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The Contribution to human resources of Institutional Scientific Initiation Scholarship Program of the Museu Paraense Emílio Goeldi

Ana Yoshi Harada[1], Mara Luiza Videira Marceliano[1]

[1] PhD in Biological Sciences, Entomology, Museu Paraense Emílio Goeldi/Zoology Coordination/Invertebrate Sector
[2] PhD in Biological Sciences, Zoology, Museu Paraense Emílio Goeldi/ Zoology Coordination/Ornithology Sector

***Abstract*— *The Museu Paraense Emílio Goeldi (MPEG) is one of the oldest museums in Brazil that carries out basic research, and preserves important scientific collections in the areas of Biological and Human Sciences. The institution works in the formation of human resources, at the level of scientific initiation (SI) and graduate studies. In relation to the SI, there is the Institutional Program of Scientific Initiation Scholarships (PIBIC/MPEG/CNPq), which is an initiative from the National Council for Scientific and Technological Development (CNPq) and aims to train staff at the undergraduate level and introduce the student to scientific knowledge. This work aimed to carry out a retrospective research on the research and guidelines conducted in the PIBIC/MPEG/CNPq, published in the respective Abstracts published annually. The period 1997-2019 was evaluated and emphasis was given to works with themes on the Coastal Zone or the Amazonian Continental Area. The following were considered: area of knowledge of the research; sub-area of knowledge and specialty (according to the table of CNPq knowledge areas); sector of activity of the supervisor; year of activity; student, institution of graduation of the supervisor; course attended by the supervisor and; research in the continent or coastal areas. Dynamic tables and graphics were produced. The results showed that the PIBIC/MPEG/CNPq program covered 1154 undergraduate students in the areas of basic and applied sciences. A total of 1877 scientific initiation scholarships were made available, 930 and 947 with themes about the continent and the coastal region, respectively. Several of these students entered the graduate programs at their home institution, at MPEG or at programs in other states or regions of the country. The conclusion is that the PIBIC/MPEG/CNPq is an opportunity offered to young Amazonian people to start working on research, human resources training and scientific, regional and national development, thus strengthening research and, consequently, the development of Brazil.*

Keywords*— *Amazon, Coast Zone, human resources, scholarship.

I. INTRODUCTION

The Museu Paraense Emílio Goeldi (MPEG) was created 154 years ago (1866), as a Museum of Natural History, by initiative of researchers and politicians from Pará, with the purpose of exposing to society part of the natural and ethnographic riches from Amazon, without entering into the forest. In this sense, it served as support for important scientific expeditions of renowned national and foreign scientists such as Agassiz, Martius, Spix, Wallace, and others, who investigated the biodiversity and ethnicities of Amazon from the 19th century [18]. It is worth noting that the material collected in these expeditions was deposited by them in European Museums [15].

Since 1871, MPEG has been considered among the oldest Brazilian institutions of natural and ethnographic research, under the name of *Museu Etnográfico* e de *História Natural*, Ferreira Penna. In the meantime, scientists from the institution started to publish their scientific works in local, national, and international journals, leveraging the knowledge about the Amazonian nature (biological and socio-cultural). As a result of their research, they have begun to form Scientific Collections in the areas of Zoology, Botany, and Ethnography, which today are important National, Neotropical, and World references [6, 14,18].

The demands of the Amazon led the institution to act, actively, in the areas of Human Sciences (Archaeology,

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Anthropology and Linguist), Natural Sciences (Botany, Ecology, Geosciences and Zoology), Technological Innovation and Education (Environmental and Scientific), and also in the dissemination of scientific knowledge (Social Communication and Scientific and Cultural Exhibitions). Today it is one of the oldest museums in Brazil that carries out basic research and preserves important scientific collections in the areas of Biological Sciences and Humanities, characterized as of greater importance of the taxonomic group, for the Neotropical Region.

From the 1960's on, the institution also started to act in the formation of young potential students, interested in science. For several years now, it has been developing staff training programs, from middle to postgraduate levels. These actions perfectly meet the institutional mission: "To conduct research, promote technological innovation, train human resources, conserve collections, generate and communicate knowledge in the areas of natural and human sciences related to Amazon".

One of the staff training programs, at the university undergraduate level developed at MPEG is the Institutional Program for Scientific Initiation Scholarships (PIBIC/MPEG) which is an initiative of National Council for Scientific and Technological Development (CNPq) that aims at "awakening scientific vocation and encouraging special talents among university undergraduate students, through participation in Research Projects, guided by a qualified researcher," in public and private institutions throughout the country. The seriousness with which it has been developed shows its importance and necessity for the formation of professionals in all areas of scientific and technological knowledge in the country [9,17]. The seven SI Fellowship programs from CNPq are important pillars of the Graduate Programs, strengthening research and, consequently, the development of Brazil [1,3,10,15,17].

PIBIC/MPEG/CNPq started in MPEG m 1993 and has been providing high quality training to young Amazonian students, incorporating them into Research and Extension Programs and Projects (Education, Communication and Technological Innovation) developed at the institution. It is worth mentioning that over a thousand professionals who today contribute to the development of the Brazilian Amazon have been trained through this program.

In this sense, this work aims to disseminate the contribution of MPEG in staff training through PIBIC/MPEG/CNPq during the last 23 years, comparing and emphasizing the Coastal Zone and the Amazonian Continental Area.

II. MATERIAL AND METHODS

Data were compiled and analyzed from all the guidelines conducted under the Institutional Scientific Initiation Program (PIBIC), supported by the National Council for Scientific and Technological Development (CNPq), published in the respective Abstracts for the period (1997-2019).

2.1 Reviewed Literature

The research was developed relating the items: area of knowledge of the research, sub-area of knowledge and specialty, according to the adapted table of knowledge areas of CNPq. The area of activity of the supervisor, year of activity, student, institution of the graduation course of the student, course attended by the student, research in the continent, research in large coastal areas, members of the Coastal Studies Program of MPEG (PEC/MPEG).

Several publications were also consulted involving the contribution and impact of the Institutional Scientific Initiation Scholarship Program (PIBIC/CNPq) on other Brazilian institutions and other aspects involving the training of staff for discussion. The oriented works involve research in all areas of knowledge developed at MPEG, involving ecosystem functions and services, and/or socioeconomic and cultural benefits that are being evaluated and compared with the production of the PEC/MPEG.

2.2 Selection Criteria

To evaluate the contribution of the Scientific Initiation Scholarship Program of the Convention between the Museu Paraense Emílio Goeldi and the National Council for Scientific and Technological Development (PIBIC/MPEG/CNPq), data published in the Abstract's Books from 1997 to 2019 involving the 1) Areas of activity of the mentors, 2) Areas, Subareas and Specialty of knowledge of the research developed by the students, 3) Location of the research, Continental or Coastal, 4) Whether the research was conducted by member or not of the PEC/MPEG, 5) Name, Institution and Academic Training Course of the student and 6) Year of activity of the student and the mentor in the PEC/MPEG.

2.3 Data Collection

We consider four major Areas of Knowledge, grouping several areas of CNPq into a single area: 1) Biological Sciences, Health and Forestry - CBSF (Biological Sciences, Health Sciences, Forestry Resources and Forest Engineering), 2) Earth Sciences and Engineering - CTE (Exact and Earth Sciences, Engineering), 3) Humanities, Applied Social Sciences, Linguistics, Arts and Letters - CHSALLA (Humanities, Applied Social Sciences, Linguistics, Letters and Arts) and

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Multidisciplinary - MULTD (when the research involved the combination of more than two areas of Knowledge);

The 27 sub-areas grouped by Area of knowledge were: 1) CBSF (Botany, Applied Botany, Ecology, Mycology, Microbiology, Fishing Resources and Fishing Engineering, Zoology and Applied Zoology), 2) CTE (Computer Science, Information Science, Physics, Geosciences, Geophysics, Physical Geography and Meteorology), 3) CHSLLA (Administration, Anthropology, Archaeology, Architecture and Urbanism, Political Science, Law, Economics, Education, History, Linguistics, Theology) and MULTD (Multidisciplinary).

The 28 Specialties grouped by Area of knowledge were: 1) CBSF, 16 (Beekeeping, General Biology, Bioprospection, Biochemistry, Botany Economics, Behavior, Ecosystems Ecology, Landscape Ecology, Medical Entomology, Ethnobotany, Phytochemistry, Inland Water Fishing Resources, Algae Taxonomy, Cryptogamos Taxonomy, Phanerogamos Taxonomy, Taxonomy of Fungi, Taxonomy of Recent Groups), 2) CTE, 13 (Classical Areas of Phenomenology and its Applications, Climatology, Landscape Ecology, Physics, Geoecology, Geography, Geomorphology, Methodology and Techniques of Computing, Pedology, Remote Sensing, Information Systems, Information Technology), 3) CHSLLA, 20 (Specific Sectors Administration, Public Administration, Anthropology of Afro-Brazilian Populations, Rural Anthropology, Urban Anthropology, Historical Archaeology, Prehistoric Archaeology, Special Rights, Agricultural and Natural Resource Economies, Indigenous Ethnology, Modern and Contemporary History, Applied Linguistics, Historical Linguistics, Pedology, Public Policy, Architecture and Urbanism Project, Information Representation, Sociolinguistics and Dialectology, Pastoral Theology, Special Topics in Education) and MULTD (Innovation, Multidisciplinary).

2.4 Conceptual structure of the data

To adjust the contribution from MPEG to human resources training, at the graduate level, through PIBIC/MPEG/CNPq, a compilation spreadsheet was organized containing the following items: a) Program Name (PIBIC), b) Year the Orientation took place, c) Supervisor - ORI, c.1) Name of the Supervisor, d) Research Location Area (Continental - CONT or Coastal - COAST), c.2) Coordination or Sector of the Supervisor in MPEG (Botany - COBOT, Communication and Extension - COCEX Earth Science and Ecology - COCTE, Human Sciences - COCHS, Research and Postgraduate program - COPPG, Planning and Follow-up Coordination - COPAC Zoology-COZOO), c.3) Work of the Supervisor at PEC/MPEG, e) Student: e.1) Name, e.2)- Institution of Origin, e.3) Course attended at graduation, e.4) Title of the research, f) Area of knowledge of research -AC, g) Subarea of research knowledge-SUBA, h) Specialty of research - ESP.

The four areas, 27 sub-areas and 49 specialties were grouped based on the standard CNPq Table adapted. In the area 1) Biological Sciences, Health and Forestry - it was grouped the Biological Sciences, Health and Forestry Resources -CBSF, 2) Earth Sciences and Engineering - it was grouped the Earth Sciences and Engineering - CTE, 3) Humanities, Applied Social Sciences, Linguistics, Letters and Arts - CHSALLA and Multidisciplinary - MULTD - when the research involves more than two of these major areas to better visualize the research.

2.5 Data Analysis

The data were compiled and analyzed in tables of the EXCEL Program version 10.0. Pivot tables and graphics were produced for all items in topic 2.4. The tables were grouped by year of activity, Coordination (Area of Action of the Supervisor), Name and Action or Not of the Supervisor in the PEC/MPEG, Name, Institution and Course of the Student, Area, subarea and specialty of knowledge and location (Continental or Coastal) of the research developed by the student to show the contribution of PIBIC/MPEG/CNPq in the scientific formation of undergraduate students in an institution in the Brazilian Amazon during 23 years of the existence of the Coastal Studies Program (PEC/MPEG).

It should be noted that information regarding the courses and year of activity of students in the period from 1997 to 2003 was not computed due to its non-existence in the source consulted. This fact justifies the difference in information for these items in relation to the number of scholarships used in these periods.

III. RESULTS AND DISCUSSION

The PIBIC/MPEG/CNPq Program covered 1154 undergraduate students, from 1997 to 2019, in the areas of basic and applied sciences developed in MPEG.

It is known that the ecosystems of the Brazilian Amazon coast have peculiar characteristics, resulting from their privileged geographical location, involving the Amazonas River delta and the interference of intertropical equatorial currents [11]. Its mangrove ecosystem, besides being the most preserved on the planet, is an important reservoir of biodiversity and conservation of continental areas [2,7,8,11].

Although the coastal and continental biomes have distinct characteristics, they have closely related structural functions, considering that nature is a continuous transformation of phenomena and processes that today are

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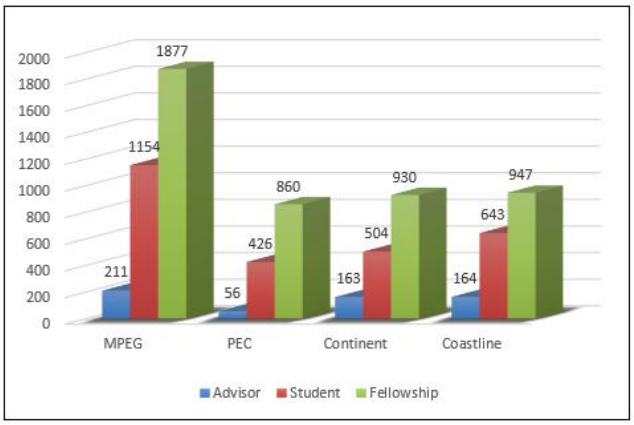
quite altered due to the actions of humanity. Thus, researches involving structural knowledge, dynamics, and natural and artificial processes in the Amazonian transect-continent coast are of high importance for the conservation and maintenance of the planet. In this context, the PIBIC/MPEG/CNPq program has been contributing to the formation of young scientists since the 1990s' seeking to understand this complex system (Graphic 1).

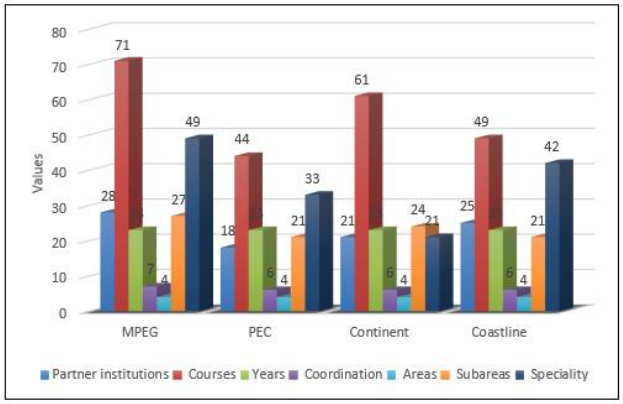


Subtitle: MPEG: Museu Paraense Emílio Goeldi
PEC: Coastline Studies Program

Graphic 1. Comparison between PEC and MPEG contributions at PIBIC/MPEG/CNPq Program, in Continental and Coastaline, from 1997 to 2019 period.

For 23 years (1997 to 2019), the MPEG/CNPq Institutional Scientific Initiation Scholarship Program contributed to the Scientific Initiation (IC) of 1154 potential young people in the Brazilian Eastern Amazon. These students came from 71 courses of 28 undergraduate programs in the State of Pará, Brazil. These students undertook 61 and 49 studies related to themes on the continent and coastal regions, respectively (Graphic 2). These data show the opportunities that MPEG has been offering to young Amazonian people to work in research, allowing them to enter and conclude graduate programs more quickly, to contribute to regional development. These results corroborate those of other authors for other institutions in other Brazilian regions [9,10,13,16,17].

Most of the students who choose the academic-scientific activities enter in the postgraduate programs existing in the institution of origin or in MPEG, others choose courses in programs allocated in other states or regions of the country, according to their particular interests. The performance of 211 researchers (supervisors) allocated in 7 Research Coordination, extension and technological innovation involving 49 specialties in 27 sub-areas of 4 areas of scientific knowledge shows the amplitude of knowledge and experiences offered by the institution to potential Amazonian young. This training is substantial to broaden the vision and critical capacity of these young people by directing them to professional activities that they may exercise in the future [10,11]. The Coastal Studies Program (PEC/MPEG) which involves current and past activities, with 1/3 of the researchers from institution (supervisors) and contributed with 860 guidelines (Graphic 2).



Graphic 2. Comparison between PEC and MPEG contributions at PIBIC/MPEG/CNPq Program, in Continental and Coastline among partner institutions considering the coordination and chosen areas.

In this context, MPEG is a research, extension and technological innovation institution, contributing over 23 years with the formation of 1877 scholarships for scientific initiation, 930 of them on subjects related to the continent and 947 on the coastal region, in collaboration with the PIBIC and PIBITI/CNPq Programs. This activity allows young scientists to accelerate the period of entry and stay in graduate programs, thus making available, in a shorter time, Masters and Doctors to contribute to the development of the country, a fact also argued by other researchers, for other Brazilian regions [16,17,10].

3.1 Institutional Contribution by Sectors of Activities (Coordination) x Scientific Knowledge (Areas, Subareas, Specialties)

The Museu Paraense Emílio Goeldi (MPEG) is made up of seven Departments (former Departments) in which students have contact with supervisors in their respective sectors (Departments), either sent by educational institutions or on their own initiative, out of affinity with the area of knowledge, in order to develop supervised internships and after, they are guided to enroll in the annual calls for proposals of the PIBIC/PIBITI/MPEG/CNPq Programs, to apply for the scholarships. The students of IC (PIBIC/PIBITI) have the contact with research and science during the period of the current scholarship, are trained in

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technical-scientific activities in the laboratory, in existing collections in MPEG and in field studies to develop their research projects supervised by their mentors.

Table 1. Human Resources Training through the PIBIC/MPEG/CNPq Program (1997-2019), by MPEG Coordination, in Continental and Coastal areas.

	COBOT		COCEX		COCHS		COCTE		COPAC		COPPG		COZOO		Total	
	CONT	COAST	CONT	COAST	CONT	COAST	CONT	COAST	CONT	COAST	CONT	COAST	CONT	COAST	CONT	COAST
Advisor	8	9	4	4	11	11	11	17	6	5	5	2	17	17	24	21
Student	172	202	8	17	115	85	151	141	11	16	5	2	191	189	661	646
Fellowship	230	286	10	25	204	131	206	218	10	8	9	14	5	2	920	947
Partner institutions	40	54	5	6	36	26	23	31	5	4	4	1	52	38	164	155
Course	13	15	4	4	19	17	13	25	8	6	0	0	9	9	38	42
Years	23	23	5	8	23	23	23	23	10	5	5	2	23	23	23	23
Coordination	18	17	6	9	21	18	32	218	10	9	4	1	22	15	61	49
Areas	4	4	2	1	4	4	4	4	4	4	1	2	1	1	4	1
Subareas	84	93	2	4	70	51	45	51	1	1	0	0	1	1	256	256
Specialization	9	13	4	6	9	8	16	14	8	7	2	1	13	15	21	25

Subtitle: COBOT: Botany Coordination; COCEX: Communication and Extension Coordination; COCTE: Earth Science and Ecology Coordination; COPAC: Planning and Follow-up Coordination; COPPG: Research and Postgraduate Program Coordination; COZOO: Zoology Coordination; CONT: Continental.

Since its creation, MPEG has prioritized the study of biodiversity, also contributing to the humanities (indigenous and cabloca), which justifies its greater action with the scientific initiation of potential young people, in Biological Sciences. Thus, the Coordination in Zoology (COZOO), which has the largest number of supervisors (61) and trained 327 students; the Coordination in Botany (COBOT), which worked with 64 supervisors training 326 students over a period of 23 years. On the other hand, the Coordination of Earth Sciences and Ecology (COCTE - Geosciences and Related), created in the 1990s to meet regional demands, had the work of 45 supervisors who trained 271 students. The Coordination of Human Sciences (COCHS) worked with 42 supervisors training 202 students. The Planning and Follow-up Coordination (COPAC), which is also a technology transfer and innovation area with 10 years of activity, involved 5 supervisors who trained 25 students. It is worth mentioning that training on Technological Innovation is also developed at the COBOT, COCTE and COZOO Coordination Offices. The Popularization of Science developed mainly by the Coordination of Communication and Extension (COCEX) tied with 10 tutors and 25 students, is developed in all Coordination (Tables 1 and 2).

Thus, the data show that basic research remains the institutional pillar, although some sectors are developing research in innovation and technology transfer. Therefore, since its creation (1866), MPEG has sought to know and understand the standards, dynamics and processes of biodiversity and Amazonian ethnic groups. In view of that, it preserves and maintains the testimonies of its research in Neotropical Zoological Scientific Collections (Mastozoology, Oritology, Invertebrates, Herpetology, and Ichthyology) and Botanicals considered important collections of Neotropical flora and fauna. In the Humanities area it has one of the most important ethnographic and archaeological collections of the Brazilian Amazon. These collections support the Research Projects of the students of IC and PG (postgraduate program) of the institution, as well as those of national and foreign interinstitutional exchanges. Students who use these collections are encouraged to develop research that shows the evolutionary processes, uses and customs of the objects of study in their respective areas of knowledge.

3.2 Contribution of the Coastal Studies Program (PEC/MPEG)

The Coastal Studies Program from MPEC (PEC/MPEG) is one of the structuring programs from the institution. It was created in 1997, at the initiative of researchers who worked and are active in the Amazonian Coastal Zone with the mission "To generate, integrate and communicate knowledge about natural systems and the socio-cultural diversity of the coastal and marine Amazon". The PEC/MPEG has been developing interdisciplinary projects in various parts of the Amazon coast (Pará and Amapá), seeking to integrate communities with the mutual exchange of knowledge and experience [5,12]. Human Resource Training, from high school to graduate school, involving scholarship students and/or volunteers has been a

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constant concern of the members of PEC/MPEG, as can be seen in table 2.

Table 2. Human Resource Training through the PIBIC/MPEG/CNPq Program (1997-2019), by MPEG X PEC/MPEG Coordination (1997-2019).

	COBOT		COCEX		COCHS		COCTE		COPAC		COPPG		COZOO	
	NPEC	PEC	NPEC	PEC	NPEC	PEC	NPEC	PEC	NPEC	PEC	NPEC	PEC	NPEC	PEC
Advisor	9	8	5	2	11	12	17	14	7	0	6	2	9	5
Student	204	137	24	2	141	66	137	145	5	2	14	0	256	76
Fellowship	407	209	33	2	219	116	200	224	41	0	5	2	392	127
Partner institutions	64	54	8	2	20	8	34	17	6	1	6	0	54	10
Course	17	10	5	2	20	16	20	20	11	0	5	2	11	6
Years	23	21	9	2	23	22	23	23	4	2	5	2	23	23
Coordination	21	19	12	3	10	19	32	28	14	0	3	1	14	11
Areas	4	2	2	1	4	4	4	4	3	0	3	1	4	3
Subareas	9	8	5	2	11	12	17	14	7	0	6	2	9	5
Specialization	6	9	6	2	9	5	15	9	10	0	2	1	11	6

Subtitle: COBOT: Botany Coordination; COCEX: Communication and Extension Coordination; COCTE: Earth Science and Ecology Coordination; COPAC: Planning and Monitoring Coordination; COPPG: Research and Postgraduate Coordination; COZOO: Zoology Coordination; CONT: Continental; PEC: Works in Coastal Studies; NPEC: Works in other areas.

Among 1154 Scientific Initiation (IC) students, 424 were trained in the PIBIC/MPEG/CNPq program, coming from 28 institutions (44 courses), guided by one of the 56 members of the PEC/MPEG over 23 years (1997 to 2019). The contribution to IC training by the members of the PEC/MPEG in the Coordination is shown in table 2. This fact confirms the importance of MPEG as a research institution focused on Amazonian natural history (sociobiodiversity) in the formation of potential researchers.

3.3 Partnerships

Collaboration in research projects and programs in inter-institutional and intra-institutional partnerships is important to fill institutional gaps, broadening horizons and enabling more successful knowledge generation. In this sense, a series of projects considered "Âncora" as IBID - (Projeto Manguezais Paraense: Recursos naturais, usos sociais e indicadores para a sustentabilidade, MADAM, (Programa Manguezais da Amazônia), PIATAM MAR, RENAS (Projeto Recursos Naturais e Antropologia Social), besides others that involved and involve national and international cooperation were and are of utmost importance for the performance of the PEC/MPEG [5]. The partnerships are shown in Table 3.

Table 3. Partnerships established by the PIBIC/MPEG in the period (1997-2019).

	COLABORATOR				
SCALE	1-5	6-50	51-150	151-300	>300
Advisor	16	7	2	1	2
Student	17	7	3	1	1
Fellowship	16	6	2	0	0
Course	22	5	0	0	0
Years	20	8	0	0	0
Coordination	24	4	0	0	0
Area	28	0	0	0	0
Subarea	20	7	0	0	0
Specialty	18	10	0	0	0

The higher education institutions that are partners in the PIBIC/MPEG/CNPq program are located mainly in the metropolitan region of Belém-Pará and total 28. The partnerships with these institutions generated 1154 participating students (from 1997 to 2019), and in 17 of them 1 to 5 students were trained, and in only one of them there were more than 300 students (Table 3). This demonstrates the insertion of MPEG in higher education courses in the state of Para as a fundamental action to enable the exploitation of these potentials in the academy and other development sectors of the country. Similar facts for the Amazon and other Brazilian regions are shown by other authors [1,3, 7,10,11,16].

3.4 Origin and Student Profile

The PIBIC/MPEG/CNPq scholarship holders go through an institutional selection process, for which they must meet the requirements of the public notice, such as: have good academic performance, without disapproval, demonstrate interest in research, tooth others. They are

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indicated by a researcher with scientific production who will be their respective mentors.

The selection occurs once a year and the scholarship are valid for 12 months. In exceptional cases, when there are withdrawals or conclusions of new scholarship course calls are made to fill vacancies. These scholars are valid for less than 12 months. At the end of the scholarship period, students will present the research conducted during the PTBIC/MPEG/CNPq Seminar held annually in the form of an oral communication or panel, depending on the scholarship period. On this occasion, the quality of the Program is evaluated through the results presented, in addition to the interest, performance, and capacity demonstrated by the scholarship recipients.

3.5 Impact of Training for the Amazon Region (Participation/continuity of the scholarship holder in the Program)

The training offered to the PIBIC/MPEG/CNPq program fellows has shown that the contact and stimulus to the fellow with scientific research leading him/her to the academic universe is important:

a) Expand the capacity for interaction between students and researchers at various levels.

b) Improve the capacity of deduction and reasoning.

c) Enable them to enter postgraduate programs.

It is observed that most of the students coming from these programs enter the master's courses of MPEG and other institutions and also conclude the Master's course within the period (two years) established by CAPES (Coordination of Higher Education Improvement). It is worth mentioning that the PIBIC Program has been showing similar impacts in institutions from north to south of the country, demonstrating its important role in the process of training new scientists in the country [1,3,10,11].

IV. CONCLUSION

PIBIC/CNPq Program since its creation in the 1950s has been an important pillar for the training of new scientists in the country, and the PIBIC/MPEG/CNPq data has substantially contributed to the training of new professionals in the eastern amazon region.

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