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AMAZONIAN EDUCATION NETWORK IN SCIENCES AND MATHEMATICS: IMPACTS IN PHD FORMATION FOR NETWORKING

REDE AMAZÔNICA DE EDUCAÇÃO EM CIÊNCIAS E MATEMÁTICA: IMPACTOS NA FORMAÇÃO DE DOUTORES PARA O TRABALHO EM REDE

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Abstract: This paper investigated the impacts of scientific production and insertion in stricto sensu Post-Graduation Programs in the Legal Amazon by graduates of the Amazonian Education Network in Sciences and Mathematics Post-Graduation Program (Programa de Pós-Graduação da Rede Amazônica de Educação em Ciências e Matemática - REAMEC). For such, we ascertained the curricula of twenty-nine graduates of the first class through a Lattes platform in what is constituted as a descriptive, exploratory paper from a quantitative approach. The study shows there has been a significant increase in the production, mainly of chapters of books and publications in journals with *Qualis*/Capes, in comparison the the period before joining the Program. By February 2017, time of information gathering from the curricula, nine graduates were already registered and working on post-graduation programs. This demonstrates that the Program is being consolidated in the Amazon region with outlook for a growth in research and an increase in the number of Science and Mathematics Teaching Masters Programs.
Keywords: Postgraduate. REAMEC. Scientific production. Legal Amazon.

Resumo: Este trabalho investigou os impactos da produção científica e inserção em Programas de Pós-graduação stricto sensu na Amazônia Legal, pelos egressos do Programa de Pós-Graduação da Rede Amazônica de Educação em Ciências e Matemática (REAMEC). Para tanto, realizamos um levantamento dos currículos de vinte e nove egressos da primeira turma, mediante plataforma Lattes, constituindo-se em um trabalho descritivo e exploratório de abordagem quantitativa. O estudo mostrou que houve um aumento significativo na produção, sobretudo, em capítulos de livros e publicação em periódicos com *Qualis*/Capes em comparação com o período anterior à entrada no Programa. E, até fevereiro de 2017, período de coleta das informações nos currículos, sete egressos já estavam credenciados e atuando em programas de pós-graduação. Isso demonstra que o Programa vem se consolidando na região Amazônica, com perspectivas de crescimento em pesquisas, e aumento na quantidade de Programas de mestrado em Ensino de Ciências e Matemática.
Palavras-chave: Pós-Graduação. REAMEC. Produção Científica. Amazônia Legal.

1 INTRODUCTION

The Brazilian territory denominated Legal Amazon is an area that corresponds to 59% of the country and covers nine states: Acre, Amapá, Amazonas, Mato Grosso, Maranhão, Pará, Rondônia, Roraima, and Tocantins. It was instituted in 1953, with its territorial boundaries originating from the need to plan the economic development of the region, and therefore it is not limited to the wet forest ecosystem, which occupies 49% of the national territory, also extending into the territories of eight neighboring countries (BRASIL, 2008).

As recommended by CAPES in 2010, the Sciences and Mathematics Education Post-Graduation Program (Programa de Pós-graduação em Educação em Ciências e Matemática - PPGECEM) of the Amazonian Sciences and Mathematics Education Network (Rede Amazônica de Educação em Ciências e Matemática - REAMEC) launched on that same year its first call notice offering 30 vacancies for active professors in registered Licentiate Degree Courses of Higher Education Institutions (HEI) through agreement with the Network. The course, at the doctorate level, was implemented in the Legal Amazon region as a target of the project titled "Acelera Amazônia - Accelerating the Amazon" launched by the Post-Graduation Pro-Rectors Forum of the States that comprise the Legal Amazon Region (REAMEC, 2008).

One aspect to be considered is that professional training in the Legal Amazon Region Education area and the number of institutions offering licentiate degrees has been witnessing significant growth, mostly in the interior of the States. The results disclosed by several indicators, such as the Basic Education Evaluation System, National Intermediate Education Exam, Basic Education Development Index, show the need for adequate basic education teacher training. For such, PhD are needed, mostly in the Science and Mathematics Education area, to work in teacher training courses.

Faced with the need for PhD, post-graduation has shown a significant increase in vacancy offerings throughout the country, leaping from 673 masters and doctorate courses in 1976 to 6472 academic masters and doctorate and professionals masters in 2017 (ALVES; MELLO, 2017), which is not proportional for all regions regarding the number of vacancies and programs, and does not meet the demand to train teacher trainers, especially in the Science and Mathematics Teaching area. The first Stricto sensu level program in the Legal Amazon started to be implemented in 2002 by the Federal University of Pará (UFPA) (MATOS; GONÇALVES, 2014), therefore it is still recent and not sufficient to meet the demand in a region of vast territorial expansion.

In an attempt to meet the training demands in that region, the PPGECEM/REAMEC was established, and the objective of this paper is to verify any impact in the region, through a quantitative ascertainment, relative to the number of scientific productions and masters insertion in the region by the twenty nine graduates of the first class.

2 THE AMAZONIAN EDUCATION NETWORK IN SCIENCES AND MATHEMATICS

In order to create the networking proposal, some seminars took place in Amapá in 2006 and in São Luís in 2007, when this idea was presented and discussed. In August 2007, during a workshop in Manaus, it was possible to make headway in defining the early framework of the academic doctorate and network functionality project. During that same meeting, PhD professors from the Higher Education Institutions (HEI) in the region were selected as state representatives to constitute the REAMEC Commission in charge of elaborating the proposal presented herein (REAMEC, 2008).

The doctorate proposals in their project highlights

> [...] the strong possibility of training teacher trainer professors who are researchers in the area through research and working in early and continued training and informal education may diagnose the reality of the Region and contribute towards the construction of knowledge in the area and preparing qualified professionals to intervene with aims towards regional development and social justice (REAMEC, 2008, p. 39-40).

One of the long term aims was to graduate 150 PhD by 2020 in the Legal Amazon through a joint action between the HEI and the existing PhD in the region, the area and related areas. One other aim would be the implementation in each State of a Masters in Science and Mathematics Education, academic or professional, depending on demand (REAMEC, 2008), thus broadening the offering of post-graduation programs in the Legal Amazon region.

One justification for the Network project is that "it is possible to make regional forms of connection and articulation, fruitful in the Amazon, viable and/or bring out their potential with the creation of inter-institutional networks in strategic areas such as Science and Mathematics research and education", this way, with the PhD formation arises the possibility of connections and the formation of new networks aimed at effectively meeting the demand for qualification at the masters and doctoral level in the region (REAMEC, 2008, p.45).

During the Network project configuration period a preliminary ascertainment was carried out of the institutional Web sites, which pointed the existence of at least 146 licentiate degree courses in Physics, Chemistry, Biology and Mathematics in the region. A more recent research found 232 licentiate degree courses offered by public schools in the area of Nature

Sciences (Biology, Physics and Chemistry) in the same region (ALVES, CARVALHO & PALMA, 2015). It could be said that there was a highly relevant increase regarding the Natural Sciences and Mathematics area, mainly because the second ascertainment did not consider the Licentiate Degree courses in Mathematics. This way, the initially forecast demand for masters, PhD candidates may have grown in a similar fashion.

By implementing the Network program, the idea was to make an effort aimed towards training trainer-researcher teachers that could work in higher education in the region. Formation "PhD in/from and for the region, and therefore establishing them within this geographic space to gain, in the medium term, doctorate competence in the Amazon" (REAMEC, 2008, p. 41).

The PPGECEM responsibilities and attributions were shared among the institutions involved. Initially, nineteen higher education institutions were registered through agreement, and eight institutions with two terms added to the initial agreement were added. According to the project (REAMEC, 2008), three institutions would be the Network's head office, with the selection criteria being the existence of consolidated Master in Education programs and being located in the three most populated states in the Legal Amazon. Thus, the Network features three coordination centers and one general coordination. There are also the the state nuclei that provide support to the participating States.

The centers elected for the demand were: the Amazon State University (UEA) that since 2006 has maintained a Professional Masters Program in Science and Mathematics Teaching; the Mato Grosso Federal University (UFMT) that since 1989 has maintained the Academic Masters in Education, score of 5, that includes a line of research in Science and Mathematics Education; and the Pará Federal University (UFPA) that since 2002 has maintained an Academic Masters Program in Science and Mathematics Education. The general program coordination is currently at the UFMT (REAMEC, 2008). The HEI count on the participation of registered teachers and PhD teachers from other regions in the country who work mainly in the guidance and co-guidance of dissertations.

The first class joined REAMEC in 2011 with 30 vacancies for two lines of research presented by the program: line 1, Teacher Training for Sciences and Mathematics Education; and line 2, Foundations and Methodologies for Sciences and Mathematics Education. Line 1 covers issues such as early and continued training for Science and Mathematics Education professionals, as can be seen on the program's Website.

> This line of research has inserted issues related to early and continued training for Science and Mathematics Education professionals, whether in terms of ideologies,

> whether for pedagogical practices, at any teaching level and systems, prioritizing issues that involve both training reflexive-researcher teachers and the outlook for training new/other teacher professional training and development cultures. This line's proposal integrates studies and analyses developed from issues such as: reflexive training, practice epistemology, learning for teaching, teaching profile, teaching career, professionalization, knowledge, professional beliefs and knowledge items for teaching sciences and mathematics. It further includes studies about the state-of-the-art in teacher training and current training trends. Priority will be given for research that may imply in intervening in teaching/education contexts and in different realities deemed to be study focuses, with special attention to the classroom and training groups of teachers in pursuit of training academic leaderships, whether as studies of ongoing processes, whether as evaluations of consolidated experiences. (Available at http://www.ufmt.br/ufmt/un/secao/4590/ppgecem. Accessed on June 05, 2017).

In line of research 2, the investigations refer to teaching and learning processes as described in the program information.

> This line of research has inserted issues related to teaching and learning processes whiting the scope of formal and non-formal teaching at different teaching levels, such as concept formation, interactions in Sciences and Mathematics classes, teaching-learning methodologies and approaches, studies concerning constructivist teaching and learning processes, construction and analysis of didactic resources, the theory and practice relation in the classroom, curriculum and curricular components, as well as researches in/about teaching in the area being considered. Privilege is granted for issues that are not limited to studying/investigating the state-of-the-art, but that are configured in terms of context transforming proposals that are qualitatively differentiated, whether at the context intervention level, whether as evaluations of accomplished actions, or even in process if the case may be, and may configure models for already developed processes or those under development. (Available at http://www.ufmt.br/ufmt/un/secao/4590/ppgecem. Accessed on June 05, 2017).

During the selection process, the candidates choose the line they wish to join and undergo the selection process that includes a written exam and presential defense of the project sent at the moment of enrollment. Two disciplines are compulsory for both lines of research and two compulsory ones according to the chosen line.

The profile of a PhD students from PPGECEM/REAMEC is of a,

> [...] researcher professional who is engaged in the construction of citizenship by developing researches and producing knowledge in the area with aims to implant and implement projects that promote regional and local development. A differentiated teacher-researcher-trainer professional working on projects and action that yield processes and/or products that promote teaching and learning quality improvement in Basic Education and early and continued teacher training for teaching sciences and mathematics. Such professionals must be qualified with special autonomy, competence and innovation attributes that enable them to formulate, plan, develop and evaluate (1) research projects, (2) new methodologies, and (3) products for Sciences and Mathematics Education within the regional context of the Amazon (REAMEC, 2008, p.56).

The program has biannual selection and the total credits to be studied by undergraduate PhD is of 152,which corresponds to a total of 2,280 hours, with 40 credits (600 hs) for compulsory and optional disciplines, 16 for Research Seminars I and II (240 hs), 12 for Scheduled Activities (180 hs), 08 for teaching internship (120 hs), and 76 credits for elaborating

the Dissertation defense (1140 hs) (REAMEC, 2008). The disciplines and academic events required for course completion may be organized in spaces located in different States considering the numeric factors that constitute the student body at the time of the event in question.

The compulsory disciplines for the PhD students enrolled in both lines are shown in Chart 1, and the compulsory disciplines per line of research in Chart 2.

Chart 1 - Compulsory disciplines for both lines of research

Compulsory Discipline	**Class Hours**	**Credits**
Sciences and Mathematics Education Research	120 hs	08
Epistemological Bases for Sciences and Mathematics Teaching	120 hs	08

Source: http://www.ufmt.br/ufmt/un/secao/4584/ppgecem

Chart 2 - Compulsory disciplines per line of research

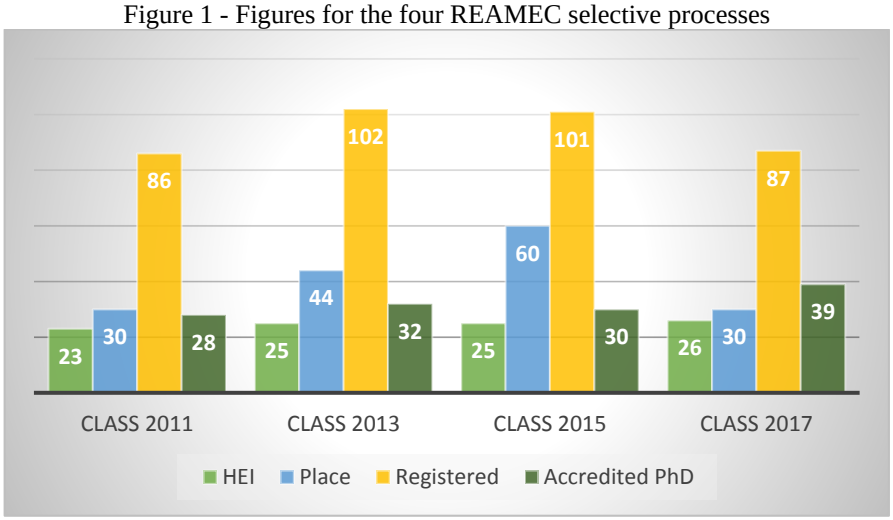
Compulsory Discipline	Line of Research	Class Hours/Credits
Teacher Formation: Trends and Approaches	1	90hs/06
Sciences and Mathematics Teacher Training Research.	1	90hs/06
Foundations, pedagogical and methodological trends for teaching Sciences and Mathematics.	2	90hs/06
Research trends and approaches in teaching Sciences and Mathematics	2	90hs/06

Source: http://www.ufmt.br/ufmt/un/secao/4584/ppgecem

In addition to the four compulsory disciplines, the PhD students must take two optional disciplines that include six credits each (90 hs), as well as their compulsory participation in both research seminars, with Research Seminar I held at the Belém center, in UFPA, and Research Seminar II at the Manaus center in the Amazonas State University (UEA). The seminars are usually held during the month of June, in the third and fifth doctorate semesters. As is the case in other programs and following Capes rules to realize the qualification, the PhD studant must, besides the disciplines, attend the scheduled activities, namely technical and bibliographical productions carried out since joining the PPGECEM, and the teaching internship (REAMEC, 2008).

The Program has offered four selective processes, and in each process the figures for vacancy offerings, participating institutions, enrollments and registered PhD change, as shown in Figure 1.

Figure 1 - Figures for the four REAMEC selective processes



Source: Data collected from the selection call notices (REAMEC, 2010, 2012, 2014, 2016).

In total, the three Network centers offered 164 vacancies, and a discreet growth in the number of participating HEI and registered PhD can be observed. According to the selection call notice for the 2017 class, there are currently thirteen HEI collaborating PhD from regions outside the Legal Amazon. Over sixty PhD had already graduated through the Network by the first semester, 2017.

Despite the Network being consolidated, there are budgetary/financial difficulties because of the long the distances between the centers, the HEI the undergraduate PhD are located, and every bench, seminar and guidance generates costs, which caused the offering of vacancies to be reduced in the latest call notice from 60 to 30. One other factor to be considered concerns guidance, since there are 39 permanent registered professors and 13 collaborating professors who are PhD from other regions in the country, some of which hold two or more ongoing guidance's from the 2015 and 2017 classes with a total of 90 PhD students.

The Program arose from the need for and urgency to bring to the Amazon region actions to improve Sciences Education and Sciences development, and the first ascertainment of information from the first graduate PhD curricula showed how networking contributed towards a change in publications by graduates within the Legal Amazon context, below is presented the methodological path that guided this study.

3 METHODOLOGICAL PATH

The twenty-nine graduates set this study as a descriptive, exploratory ascertainment with the objective of verifying any impact in the Legal Amazon region regarding the number of scientific productions and masters insertions from the first PPGECEM/REAMEC class. As to the type of approach, it is characterized as quantitative, since the numeric data will serve to

express characteristics of the studied object and "[...] may be very useful in comprehending several educational problems" (GATTI, 2004, p. 13). The ascertainment was performed online on the Lattes platform between December 05, 2016 and February 09, 2017. Sampieri et al. (2013) wrote that document analysis, in the case of this study from public archives are a valuable source of data that can help understand a core phenomenon in the study.

The criteria for data collection were established in a form containing items that take into consideration from the early training area, scientific productions before and after joining the REAMEC, professional activity, up to curriculum updating on the platform. Among the criteria analyzed are the graduate profile, by analyzing the States where they worked when joining the PPGECEM and where they currently work, the professional activity HEI, graduation read, and the program and area of the masters read. Also considered was the time period in years between graduation and joining the doctorate and working in licentiate degree courses.

One other criterion was scientific production by counting research projects, participation in defense and qualification benches, stricto sensu post-graduation program guidance, journal publications, events, books and book chapters.

Result analyses were performed by means of frequency and percentage in addition to systematizing and organizing the graduate's data, for example, the total sum of publication before and after joining the PPGECEM. These analyses allowed for the gathering of significant data regarding the graduates' bibliographical production and their insertion in stricto sensu post-graduation programs, as presented below.

4 IMPACTS FROM THIS NETWORK GRADUATION ON GRADUATES

Twenty nine PhD graduated from the first Network class, fifteen of which were male and fourteen, female, the dissertation defenses took place between April 29,2014 and July 25, 2016. There were eighteen defenses in 2014, nine in 2015, and two in 2016, ending the defenses of the first class that joined in 2011, only one female entrant did not finish her doctorate. Regarding the distribution of the twenty nine PhD through the three centers, eleven were enrolled in the Cuiabá center, nine in the Belém center, and the other nine in the Manaus center.

As to curriculum update on the Lattes platform, the majority of graduates (17) has recently updated within a time period of under two months in relation to the consultation date. Three of them updated within the period of two to four months before the consultation. Three graduates updated their curricula within a period of four to six months before the consultation, five of them had not updated their curricula for a period of over six months, and one of the

graduates has not updated the lattes for a period of over two years, with no record of defense or finishing the doctorate program.

Among all the information analyzed in the curricula of the investigated individuals is the State in which the Network graduate PhD was working in the period of joining (2010) the PPGECEM and the location they were working professionally in the period of data collection (2017). In this category, the State of Pará houses the highest number of graduates from the first class, with seven PhD graduating from the Network. Amazonas received six PhD in the first class from the Network, while the states of Rondônia and Mato Grosso rank third with four graduates each. The remaining States that comprise the Legal Amazon appear with one PhD each. Two PhD did not remain in the region, one being in the State of Minas Gerais and the other in the Distrito Federal. Both graduates who are outside the Legal Amazon left the region after finishing their doctorate for personal reasons.

As to the professional activity of the twenty nine graduates, 16 higher education institutions were identified, with 15 being public and 1 private. Among those institutions, the Pará State University (UEPA) is represented by six PhD, followed by the Rondônia Federal University (UNIR). The distribution of institutions where the Network graduates work, where twelve PhD work in Federal Universities, eleven in State Universities, five in Federal Institutes and one in a Private University.

The data are detailed in Table 1, with the sixteen institutions where they are working and the respective number of PhD graduated from the Network in its first class.

Table 1 - Number of Graduates by HEI

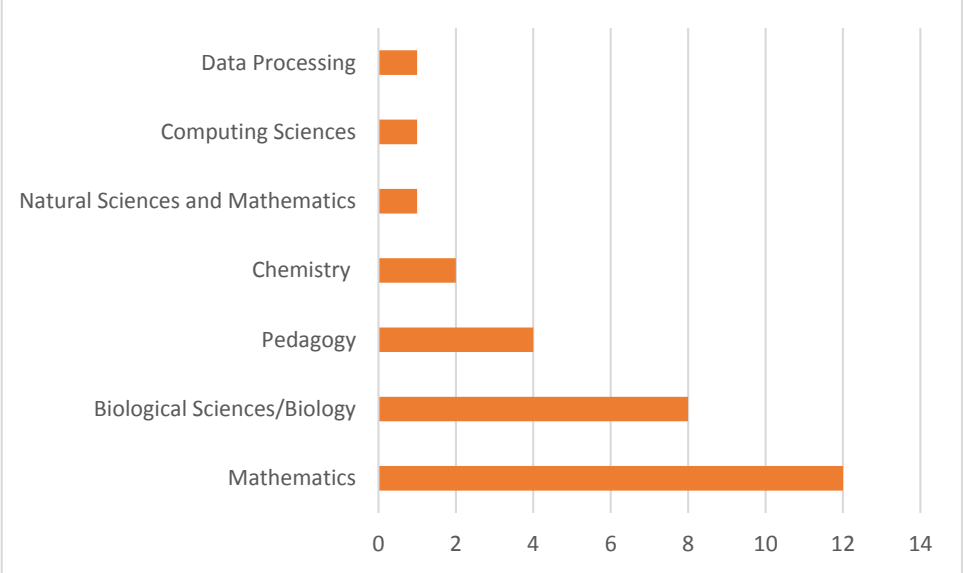
HEI	Number of graduated PhD
University of Brasília – UNB	01
Mato Grosso Federal University – UFMT	02
Rondônia Federal University – UNIR	04
Tocantins Federal University – UFT	02
Acre Federal University – UFAC	01
Amapá Federal University – UNIFAP	01
Pará Federal University – UFPA	01
Amazonas State University – UEA	03
Pará State University – UEPA	06
Mato Grosso State University – UNEMAT	01
Roraima State University – UERR	01
Amazonas Federal Institute – IFAM	02
Maranhão Federal Institute – IFMA	01

Mato Grosso Federal Institute – IFMT		01
Minas Gerais Federal Institute – IFMG		01
Northern Educational Union – UNINORTE		01
	Total	**29**

Source: Data collected from the *Lattes* curricula of PhD students from REAMEC.

Each curriculum had identified the graduation of the PhD students from the Network. The graduates' early training, that is, the graduation courses they are qualified, are represented in Figure 2.

Figure 2 - Early training of Graduated PhD/REAMEC



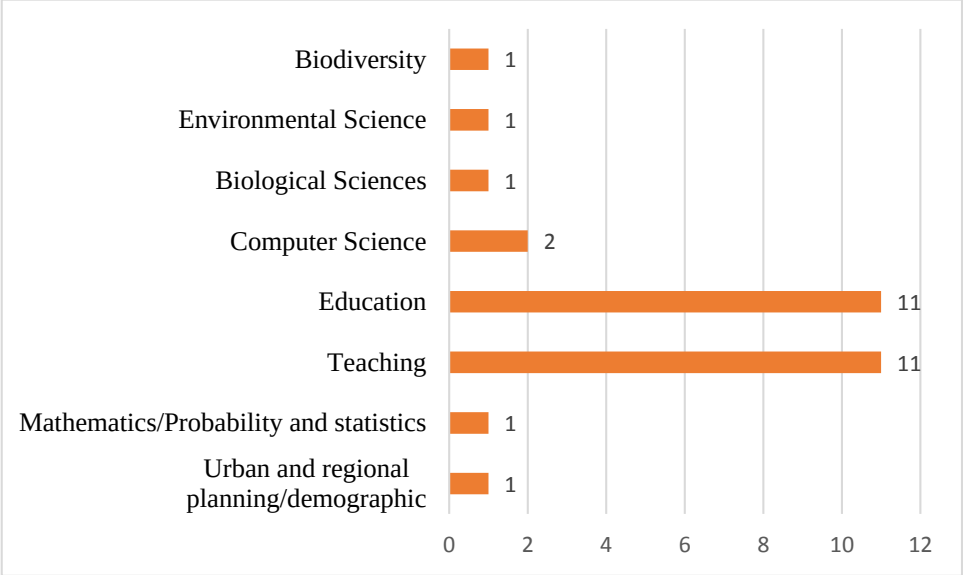
Source: Data collected from the *Lattes* curricula of PhD students from REAMEC.

As to the type of graduation, twenty two PhD hold a licentiate degree, three bachelor degrees and four did not state clearly in the curriculum whether they hold a licentiate or bachelor degree, that is, the information inserted in the lattes curriculum is not exact.

A further piece of information ascertained was the name of the Post-Graduation Programs where the graduates read their masters, the masters by area of evaluation were identified and Figure 3 presents the quantitative of graduates by area[1] of the masters read by the research individuals.

[1] Evaluation Area in accordance with Capes has a practical purpose with the objective of providing the teaching Institutions research and innovation in a swift, functional manner of systematizing and providing information related to research projects and human resources to the science and technology management bodies. The areas feature a four-level hierarchization, from the more general to the more specific covering nine major areas in which 48 CAPES evaluation areas are distributed.

Figure 3 Number of graduates by area of Masters read



Source: Data collected from the *Lattes* curricula.

The REAMEC selective process does not require the candidate to hold a masters in the Teaching or Education area, which broadens the possibilities for all other professionals who work in teacher training to qualify for the professional activity. However, it can be noticed from the data that the majority of PhD graduated from REAMEC read the masters in either the Teaching or Education area, while only seven graduates read the masters in more specific areas in their early training.

The type of master was also analyzed, whether academic or professional, with the result of twenty two individuals having graduated with academic masters, six obtained the master title with academic masters, and one graduate read the master abroad and the type of master degree is not stated in *Lattes* neither was it found in the Sucupira Platform.

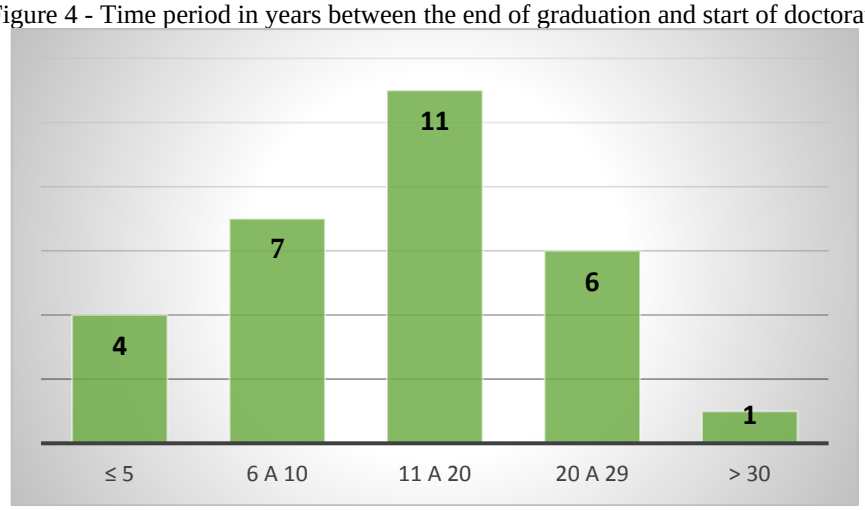
Whether the graduates teach licentiate degree courses was verified and it was found that seventeen graduates work in licentiate degree courses, however, nine PhD did not inform in their the activity, and one informed only about working in teaching master's degree. This piece of information is important because one of REAMEC's aims is to improve teacher training in the LA region.

The interval between graduation and joining the masters was considered, and a considerable variation was found between the shortest time of five years up to thirty one years after graduation.

To present the data, the following time range variations were organized: equal to or under five years (≤ 5 years); six to ten years (6 to 10 years); eleven to twenty years (11 to 20

years); a value between twenty and twenty nine years (20-29) and over thirty years (> 30 years), according to Figure 4.

Figure 4 - Time period in years between the end of graduation and start of doctorate



Source: Data collected from the *Lattes* curricula.

For those who read two graduations, the licentiate degree was considered, and those who hold two licentiate degrees the time period from the first was accounted. Most graduated PhD took between eleven and twenty years between finishing graduation and starting the doctorate. That may be a reflex of the lack of *stricto sensu* programs in the Legal Amazon and the difficulties to move to the South and Southeast regions, where more qualification opportunities are offered in this area of knowledge.

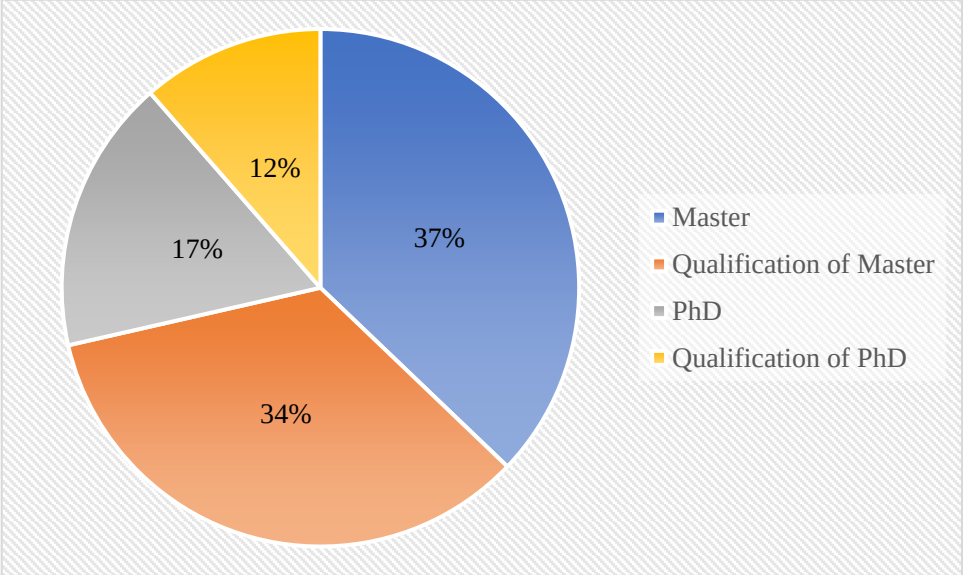
As to scientific productions by the graduates, the data were divided into: research projects carried out or ongoing; participation in defense benches or either masters or doctorate qualification; masters guidance or co-guidance; articles published; papers published at events; published books and book chapters; and scientific production abstract.

As to the research projects carried out or ongoing, it was found that before enrolling in the Network doctorate program, sixteen graduates were already carrying out research projects. In the ascertainment it was further observed that seven of them had no record of coordination or participation in projects. Six graduates had more projects developed before joining the program, however, it is necessary to record that many of them had worked for a long time in higher education institutions, and three graduates carried out research only after 2011.

In total there are twenty two additional projects after 2011, with sixty projects after joining the Network and thirty eight projects before enrolling in the doctorate. This shows that the doctorate made possible a researcher profile for the graduates, broadening research and thus increasing the number of publications.

Regarding participation in masters and/or doctorate benches, the ascertainment accounted defense bench with qualification bench. Sixteen graduates, or 44.8% of individuals researched, participated in masters benches and six graduates have already participated in doctorate benches, in addition to participating in masters and doctorate benches. The number of benches separated by level are shown in Figure 5.

Figure 5 - Number of graduates who participated in defense benches



Source: Data collected from the *Lattes* curricula.

The total sum of all benches up to the time of the ascertainment is of one hundred and three benches in which those sixteen graduates participated, with forty six masters benches, forty three masters qualification, seven doctorate benches and another seven doctorate qualification. One relevant piece of data is that one of the graduates participated in forty five benches, seventeen of which were masters benches and twenty three masters qualification, one doctorate bench and four doctorate qualifications.

As for insertion and guidance in masters programs, also one of REAMEC's aims, five PhD graduated from the first class are already inserted and guiding eighteen masters. There are also two graduates with three masters co-coordinations.

During the ascertainment, the names of the programs those graduates work in was sought, thus allowing to observe the areas and grades according to CAPES and are summarized in Chart 3.

Chart 3 - Graduates' working programs

Name	HEI	Evaluation Area	Type	Grade
Post-Graduation in Chemistry	UFAM	Chemistry	Academic	4
Post-Graduation in Sciences Teaching	UEA	Teaching	Academic	4
Post-Graduation in Teaching	IFMT	Teaching	Academic	3
Professional Masters in Physics Teaching (PROFIS)	UNIR	Astronomy/Physics	Professional	4
Professional Masters in Physics Teaching (PROFIS)	IFAM	Astronomy/Physics	Professional	4
Post-Graduation in Sciences and Mathematics Teaching	UFAC	Teaching	Professional	3
Post-Graduation in Natural Sciences Teaching	UFMT	Teaching	Professional	3

Source: Data collected from the *Lattes* curricula and Sucupira Platform.

Another indicator consulted was the publication of articles before and after joining the REAMEC program in 2011. Considering the total number of publications before and after, there was a 129% increase approximately. Before, twenty one graduates published a total of forty five articles in journals, after joining the doctorate course, twenty graduates jointly published a total of one hundred and three articles

Considering the average number of articles, before 2011 it was of 2.14 articles per graduate, after 2011, that average was of 5.15 articles per graduate. However, that average differs from the reality, with one graduate who alone published twenty seven articles after joining the Network, whereas the others average 3.80 articles. Noting that ten of them published no article after 2011 and, therefore, were not accounted for in calculating the average. The eight graduates who published no article before joining the program were also not considered.

The *Qualis*/CAPES[2] of the journals in which the individuals in this research published were also verified and Table 2 shows the quantitative of articles published in journals and analyzed according to *Qualis*/CAPES 2016 for the teaching area.

[2] *Qualis*-Journals is a scientific production ranking that serves to evaluate post-graduation programs. It is produced by a committee of consultants from each area of evaluation (CAPESCAPESCAPES) according to pre-defined criteria defined by the area and updated yearly.

Table 2 - *Qualis*/CAPES ranking for publications by the individuals

Qualis	**Before 2011**	**2011 to 2017**
A1	01	03
A2	09	23
B1	01	19
B2	-	08
B3	04	15
B4	01	04
B5	03	03
C	01	08
Without *Qualis*	25	20
Total	**45**	**103**

Source: Data collected from the *Lattes* curricula.

It is important that these data show that the majority of publications made after joining the Network was in journals with *Qualis*. The journals are set into quality indicative tiers - A1, the highest; A2; B1; B2; B3; B4; B5; and C - with zero weight. Consultation of the *Qualis* for a journal can be made on the Sucupira Platform.

In the paper publication in events item, for the purposes of calculation, all types of publication were considered: abstract, extended abstract and full paper, as well as local, regional, national and international events. The total sum of publications by the twenty seven graduates before 2011 found records of four hundred and seven papers in events. After enrolling in the doctorate there were four hundred and e ninety nine publications in events by twenty six graduates, a 16.8% increase. It can be stated that is a considerable number, since the time period after enrolling is inferior to starting a career for most of them.

Books and book chapters were computed separately after adding up the publications of all research individuals. There were eighteen books published after 2011, whereas eleven were published in the period before joining the program. Those twenty nine books were published by eighteen graduates, thus eleven graduates did not publish books before or after the doctorate. Before 2011, twenty two book chapters were published by eleven graduates. After 2011, there is a total of ninety three book chapters published by twenty one graduates.

In sum, the quantitative data in Table 3 show the publications accounted within this data collection period.

Table 3 - Summary of Scientific Productions

Type of Production	Before 2011	%	After 2011	%
Research Projects	38	38.8	60	61.2
Articles in Journals	45	30.4	103	69.9
Publication in Events	427	46	499	54
Book	11	38	18	62
Book Chapter	22	19.1	93	80.9

Source: Data collected from the *Lattes* curricula.

By adding up graduate productions, it can be observed that there has been an increase in the quantity of scientific productions in general. Further considering that there was a greater production in a shorter time period, since the majority of graduates started their professional careers several years before joining the Network.

A production increase is expected in any post-graduation program, whether at the masters or doctorate level, which was attained by the Network graduates in very surprising proportions indeed for a new doctorate program. One factor that may have contributed towards such increase is the fact that the graduates are higher education professors, and there are those who work in licentiate degree and post-graduation courses. This exclusive Network profile allows for high scientific production results and research preparation.

5 FINAL CONSIDERATIONS

The results shown bring evidence of a significant increase in scientific production by the graduates. They produced and published more, especially regarding articles in journals, books and book chapters. Seven graduates entered *stricto sensu* post-graduation programs up to the period of ascertaining each graduate's *Lattes* curriculum, which demonstrates that REAMEC has been meeting its objective of form PhD to work in masters in the Legal Amazon region.

One fact that stood out was that two graduates from the first class left the amazon region, one went southeast, to the State of Minas Gerais, the other to the Distrito Federal. Although one of the Network objectives is to form PhD to broaden opportunities and the offering of post-graduation programs in the Legal Amazon region, it already features tow PhD working outside the region of focus.

It can also be observed how important the Network is in a region where there are no other programs to form PhD for Sciences and Mathematics Teaching, and taking into consideration the first and second classes, the Network had trained over sixty doctors by the

first semester of 2017. A program that arose as a one-off and is currently consolidated in the region featuring over sixty graduated doctors and many more in the phase of qualification and dissertation defense and that attained a score of 5 in the most recent four-yearly evaluation (2013-2016) by CAPES.

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