

## **KNOWLEDGE PRODUCED BY UNIMONTES RESEARCH GROUPS (2007-2010)**

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### **ABSTRACT**

Universities contribute to disseminate knowledge, either through research or hand training of skilled labor. This knowledge is essential, especially in localities, regions and countries that are not considered developed, unable to welfare. Thus, the role of universities is essential in these environments. The State University of Montes Claros – UNIMONTES has over 50 years in the North of Minas Gerais. Its work impacts more than 300 municipalities, through the training of human resources or through the development of research. Many of these initiatives are linked to 35 research groups at the University, covering almost all areas of knowledge, and have more than 386 researchers as members, of which 176 are doctors. Much remains to be developed, but these groups have produced articles and made possible the rise of these guidelines, dissertations and monographs. In short, it generates knowledge that can greatly contribute to the promotion of regional development. The first item of this article presents theoretical discussion about the importance of institutions to promote development and knowledge through dynamic processes of growth and development of technologies as well as the discussion on the role of universities in this process. The second item presents the data analysis of the research groups of UNIMONTES, subdivided in their fields of knowledge.

**Key words:** University, research groups, development.  
JEL: I20, I23, R58

### **1. Importance of institutions to promote development and knowledge**

For Evolutionary Theory, institutions are shrouded in a dynamic process of growth and technological change, that is, there is a strong interrelationship between development, growth, technological innovation and institutional

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apparatus, showing that these concepts cannot be understood in isolation. In this dynamic process, innovation is a crucial role in driving change and affects the trajectory or paradigm. The movement of the border takes place through the paradigm succession. Dosi (1982) believes that technological paradigm is a standard to technical problems solutions, selected from principles derived from scientific knowledge and production practices. Over time, they follow one another, depending on the solutions presented. The path, on the other way, is the concrete way in which the paradigm exists, a possible direction between several possible which is followed by technology. This is the trade-offs shift between technical and economic dimensions. Therefore, a paradigm can count on various trajectories.

Thus, those who have mastered technology, according to the neo-Schumpeterian, are better able to develop improvements and remain as a differential producer. This occurs not only within companies, but also for the countries. After all, with the movement of the technological frontier, a new paradigm appears. With it also appear to the peripheral countries, the so-called „windows of opportunity” (as presented by Perez and Soete, 1988). In this view, development is seen as a process of accumulation of social and technological capabilities that depends on the use of successive and different windows of opportunity.

However, the existence of such 'opportunity' isn't use of guarantee by the least developed countries. In allusion made by List (1841), countries that can develop „kick” the stairs that went up out, so others cannot do the same way. Based on this idea, Chang (2004) concluded that these developed countries of today 'kick the stairs' to propose to the peripheral countries practices and policies they used to 'go up', that is to reach the technological frontier.

The process of „achieving the technological frontier” or catching up, can be understood as one in which the countries less developed technologically, can reach levels previously dominated by technologically advanced countries. Albuquerque (2009) considers that the process of catching up has two fundamental dimensions: the international (the dynamics of technological progress of the central countries generate innovations and changes the paradigms, and, on the other hand, such a move opens up possibilities for the peripheral countries); and internal (to take advantage of opportunities, countries that are technologically backward should develop their absorption capacity).

According to Abramovitz (1989), models of catching-up consider that the least developed countries have a growth potential higher than the countries that are already technologically developed. This happens because the technologically backward countries have the ability to imitate existing technologies; after all for those who are on the border, only innovations matter. However, for this to occur, it is necessary a set of social features, called „Social Capability”, able to provide the most backward countries the possibility to imitate the already created technologies. In addition to developing their „social skills”, countries should also

worry about the „absorption capacity” as quoted. For this purpose, two points appear as critical. The first is regarding to resources for R & D; and second, the resources for education, because to develop the absorption capacity it takes a certain level of scientific infrastructure.

Analyzing cases of successful catching up, Mazzoleni and Nelson (2007) identified three aspects present in these processes: flow of people (leaving the technologically backward countries to acquire technology expertise in developed countries); government support for emerging industry; and property rights. In addition, Póvoa (2008) adds to this analysis other elements such as: promotion of education, training and applied research by the government; innovations in the organizational context; and investment in the most dynamic and progressive existing industries. The author draws attention to the fact that all these elements are connected and it would be complex to state which one is the most relevant in each process of catching up.

Faced with of what was discussed among the relevant institutions, the universities, they present themselves as fundamental in this process. It contributes to disseminate knowledge, whether through research or hand training of skilled labor. Such knowledge is essential, especially in localities, regions and countries that are not considered developed, unable to welfare. Thus, the role of universities is even more relevant in these poor environments socioeconomic development.

### **1.1. The role of Universities**

Universities have emerged to disseminate ideas, break the limits to knowledge, responding to hunger for intellectual freedom. The fact that universities act in different sectors emphasizes its relevance to the development of economies and society as a whole.

Based on data on OECD countries, Mowery and Sampat (2005) observed that universities vary how combine search functions and education among the countries studied. However, it was concluded that after the 1970s, external and internal factors to universities, came to the industry in these countries: there was both an incentive from the government to approach the university industry (through the creation of the 'science parks'; business incubation, seed capital funds, creation of 'institutions bridge', to mediate the university-business relationship, as well as the creation of laws, such as the Bayh-Dole Act of 1980) to accelerate the process of technology transfer due the challenges of a knowledge-based economy; as to change by the universities themselves, who adopted a more aggressive and 'corporate' approach (focused on patenting, for example) to expand their budgets, which had been reduced from this decade.

In the late 1980s, Jaffe (1989) interested in knowing, as the article title indicates, about the „actual effects of academic research.” He analyzed patents and the relationship of the expenses involved in academic research and industry. Based on the data of US patents, analyzing eight years (1972-77, 1979 and 1981),

Jaffe identified in areas such as medicine, medical technology, electronics and nuclear technology, a significant effect of university research on patents for companies. It also suggests that academic research also seems to have an indirect effect on local innovation. To the author spillovers effects of knowledge (knowledge spillovers) indicate that academic research leads to the location of R&D spending industry.

It is known that the savings do not live with the same challenges and problems. Studies on the dichotomy „center versus edge” as Arocena and Sutz (2005); Albuquerque (1997, 2001 and 2009), has pointed out that the gap of inequality between these realities is magnified by differences in access to knowledge, its generation and control. Consider that contemporary inequality (between regions/countries) has its roots in this new role of knowledge and learning conditions. For these, then, the 'learning' is a new feature, or divider, of the distinct realities: development-underdevelopment and there is a tendency to enlarge this gap, which does not mean that it cannot be overcome. „... Knowledge, learning and innovation are factors that develop with increasing returns to scale. It is not surprising that there is an intrinsic tendency towards increasing inequality” Arocena and Sutz (2005, p. 49).

Thus, universities have enhanced its role in this perspective. The following are data on UNIMONTES and its operations in the North of the State of Minas Gerais, Brazil.

## **1.2. UNIMONTES and its performance**

The State University of Montes Claros - UNIMONTES has been operating for over 50 years with teaching, research and extension. It is a public institution whose headquarters campus is located in the municipality of Montes Claros (MG), and other 12 campuses located in Almenara, Bocaiúva, Brasília de Minas, Espinosa, Janaúba, Janaúria, Joáima, Paracatu, Pirapora, Salinas, São Francisco and Unai. UNIMONTES develops teaching, research, extension and innovation in the North and Northwest of the State of Minas Gerais, and in the valleys of the Jequitinhonha and Mucuri, localities historically known for their low levels of socioeconomic development, which increases the relevance of the university's activities in this scope.

Thus, UNIMONTES has contributed to the generation of knowledge and training of human resources reaching more than 336 municipalities and covering a population that exceeds 2.5 million inhabitants, through its classroom courses and distance learning courses. The institution offers regular courses in undergraduate and graduate „broad sense” and „strict sense”, being 32 regular undergraduate courses, 2 technologists' courses and 15 courses graduate strict sense. In the first half of 2015 it was registered almost 10 000 (9,392) students in the institution, among the participants of undergraduate and graduate. Specifically, in relation to graduate, the UNIMONTES has evolved reaching the amount of 15 courses, of these, 3 are doctorates.

**Table 1.** Graduate programs in UNIMONTES and number of students (2015)

| <b>Programs</b>  | <b>Number or current students</b> |
|--|-----------------------------------|
| Masters degree in Health Sciences                          | 33                                |
| Doctorate in Health Sciences                               | 62                                |
| Masters degree in Social Development                       | 59                                |
| Doctorate in Social Development                            | 06                                |
| Masters degree in Vegetable Production in Semi-Arid        | 33                                |
| Doctorate in Plant Production in Semi-Arid                 | 17                                |
| Masters degree in Biological Sciences                      | 51                                |
| Masters degree in Geography                                | 15                                |
| Masters degree in History                                  | 45                                |
| Masters degree in Literature - Literary Studies            | 48                                |
| Masters degree in Animal Science                           | 44                                |
| Professional Masters in Biotechnology                      | 40                                |
| Professional Masters in Primary Care Health                | 28                                |
| Professional Masters in Letters                            | 46                                |
| Professional Masters in Computational and Systems Modeling | 24                                |
| <b>Total</b>   | <b>551</b>                        |

*Source: Dean of Graduate Studies (UNIMONTES).*

In this sense, the qualification of UNIMONTES teachers, from the late 1990s in UNIMONTES through Master's programs and institutional PhD, as well as other initiatives, was instrumental in the progress of the institution, consolidating knowledge, including contributing to the university boom occurred in recent years, as shown Antunes-Souza, Souza, Sizilio (2010). Thus, it is considered to have been one of the factors that contributed to the emergence of these graduate programs at the institution.

In fact, there was an increase of the participation of more doctors and teachers in the context of teaching, as can be glimpsed in Table 2. In 2006, there were 90 doctors on the total of 1271 teachers (7%), while in 2015 reached almost four times the number of doctors, reaching 346, and this year the total staff of 1,535 teachers (23%). This advance was critical to the growth of research and other activities of UNIMONTES.

**Table 2.** Professors (staff) – UNIMONTES (2006 – Julho/2015)

| Professors                           | 2006        | 2007        | 2008        | 2009        | 2010        | 2011        | 2012        | 2013        | 2014        | 2015        |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Professors with doctorate degree     | 90          | 122         | 124         | 136         | 140         | 167         | 195         | 226         | 286         | 346         |
| Professors with masters degree       | 339         | 349         | 386         | 384         | 419         | 460         | 494         | 462         | 517         | 564         |
| Professors with postgraduate studies | 675         | 695         | 739         | 771         | 732         | 688         | 656         | 607         | 642         | 593         |
| Professors Graduated                 | 167         | 147         | 71          | 32          | 144         | 69          | 46          | 42          | 27          | 32          |
| <b>Total</b>                         | <b>1271</b> | <b>1313</b> | <b>1320</b> | <b>1323</b> | <b>1435</b> | <b>1384</b> | <b>1391</b> | <b>1337</b> | <b>1472</b> | <b>1535</b> |

Source: Management of Human Resources (UNIMONTES).

Local development constitutes an internal process, therefore, endogenous, noticeable in small units of territory, able to promote economic dynamism and improve the population's quality of life. Within the contemporary conditions of globalization and intense transformation process, local development also represents some form of economic integration with the regional and national context, which generates and redefines opportunities and threats demanding competitiveness and specialization (Buarque, 1999).

UNIMONTES develops scientific research activities in several areas, especially important for providing subsidies for regional development. Given the above, it is clear its great importance for socio-economic and cultural development of the region. In this perspective, the study of what is being produced by UNIMONTES knowledge of research groups is a way to mirror this performance and identify what has been their path, as will be explained below.

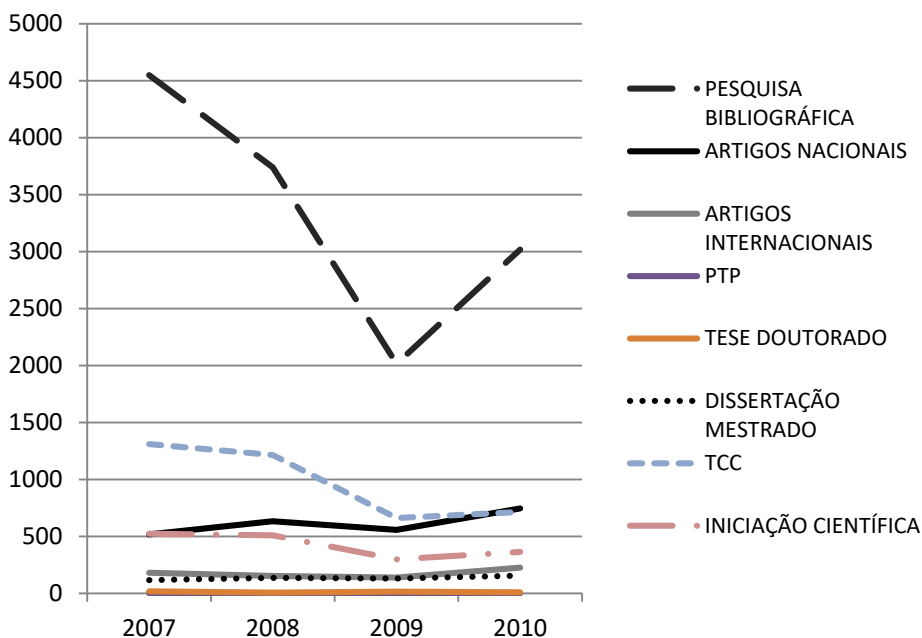
## 2. Data Analysis of UNIMONTES Research Groups

This section presents the information regarding the UNIMONTES research groups, based on data obtained from the Lattes Platform, more specifically, from the Directory of the CNPq Research Groups (DPG-CNPq), to highlight the production of knowledge of researchers in this university. The survey was conducted in the CNPq site itself, through online consultations from CENSUS 2010.

It was identified in the 2010 Census, 35 research groups working on UNIMONTES. These groups are distributed as follows: Agricultural Sciences has 6 groups, Biological Sciences 2, Health Sciences with 11, Social Sciences 2, Humanities with 12, and Linguistics, Letters and Arts 2 groups. By analyzing

separately for large areas, it is clear that there are no groups in all areas, such as the case of 'Engineering'. This brought strangeness because the university has courses in the area. However, these are newer courses compared to other courses. Still, it serves as a warning for the need to encourage the emergence of these initiatives.

As can be seen in Figure 1, by adding all the 'bibliographic production' of the UNIMONTES research groups, it is clear that there was a period of decline, which started from a level of 4,549 production, in 2007, 2,014 in 2009. However, one can observe an improvement in the last year of the analyzed series. It points out that the bibliographic production of the university increased to 3,019.



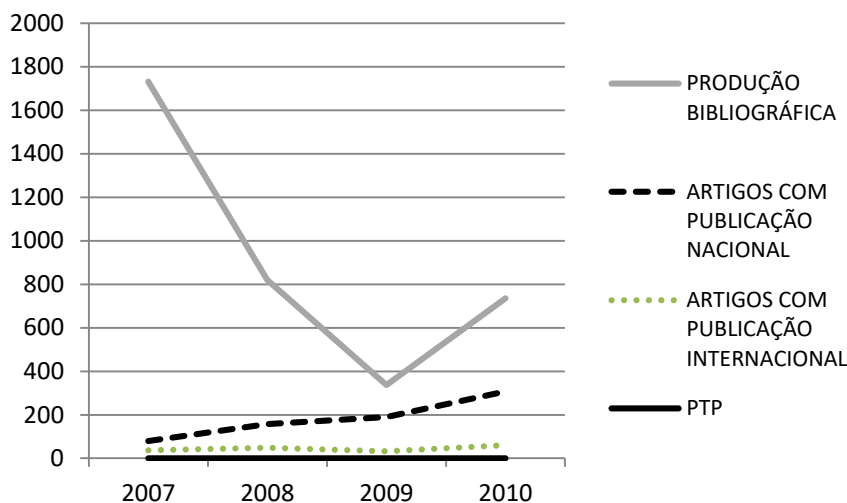
**Figure 1.** Unimontes Production (all areas)

Source: Prepared from CNPq data.

Other data show that there has been an increase in scientific production as a whole or that production remained as in relation to the thesis. Starting an analysis by the great areas of knowledge, you can identify more clearly the contribution of each of them.

Based on Figure 2, it is observed that in 2007, the number of 'articles published' in the area of Agricultural Sciences was approximately 1700. Within two years this number was significantly fall, and the number of publications decreased by half in 2008 - about 800 publications - and in 2009, fell back to less

than half of what had been published in the previous year - an average of 300 publications. In 2010, however, the number of publications in the area started to grow again, reaching 736 bibliographic researches. In relation to „articles published nationally,” during the years analyzed, increased from 79 in 2007 to 307 in 2010. The number of „articles published internationally” increased during the period but reduced its share in the total amount. In 2007, the international publication of articles represented 31% of the articles published in the area, 23% in 2008, 14% in 2009 and 1.6% in 2010. There are no records or products with patents at the University for this area of knowledge.

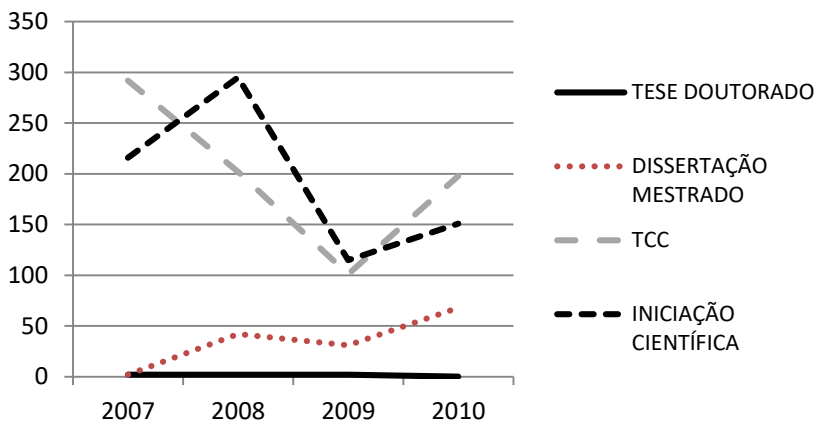


**Figure 2.** Scientific production - agricultural sciences

*Source: Prepared from CNPq data.*

Regarding the support in the training of university academics, the data for Agricultural Sciences show that in 2007, 2008 and 2009, only two doctoral theses were supervised by researchers of the research groups of the area in question. In 2010, there was no doctoral orientation. The number of master's dissertations supervised by group members increased during the years analyzed - two essays in 2007, 42 in 2008 and 68 in 2010, decreasing only in 2009, which closed with 31 orientations. The number of monograph orientations was, respectively, 292, 208, 101 and 198, with a decline in the first three years and an increase in the last year. The number of scientific projects in 2007 was 216; increased to 295 in 2008 and decreased in 2007 to 115. In 2010 there was an improvement in undergraduate numbers in the area, and the number of projects reached 151. The data analyzed are best exemplified in Figure 3.

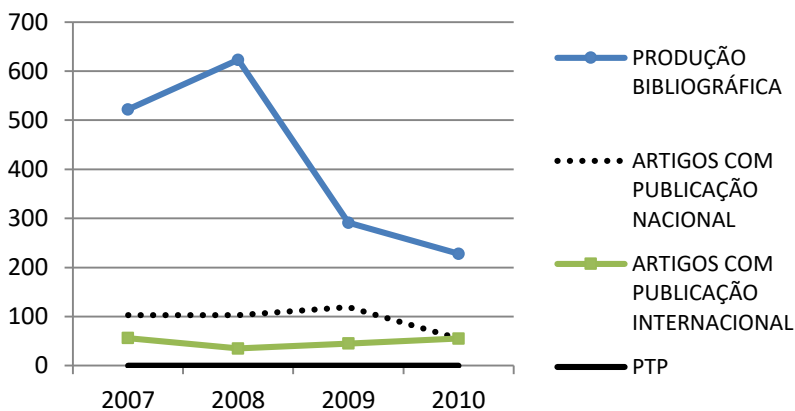




**Figure 3.** Student Training - Agrarian Sciences

Source: Prepared from CNPq data.

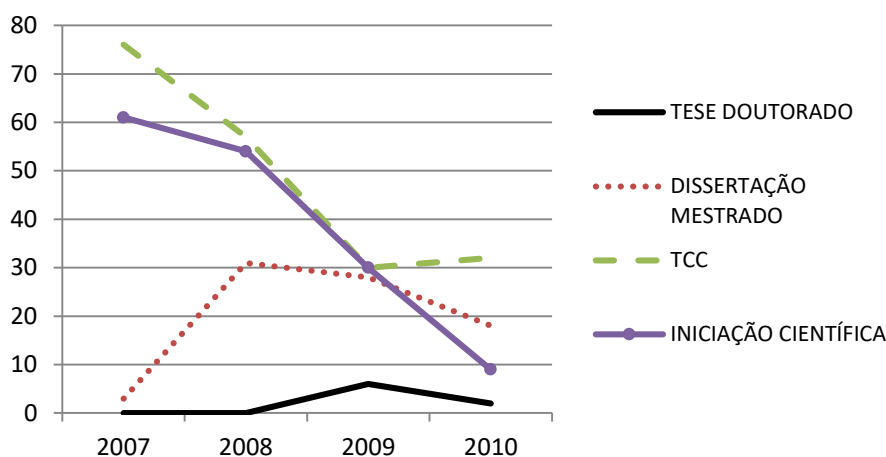
Figure 4 shows, clearly, the decrease in bibliographic production in the area of Biological Sciences of the University in 2009 and 2010. In 2007 and 2008, the number of bibliographic publications was 522 and 623, respectively; decreased to 291 and 228 within two years. The number of articles published in national and international journals, was 159 in 2007, 138 in 2008, 164 in 2009 and 110 in 2010. The number of articles published abroad represented in the period, 35.2% of the total publications in 2007; 25.36% in 2008; 27.44% in 2009; reaching 50% of the total in 2010. There are no records or products with patents at the University for this area of knowledge.



**Figure 4.** Scientific Production - Biological Sciences

Source: Prepared from CNPq data.

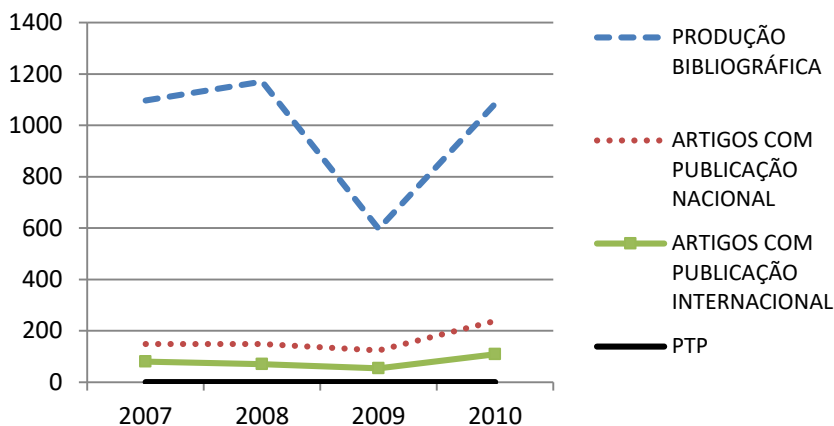
The researchers of the research groups in this area of knowledge oriented eight PhD students in four years (six in 2009 and two in 2010), according to Census data. The number of master's orientation oscillated during the four years of research. In 2007, there were only three master's orientations, increasing to 31 in 2008 and decreasing again in the following years; 28 in 2009 and 18 in 2010. The number of orientations in monographs declined in all years; decreasing 76 orientations in 2007 to 32 in 2010. The scientific projects also followed the same path and also reduced, falling from 61 projects in 2007 to 9 projects in 2010. Figure 5 shows the analyzed data and the decline in the support of researchers of the groups of Biological Sciences UNIMONTES for academic training in the last four years.



**Figure 5.** Student Training - Biological Sciences

*Source: Prepared from CNPq data.*

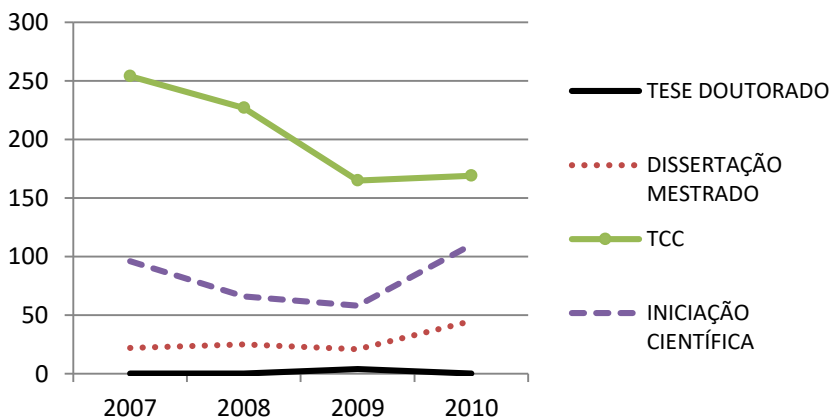
The Health Sciences area is the one with the largest number of bibliographic production in UNIMONTES. The numbers remained stable, with the exception of 2009, in which production of the groups was reduced by almost half – 1097 in 2007, 1170 in 2008, 597 in 2009 and 1,085 in 2010. In relation to the publication of articles in national magazines, it increased in 2010, almost doubling the number of publications over the previous year, from 123 to 238 published articles. The publication of articles in international journals went through the same process; reduction in 2008 and 2009 and increased in 2010. There are no records or products with patents at the University for this area of knowledge, as shown in Figure 6.



**Figure 6.** Scientific Production - Health Sciences

Source: Prepared from CNPq data.

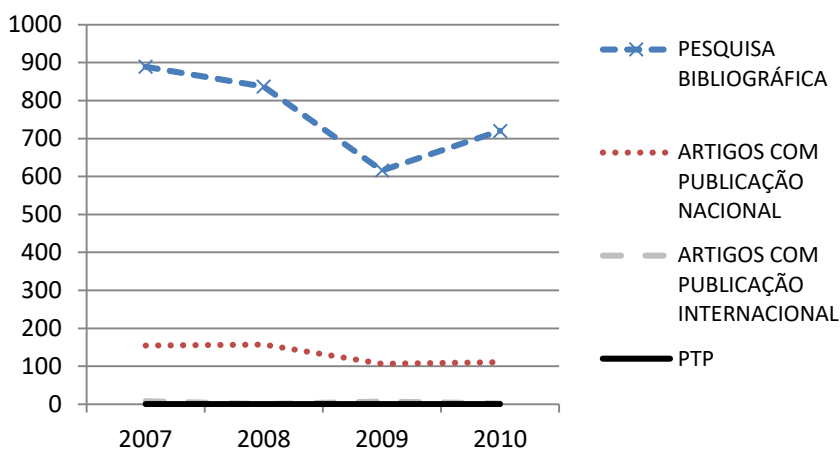
Over the past four years, researchers from groups of Health Sciences oriented four doctoral theses (all in 2009), 113 masters’ dissertations (22 in 2007; 25 in 2008; 21 in 2009 and 45 in 2010) and 815 monographs. In the case of monographs, the number of orientations decreased from 254 to 169 in 2010. With regard to scientific research, it has decreased in the early years: 96 projects in 2007; 66 in 2008; and 58 in 2009. In 2010, however, the number of scientific projects has almost doubled, ending the year with 110 projects in the area. These data are shown in Figure 7.



**Figure 7.** Student Training - Health Sciences

Source: Prepared from CNPq data.

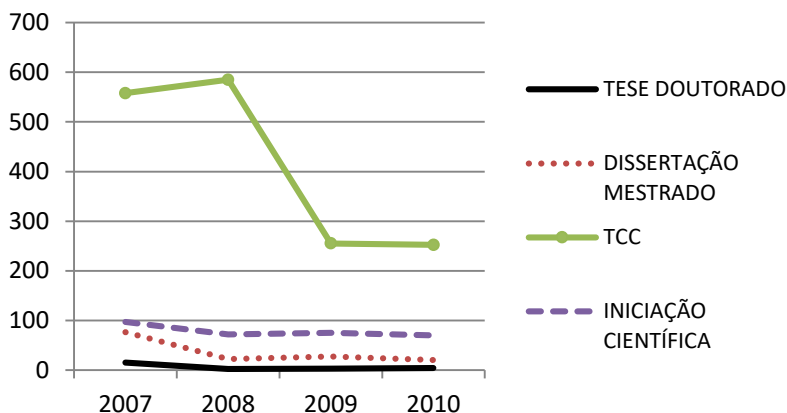
Figure 8 shows that the bibliographical production in the area of Human Sciences reduced in the first three years and returned to growth in 2010, with 889 publications in 2007; 837 in 2008, 616 in 2009 and 720 in 2010. Of the total number of articles published in the area, there is large difference between the number of national and international publications. The number of publications in the four years surveyed in the census is 530, while international publications were only 17, representing approximately 3% of the articles published in this area of knowledge. There are no products with records or patents at the University for this area of knowledge.



**Figure 8.** Scientific production - humanities

*Source: Prepared from CNPq data.*

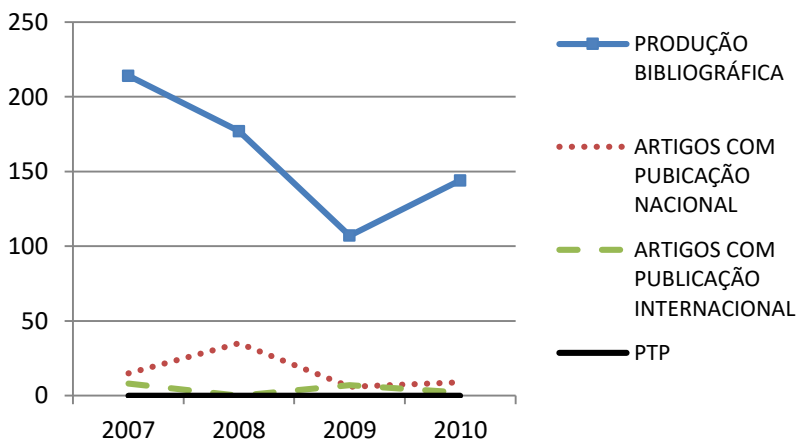
Researchers of the Humanities group oriented, between 2007 and 2010, 24 doctoral theses (more orientations by area of knowledge); 145 masters dissertations (number decreased from 76 orientations in 2007 to only 20 in 2010) and 1650 monographs (also has the highest number per area of knowledge, though in 2009 and 2010 have reduced this collaboration in academic education to less than half - 558 in 2007; 585 in 2008; 255 in 2009 and 252 in 2010). The number of scientific projects also declined between 2007 and 2010; 97 to 70 projects. The data can be confirmed in Figure 9.



**Figure 9.** Student Training - Human Sciences

Source: Prepared from CNPq data.

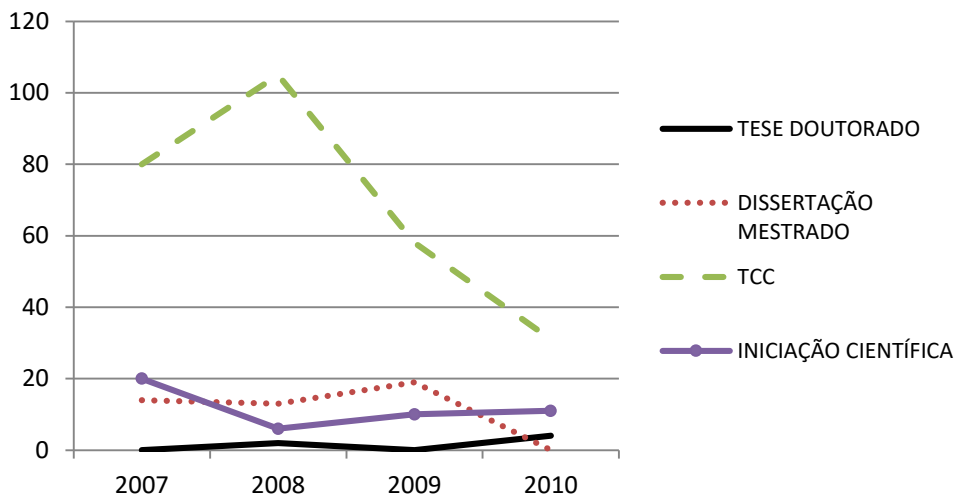
In the area of Social Sciences we can clearly observe the reduction of bibliographic production in this area of knowledge. The production which was 214 in 2007, declined to 177 in 2008 and 107 in 2009, showing better numbers only in 2010, where production reached 144. All articles published by groups in this area of knowledge were in national magazines and such publications decreased over the four years analyzed, 15 in 2007 and 35 in 2008 to 6 in 2009 and 9 in 2010. There are no records or products with patents at the University for this area of knowledge, as shown in Figure 10.



**Figure 10.** Scientific Production - Applied Social Sciences

Source: Prepared from CNPq data.

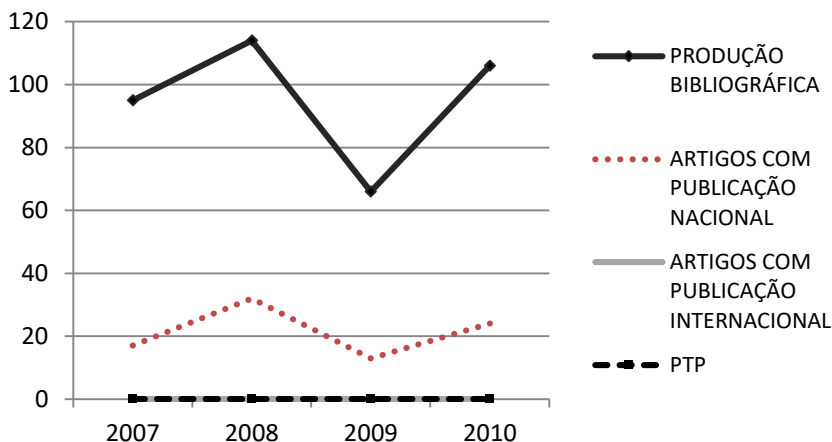
Regarding the participation of researchers from Applied Social Sciences in the academic education of their students, Figure 11 shows a low number of orientations on doctoral theses (only 6; 2 in 2008 and 4 in 2010) and masters dissertations (14 in 2007 ; 13 in 2008; 19 in 2009 and none in 2010). The number of monograph orientations also decreased for this period; 80 in 2007 and 105 in 2008 to 58 in 2009 and 31 in 2010. The number of scientific projects also declined, particularly in 2007, and returned to growth between 2009 and 2010 even in a minor way - 20 in 2007; 6 in 2008; 10 in 2009 and 11 in 2010).



**Figure 11.** Students Formation - Social Sciences

*Source: Prepared from CNPq data.*

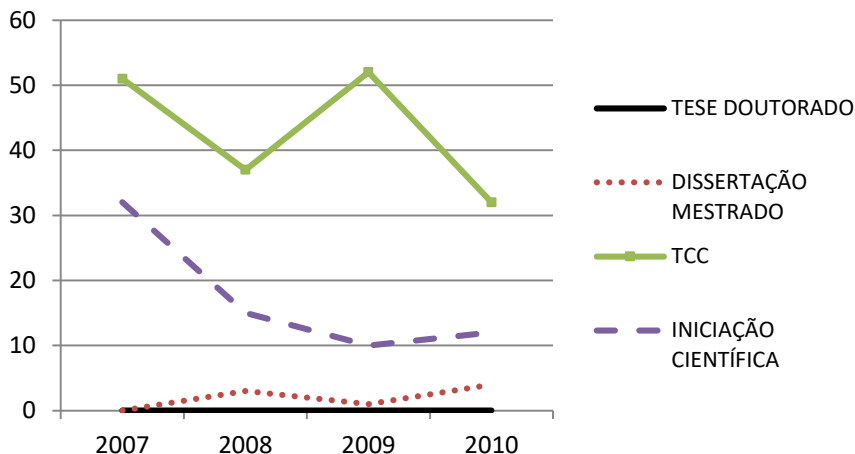
Figure 12 shows the increase in bibliographic production in the areas of „Language, Literature and Arts” of UNIMONTES in the period, with the exception of 2009: 95 in 2007; 114 in 2008; 66 in 2009; and 106 in 2010. Still, the numbers of bibliographic production of these groups are lower than in other areas of knowledge analyzed despite being the area with the highest number of research groups. The number of articles published in national level was 17 in 2007, 32 in 2008, 13 in 2009 and 24 in 2010. There was no publishing article abroad in the period. Like other areas of knowledge of UNIMONTES, the centers of „Linguistics, Literature and Arts” have no technological products with records or patents.



**Figure 12.** Scientific Production - Linguistics, Letters and Arts

Source: Prepared from CNPq data.

There was no doctoral theses orientation between 2007 and 2010 by researchers from UNIMONTES groups in this area of knowledge. As can be seen in Figure 13, the number of master's orientations has increased, although the collaboration was little: none in 2007; 3 in 2008; 1 in 2009; and 4 in 2010. The number of orientations in monographs ranged in these four years; going from 52 in 2007 to 37 in 2008, 52 in 2009 to 32 in 2010. The number of scientific projects also decreased, from 32 in 2007 to 12 projects in 2010.

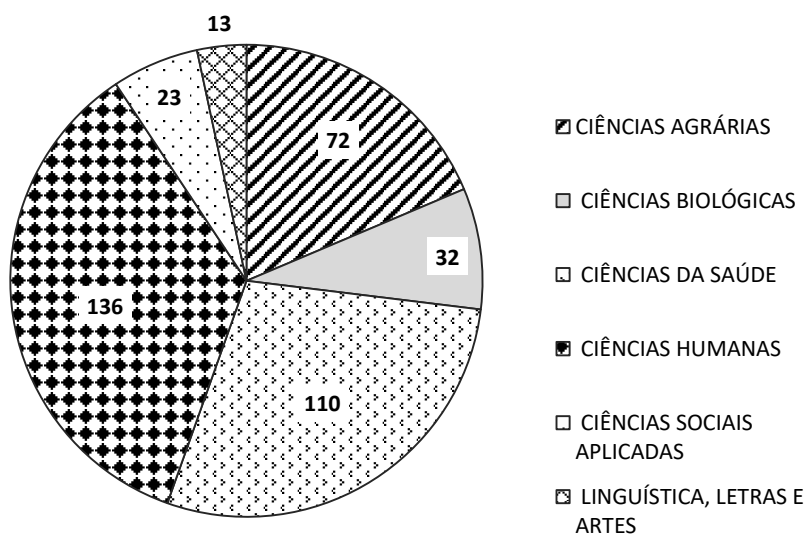


**Figure 13.** Students Formation - Linguistics, Letters and Arts

Source: Prepared from CNPq data.

The work of these research groups brought knowledge to the several areas of the university. Analyzing the groups in general, it is observed that are almost 400 researchers members with the majority concentrated in the area of Social Sciences and Health Sciences, as analyzed in Figure 14.

It should be noted that UNIMONTES had on its staff in 2015, 1,535 teachers, of whom 346 are doctors. Considering the total number of teachers in relation to those who are included in research groups, we obtain the percentage of 25%; that is, there is still the need to develop the research culture in the institution. Enlarge this activity leads to the possibility of adding more students, generating more monographs or theses and dissertations. In short, it creates the possibility of generating new products, processes, and certainly, more knowledge.

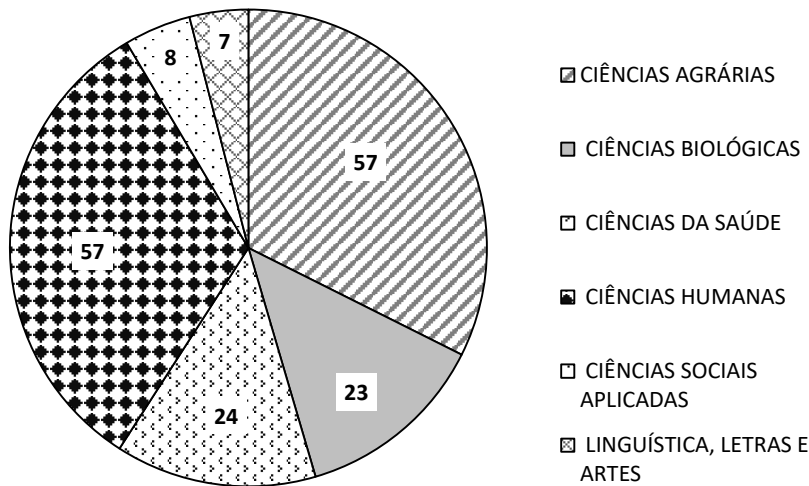


**Figure 14.** Number of Searchers per Knowledge Area (total = 386)

Source: Prepared from CNPq data.

However it does not repeat when we analyze data on researchers, specifying which one are doctors, as shown in Figure 15.





**Figure 15.** Number of Doctors per Area of Knowledge (total = 176)

*Source: Prepared from CNPq data.*

It is observed that the groups that have more doctor researchers are groups of Humanities and Agricultural Sciences. So Humanities remains highlighted in the last two analyzes. More considerations will be mentioned below.

### 3. Some Final Considerations

The UNIMONTES has, over more than 50 years of operation, contributed immensely to local development, whether by training qualified professionals, either by inserting them in their research and extension programs. The university develops scientific research activities in various fields and is crucial in providing subsidies for regional development. Given the above, it is clear the importance of UNIMONTES for socioeconomic and cultural development of the region.

On what has been presented, it is noted that the role of universities in less developed sites is even more relevant. The qualification of the teaching staff was crucial to the expansion of the University knowledge. More postgraduate courses generate qualified people, but mainly generate knowledge. In this sense, study the production of research groups can give us an idea of what has been developed at the university.

Health Sciences groups have high production. We could infer that it would be because it is one of the areas of knowledge that has largest number of research groups (11). However, this does not happen the same way in the field of Humanities, which despite having the largest number of groups (12), has bibliographic production numbers lower than the other university knowledge areas.

The analysis of data on group members' researcher shows that the participation of groups in the areas of Humanities and Health Sciences are most prominent, coming to represent around 64% of the researchers involved in research groups in UNIMONTES. However, despite this, it was noted that production in Human Sciences has witnessed a reduction. Even when analyzed data on doctors, there is again the highlight of the Humanities, with the largest number of doctors in university research groups, together with Agricultural Sciences, counting both with 57 doctors.

The areas of Applied Social Sciences and „Linguistics, Literature and Arts” exhibit low number of published articles and bibliographic production compared to other areas of knowledge. The same happens with the other variables analyzed. Both, however, have only two groups each, what can be relevant for this disparity in numbers.

Finally, it is considered that the number of teachers involved in research groups in UNIMONTES needs to be expanded. According to the data analyzed, 25% of teachers who are part of UNIMONTES frame are currently linked to a research group at least. The generation of research to a university opens up new possibilities ranging from the emergence of new products and / or processes, but mainly generates more knowledge through theses, dissertations, monographs, articles, reports. In fact, the research opens up possibilities for our teachers and our students and can prepare UNIMONTES for the challenges that the twenty-first century presents to us with new technologies and materials, new forms of social organization, globalization, among others. Efforts to qualify teachers were not in vain. But we must now launch new goals and expand research.

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