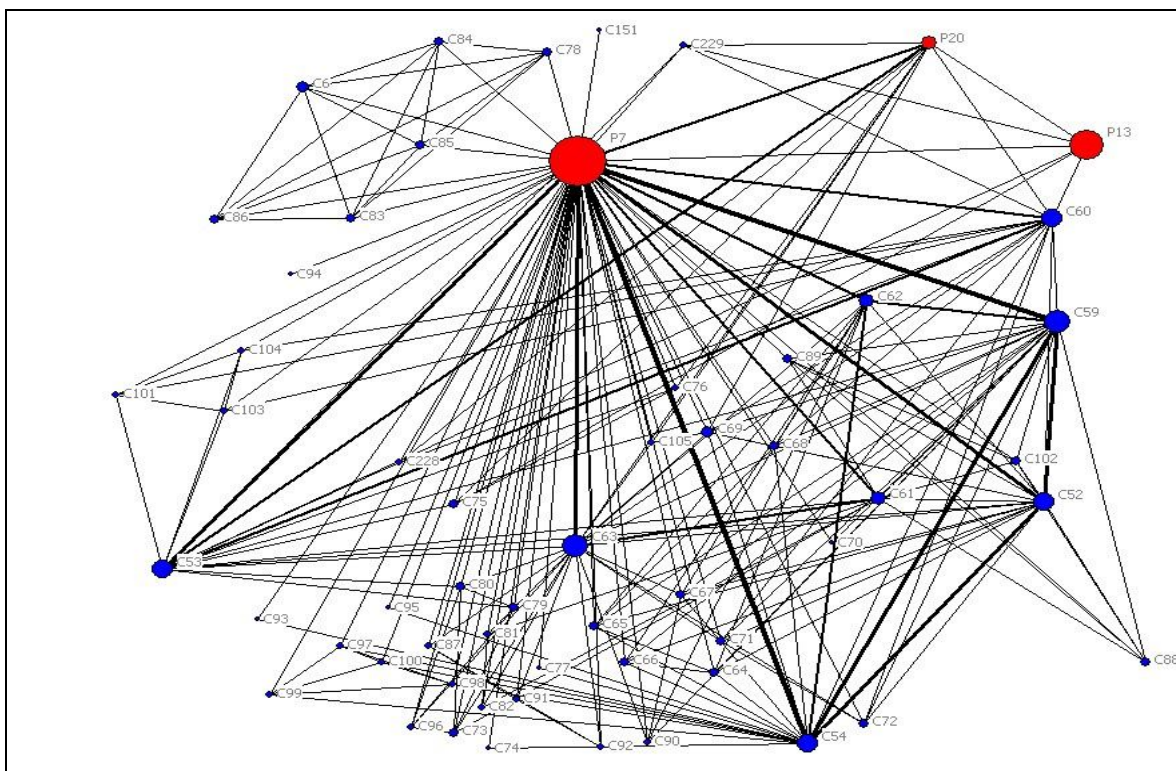


**Figure 7** – Collaborations made by author P5 in the period from 2007 to 2009.

Above we have the network formed by teacher P5. We noted that this teacher published only with collaborators of the program, totaling 11 collaborators. Thus, one can say that this teacher has a low or nonexistent collaboration level in relation to the publication of scientific articles with other teachers in the program, once P5 prefers to publish with the PPGCMH students or participants external to the Program.

When we look at their production in scientific articles in Table 1, we will note that their average productivity of articles per year is 5.33, an average that grants them fourth place, along with P13, in publication of scientific journals, part of their scientific production, in a count of 22 teachers. The nodal degree from this researcher is 11, which results in a low centrality, compared to other researchers.

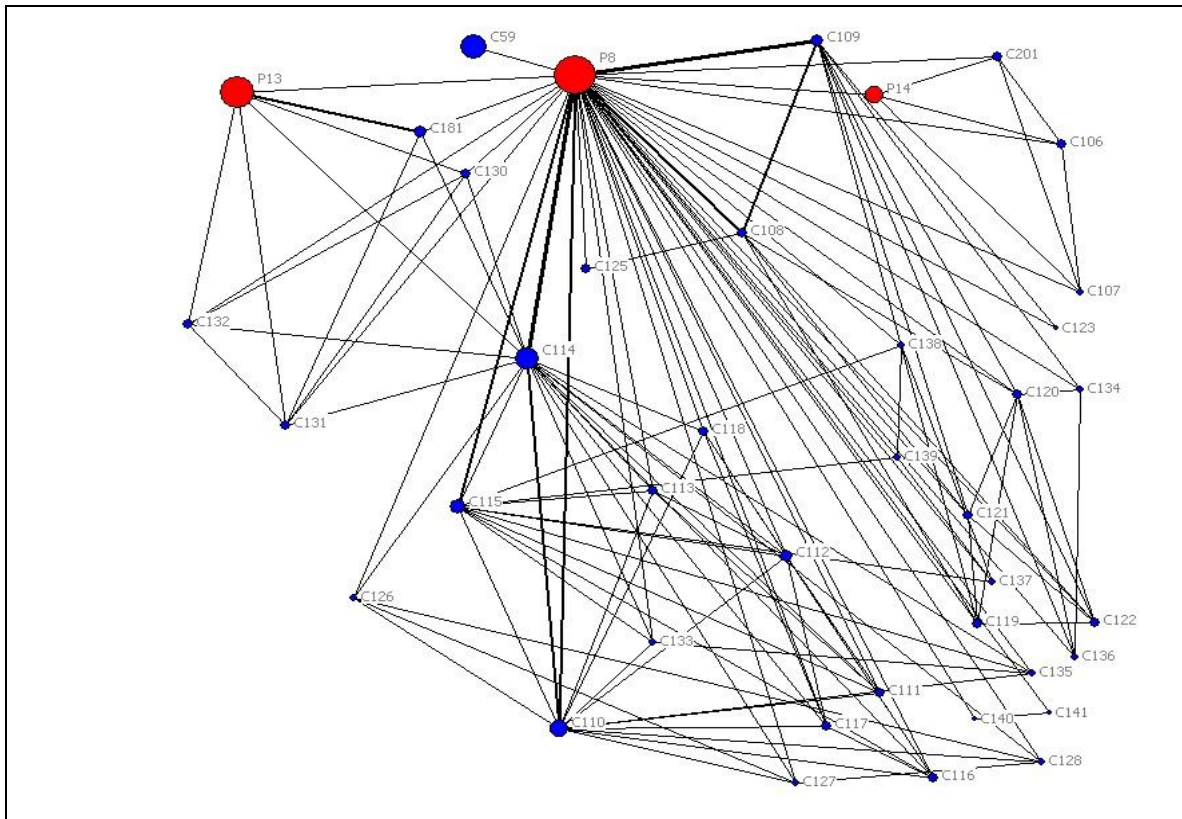
In figure 8, we present the collaboration network formed by P7.



**Figure 8** – Collaborations performed by author P7 in the period from 2007 to 2009

The network of teacher P7, which we demonstrated in Figure 8, has a total of 56 co-authors. This teacher published their papers with three teachers of the Program, i.e. this was the teacher who made more connections with other teachers. Therefore, we consider their collaboration with the teachers of the program to be high, as they prefer to publish their articles with collaborators. It is the most collaborative teacher of the PPGCMH, with a nodal degree of 57. They are also the most productive teacher, as shown in Table 1, and their annual production of papers was 11.66 – an average that grants them the first place in publication. We point out that this teacher has more connections with C59, C54, C53, C52, C63 and P20, i.e. it means they have strong ties with these collaborators and P20 teachers.

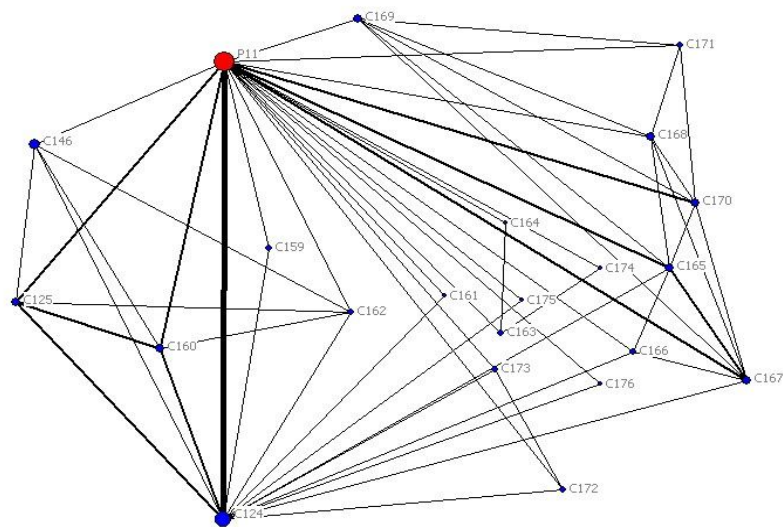
Figure 9 present the collaboration network formed by P8.



**Figure 9** – Collaboration made by author P8 in the period from 2007 to 2009

In Figure 9, we find that teacher P8 collaborated with two professors from the program. The nodal degree of this teacher is 41, which grants them the second place among teachers with the greatest centrality degree. But in Table 1, this teacher is the third most productive teacher. It was also observed that teachers form strong ties with C109 and C114.

Figure 10 shows the collaborative network of teacher P11. This teacher is, according to Table 1, the second most productive in the program.

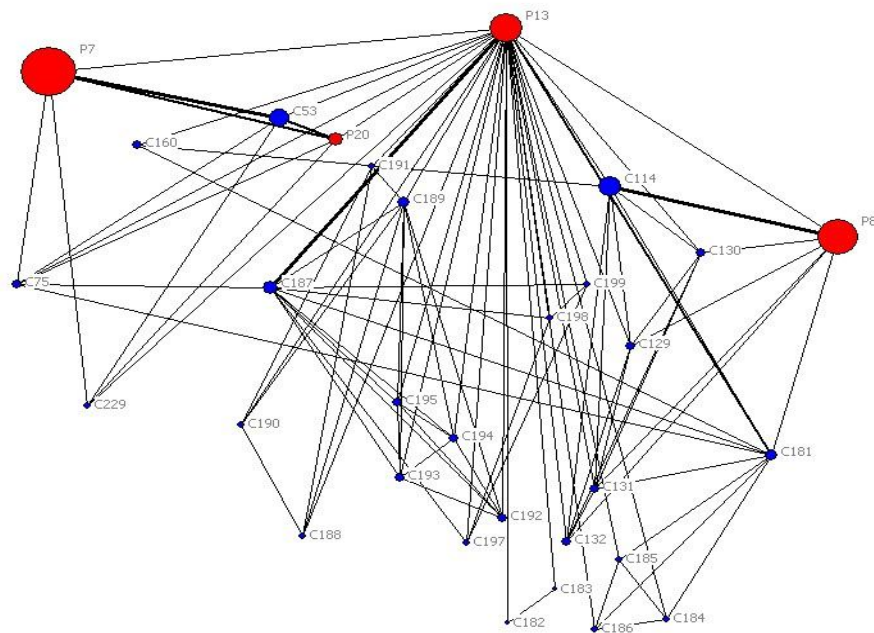


**Figure 10** – Collaborations performed by author P11 in the period from 2007 to 2009

Based Figure 10, we analyze that teacher P11 obtained a collaborative network comprised of 20 members, all of whom are employees, but has no collaboration with other teachers in the program. We note that the degree of centrality of P11 is 21. However, Table 1 shows that they are the second most productive teacher.

In figure 11, we observe the network formed by P13.

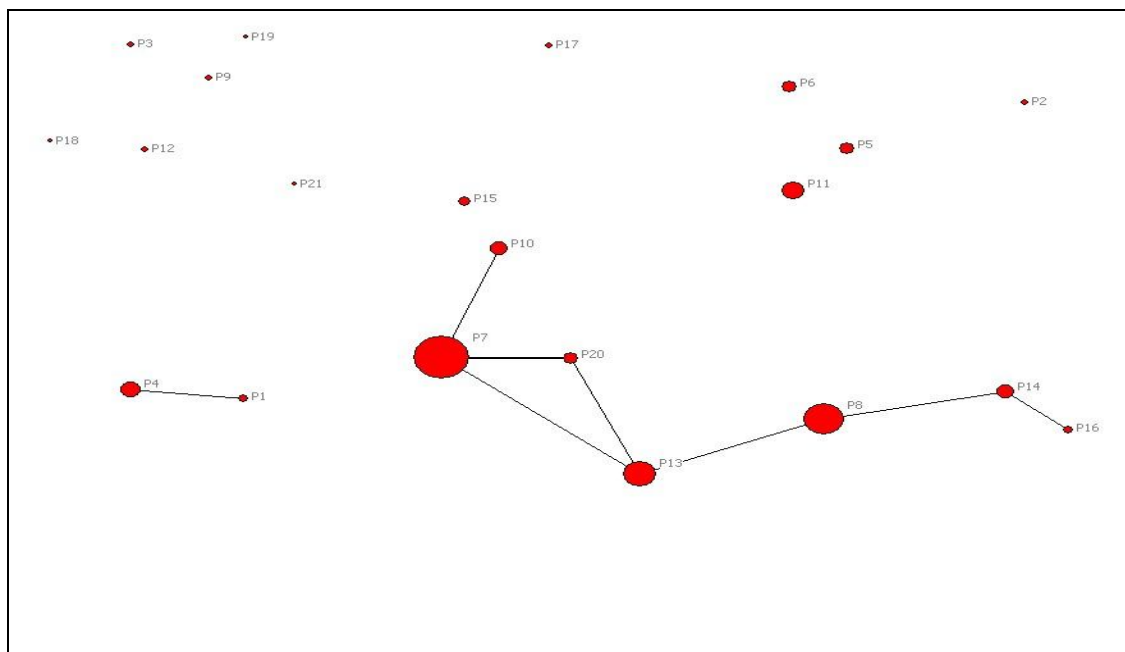




**Figure 11** – Collaborations performed by author P13 in the period from 2007 to 2009

Figure 11 shows that this network consists of 30 participants and three of them are the most collaborative teachers. We emphasize the collaboration with P7, which has the highest degree of centrality and is the most productive one. As we also highlighted, P8 has the second highest degree node and is the third most productive. The teacher analyzed in this figure, P13, is in fourth place alongside P5, in the production of articles that are part of their scientific production. Their nodal degree is 31.

Figure 12 shows the network formed by the teachers of the program.



**Figure 12** – Network collaboration formed by members of the PPGCMH

By observing Figure 12, we note that collaboration among teachers of the Program is dispersed. Many do not collaborate among themselves and there is, among some, a total lack of cooperation, i.e. they are separated in the network. For example, P11, who was appointed as one of the most collaborative teachers, however, was isolated on the teacher network when it was formulated.

As expected and discussed in Figures 7-12, the collaborative network of teachers is still very intense, or is under construction and tends to grow with the increase in the publication of articles.

The network formed by the teachers P7, P8, P10, P13, P14, P16 and P20 stands out, as it is the largest network with the greatest collaboration among teachers trained in the program.

The reasons other teachers do not collaborate can be classified into: types of research and different research lines and habits of cooperation only in their research groups, among others. These reasons could be explained by future research, in a qualitative way.

## 7 CONCLUSION

This study attempted to show, through a social network analysis, a representation of the habits of cooperation established among teachers of the PPGCMH, of the ESEF of the UFRGS, in the period from 2007 to 2009, using data from assessment documents of the CAPES. Regarding the publication of papers published during the period, results show:

With regard to production:

- The average annual production of 22 teachers in the triennium was 81.58%, which indicates good productivity, and two of them published over 10 articles per year; another two published over five per year; four published more than 3 per year; and 12 published 1-3 articles per year. The others published less than one article a year;

- In 2009, publication of papers presented in annals surpassed that of journal articles, perhaps due to CONBRACE, an important national congress of the area held this year. Another explanation would point toward a change of preference to disseminate scientific production, which can only be confirmed by comparing data from the next triennium;

- The teachers used 81 journals to publish their articles, but more than half of these titles (44) received only one article. It can be stated that the first 20 titles from the list provided in Table 3 were preferred;

- Most periodicals chosen by the PPGCMH teachers to publish their articles are in stratum B and three titles stand out: *Revista Brasileira de Medicina do Esporte* (Brazilian Journal of Sports Medicine), (B1), *Movimento* (B1), *Revista Brasileira de Cineantropometria & Desempenho Humano* (Brazilian Journal of Kinanthropometry and Human Performance) (B2), which are national publications. The ones with A1 and A2 concepts are foreign and receive a good index of articles from teachers of the PPGCMH, with 18.6% of the total number of publications;

- This choice reflects the preferred language of publication of articles: the authors prefer to publish in their mother tongue. The Portuguese language in Articles (132) is nearly twice the other two languages together – English (70 articles) and Spanish (2 articles).

With regard to collaboration:

- A productive teacher is not necessarily collaborative;
- There is an intense collaboration with regard to the production of scientific journal articles among teachers and collaborators (external participants and students);
- However, some teachers do not collaborate directly with each other, implying a low-institutional collaboration among teachers of the PPGCMH, who focus more on publishing with their non-teaching collaborators – probably research group students and external collaborators;
- The network formed by teachers P7, P8, P10, P13, P14, P16 and P20 stands out, as it is the network with the largest collaboration formed among teachers of the Program;
- Collaboration among teachers of the PPGCMH is dispersed, and many do not collaborate among themselves and, among some, there is a lack of cooperation, i.e. they are separated in the network;
- There is no evidence of strong ties among teachers of the same line of research or the same area – a factor that would be desirable in a research institution;
- The absence of strong ties may come from diverse disciplines to the curriculum of the PPGCMH, which gives rise to small study groups isolated from each other. But as a suggestion, it would be important to strengthen the ties to allow partnerships aiming at a greater financial support from development agencies – institutions that encourage joint action.

We believe that the specialization of science, specifically of physical education, hinders collective work, and it is often necessary, in the same research, to gather efforts of knowledge from several areas.

#### **LA COLABORACIÓN EN LA PRODUCCIÓN DE ARTÍCULOS DE LOS PROFESORES DEL PROGRAMA DE POSGRADO EN CIENCIA DEL MOVIMIENTO HUMANO DE LA ESEF DE LA UFRGS ENTRE 2007 Y 2009: ANÁLISIS DE RED SOCIAL**

**Resumen:** El investigador solitario es una figura distante de la contemporaneidad. El trabajo en colaboración en la comunidad científica ha experimentado una enorme expansión en el siglo XX con el apoyo de la tecnología de la información. Contribuyeron a este marco, la utilización de los

recursos electrónicos y la competición intensa en las organizaciones académicas y otras. La colaboración fortalece los lazos de la red entre los investigadores y las instituciones, que así administran recursos y actividades interdisciplinarias de investigación y contribuyen al apoyo mutuo en la construcción del conocimiento científico. Este artículo tiene como objetivo contribuir a la identificación de redes de colaboración de los profesores en el Programa de Posgrado en Ciencias del Movimiento Humano (PPGCMH) de la UFRGS, en el período 2007 hasta 2009, en relación a la última evaluación trienal de la Coordinación de Perfeccionamiento de Personal de Nivel Superior (CAPES). Fueran identificados 204 artículos e 208 autores. Los resultados apuntan hacia una colaboración en red en construcción, con pocos enlaces entre profesores e más entre los equipos de investigaciones. Este artículo contribuye a los estudios de producción científica en el campo de la educación física, y como una herramienta para las actividades de investigación y oportunidades para la cooperación institucional.

**Palabras clave:** Indicador de colaboración. Investigadores. Educación Física. Análisis de red social (ARS)

#### **A COLABORAÇÃO NA PRODUÇÃO DE ARTIGOS DOS PROFESSORES DO PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIA DO MOVIMENTO HUMANO DA ESEF DA UFRGS ENTRE 2007 E 2009: ANÁLISE DE REDE SOCIAL**

**Resumo:** O pesquisador solitário é uma figura distante da contemporaneidade. O trabalho colaborativo na comunidade científica se expandiu enormemente no século XX apoiado pela tecnologia da informação. Para tal quadro contribuíram a utilização dos recursos eletrônicos e o acirramento da competitividade no meio acadêmico e em outras organizações. A colaboração em rede fortalece laços entre pesquisadores e instituições, que, desta forma, gerem os recursos e as atividades interdisciplinares de pesquisas e contribuem para o sustento mútuo na construção do saber científico. Este artigo visa contribuir para a identificação das redes de colaboração dos professores do Programa de Pós-Graduação em Ciência do Movimento Humano (PPGCMH) da UFRGS, no período de 2007 a 2009, referente ao último triênio de avaliação da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). Foram identificados 204 artigos e 280 autores nos artigos publicados. Os resultados apontam no sentido de uma rede colaborativa em construção, com poucas ligações entre os professores e mais entre os grupos de pesquisas. Este artigo pretende contribuir para estudos no campo da produção científica da educação física, e como um instrumento às atividades de investigação e de possibilidades de intercâmbio institucional.

**Palavras-chave:** Indicador de colaboração. Pesquisadores. Educação Física. Análise de rede social (ARS)

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