



Analysis of knowledge production in Applied Social Sciences in Scientific Initiation

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Submitted on: 03/31/2022. **Approved on:** 12/12/2022. **Published on:** 06/21/2024.

ABSTRACT

Higher education institutions play a vital role in generating scientific knowledge through programs like scientific initiation scholarships. Mapping the publications produced through these programs is a key method for assessing and highlighting the development of knowledge. This study examines the scientific outputs of. This article aims to analyze the scientific output of the Programa Institucional de Bolsas de Iniciação Científica (PIBIC) of the Federal University of Ceará, focusing on the communication mediums employed by researchers (e.g., journal articles, conference proceedings). Employing an exploratory, descriptive, and documentary research design with a mixed-methods case study approach, the research utilizes scientific initiation reports as data, categorized based on publication outcomes. The analysis focuses on projects within Applied Social Sciences (SAS) and is statistically grounded in theoretical frameworks related to the Qualis ratings of publications on the Plataforma Sucupira of the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CNPq). The findings reveal that scientific outputs from these initiation projects primarily take the form of journal academic papers and conference proceedings. Mapping these outputs provides a representative sample of the university's scholarly production, addressing institutional, scientific, and societal needs, and thereby supporting the educational development of undergraduate researchers in scientific initiation, a principal goal of the PIBIC program.

Keywords: scientific production; scientific communication; Programa Institucional de Bolsas de Iniciação Científica.

INTRODUCTION

Science advances through the contributions of its community, primarily by sharing results from specialized research. Various fields of knowledge not only progress but also drive social development, reflecting the collective intellectual frameworks they create. The 2019 Web of Science report highlights that approximately 60% of Brazil's scientific research is conducted within public universities.

These Higher Education Institutions (HEIs) are governed by a triad based on teaching, research, and university outreach, where teaching and learning activities are fundamental, and the latter two stem from the former, in favor of the country's social progress and as a producer of knowledge. Research is developed through various incentive plans, such as studies from graduate programs (PG) and undergraduate scientific initiation (IC) scholarships for undergraduates, which come in the form of institutional programs supported by funding agencies and investments from the HEIs themselves, as it is the case of the Institutional Scholarship Program for Scientific Initiation (PIBIC).

PIBIC aims to integrate students into research endeavors, preparing human resources essential for Brazilian science. Participants, alongside their advisors, are committed to testing research hypotheses and generating scientific texts for dissemination through conferences, as well as national and international journals.

It is vital to understand the outputs of these institutions to promote science and sustain investment. Programs like PIBIC justify their existence by their contributions to academic peers and the broader society, highlighting the importance of mapping scientific outputs as a significant area of study.

According to the Centro de Gestão e Estudos Estratégicos (CGEE) in its 2017 assessment of PIBIC remarks that “[...] é imperioso que seus resultados sejam periodicamente avaliados, a fim de que se determine se seus objetivos estão sendo atingidos e aperfeiçoamentos sejam desenvolvidos, caso sejam considerados relevantes” (2017, p. 13)¹. This underscores the significance of PIBIC as a potent mechanism for engaging undergraduates in advanced studies.

Therefore, it is essential to understand how researchers and their advisees communicate their findings to academic communities. The final research reports recorded on the PIBIC platform are not published, which restricts public access to them unless there is an explicit effort by the researchers to disseminate their findings through various communication channels and media.

In light of these considerations, our research addresses the following questions: Do the Applied Social Sciences (SAS) projects associated with PIBIC at the Universidade Federal do Ceará (UFC in the Portuguese acronym) lead to scientific publications? What channels are used to disseminate the findings of these PIBIC/UFC projects?

¹ Translation: “[...] it is imperative that its results be periodically evaluated, in order to determine whether its objectives are being met and improvements are developed, if deemed relevant.” (Centro de Gestão e Estudos Estratégicos, 2017, p. 13, editorial translation).

Our goal is to examine and identify the scientific production presented in the reports of projects from the PIBIC/UFC programs of 2016/2017, 2017/2018, and 2018/2019 related to the SAS, as well as to understand which channels of communication are being adopted by the researchers affiliated with the program. We chose to investigate this sample because of the inclusion of Information Science (IC) and Library Science within the SAS, as well as the possibilities arising from exploring this area within the program, thus obtaining a general and specific overview of what is produced and published from the scientific initiation projects.

Scientific communication and production: some considerations

Communication represents both the starting and concluding point in the research cycle, encompassing the investigations undertaken by scholars and institutions. It is through this communication that members of various academic communities introduce new ideas and foster the development of knowledge across diverse fields.

According to Vasconcelos, Farias, and Farias (2019, p. 238)², scientific communication has the “[...] função primordial garantir o aprimoramento do conhecimento científico a partir do ciclo ininterrupto de corroborações, refutações, teorias e descobertas”, and is “[...] responsável pelos fluxos de informação dentro da comunidade científica”. It engages numerous participants in a diligent process of transforming research into publications targeted at both specialized and broader audience.

The diversity, innovation, and relevance of disseminated information are critical, as noted by Targino (2016, p. 130)³ who emphasizes the expectation that scientists “[...] tragam à tona conhecimentos inovadores e pertinentes que fortaleçam sua função em meio à tessitura social”. Science is inextricably linked with society, affecting and being affected by social changes. Driescher and Silva (2014) highlight that scientific communication also involves subjecting research to peer review, a crucial step for gaining recognition within the scientific community.

Costa (2008) describes the scientific communication process as starting with research and continuing through discussions with peers, culminating in submissions to conferences and journals. She advocates for a hybrid model of publication, both print and electronic. However, given the shift towards electronic media, primarily driven by advances in Information and Communication Technologies (ICT) since her analysis in 2008, the landscape now heavily favors digital formats.

2 Translation: “[...] primary function is to ensure the enhancement of scientific knowledge through an uninterrupted cycle of corroborations, refutations, theories, and discoveries [...] responsible for the information flows within the scientific community” (Vasconcelos; Farias; Farias, 2019, p. 238, editorial translation).

3 Translation: “[...] bring to light innovative and relevant knowledge that strengthens their role within the social fabric” (Targino, 2016, p. 130, editorial translation).

Vasconcelos, Farias, and Farias (2019) and Costa (2008) both underline that the generation of documents is essential for materializing research outcomes, highlighting that production and communication are integral to the flows that define scientific practice and contribute to the consolidation of knowledge within the academic community.

The communication of science involves validating scientific outputs through peer-established criteria, according to Targino and Torres (2014). Originally, scientific communication was meant to circulate knowledge within the academic community, rooted in scientific inquiry and responsible for disseminating researchers' extensive findings. It forms a continuous loop where scientists act as producers, consumers, and evaluators of information. In this context, disseminating results primarily from scientific endeavors, such as academic papers, books, patents are vital for the ongoing construction of knowledge.

Journals remain the most familiar and widely utilized platforms for disseminating research, including papers, reviews, interviews, and more. These outlets are considered reliable due to the rigorous peer-review process each submission undergoes before publication. Academic papers also frequently appear in technical and scientific conference proceedings, further broadening their reach within the scientific community.

Regarding books, the *Dicionário de Biblioteconomia e Arquivologia* (Cunha; Cavalcanti, 2008) defines them as more exhaustive works about a particular subject or several subjects, whether they are scientific or artistic, generally printed (a reality that is being changed with the incorporation of ICT), and which differ from periodical publications and other forms of documentary materials.

Patents are concessions that “[...] um governo outorga a um inventor dando-lhe o direito exclusivo de explorar ou vender seu invento durante um tempo limitado” (Cunha; Cavalcanti, 2008, p. 277)⁴, thus protecting intellectual property. Many patents emerge from research conducted in Higher Education Institutions (HEIs), showcasing their role in fostering innovation within society. While patents predominantly arise from the sciences and health fields within universities, the Applied Social Sciences (SAS) typically exhibit a lesser propensity for patent-producing research (Cunha, 2016).

Durham (1998) notes that public universities are pivotal in supporting research and training researchers in Brazil, governed by a triple helix model of teaching, research, and extension. This model facilitates robust communication across the three domains, enhancing social scientific development.

Publication remains a critical component of academic recognition and career progression. Biava, Pagani, and Oliveira (2017) argue that the reliance on scientific output as a metric of research capability prompts scrutiny of academic productivity and its societal and scientific impacts.

In the current scenario, the report *A pesquisa no Brasil: Promovendo a excelência* (WEB OF SCIENCE GROUP, 2019) assesses the country's research within a global framework.

⁴ Translation: “[...] a government grants to an inventor, giving them the exclusive right to exploit or sell their invention for a limited time” (Cunha; Cavalcanti, 2008, p. 277, editorial translation).

The document presents data on studies published between 2013 and 2018, highlighting the importance of international collaborations and exchange with industry in the impact and visibility of national research (Portal Periódicos da Capes, 2019).

According to this report, Brazil is currently ranked 13th in the global production of indexed research papers and reviews on the Web of Science. Brazilian scholars have published approximately 50,000 articles, witnessing a growth of 30% over the past six years – double the global average. Moreover, during the 2015-2017 period, 81% of joint publications from universities and industry originated from public universities. These institutions have long been the cornerstone of Brazilian Science and Technology Policies, driving their development for many decades.

Despite recent progress, Social Sciences, Humanities, and Arts remain underrepresented, and even overlooked in the report. This, as the authors themselves acknowledge, reflects the lower frequency of publication in the form of books or normative documents in these fields. The focus of research in Brazil has broadened over the last six years, with growth in all areas except Linguistics, Literature, and Arts, highlighting a need for enhanced public policy support in underrepresented disciplines to ensure balanced development across all fields of study.

The advancement of research excellence in Brazil is notably driven by public universities, which are central to fostering international and industrial collaborations. This progress is supported by a range of initiatives, encompassing graduate programs and various projects. Among these, the PIBIC stands out, extending its reach not only to undergraduate students but also, in some instances, to high school students.

Scientific initiation and the PIBIC program

Scientific initiation (IC) scholarships are pivotal in promoting research within undergraduate programs at Higher Education Institutions (HEIs). These scholarships are instrumental not only in nurturing students as researchers and potential graduate candidates but also in preparing them as professionals adept at meeting the demands of the traditional job market. The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) ([201-], *online*)⁵ articulates that “[...] para desenvolver um país é necessário desenvolver pessoas: elevar o patamar de informação disponível e prover a população de conhecimentos básicos de ciência e tecnologia”. This knowledge is crucial for fostering the sociocultural and scientific advancement of the nation. In this context, IC scholarships serve as a catalyst for encouraging students to pursue careers in Science and Technology (S&T). They expose students to a scientific culture from the early years of formal education, engaging them in research projects under the guidance of faculty members who act as research mentors. This

5 Translation: “[...] o desenvolvimento de um país, é essencial desenvolver sua população: elevar o nível de informação disponível e equipar a população com conhecimentos fundamentais de ciência e tecnologia.” (CNPq, [201-] *online*, editorial translation).

approach is designed to cultivate scientific skills and critical thinking necessary for navigating the traditional job market. Massi and Queiroz (2015, p. 7, our emphasis)⁶ propose that IC can be viewed from two distinct perspectives within higher education:

Na primeira, é um processo que abarca todas as experiências vivenciadas pelo aluno durante a graduação, com o **objetivo de promover o seu envolvimento com a pesquisa e, conseqüentemente, sua formação científica**, incluindo programas de treinamento, desenvolvimento de estudos sobre a metodologia científica (dentro de uma disciplina ou não), visitas programadas a institutos de pesquisa e a indústrias etc. Na segunda, [...], a IC é definida como o **desenvolvimento de um projeto de pesquisa elaborado e realizado sob orientação de um docente da universidade, executado com ou sem bolsa para os alunos**.

This understanding emphasizes that IC is not strictly tied to specific programs or scholarships; it can proceed even without financial aid. In this context, scholarships serve as financial incentives, rewarding students' dedication to their projects, given the substantial time commitment required by research activities. Therefore, the comprehensive education of a student is achieved not only through traditional coursework within HEIs but also through immersive experiences in research and knowledge production.

Additionally, Canaan and Nogueira (2015) view IC scholarships as educational assets that enhance academic pathways. They argue that these scholarships are valuable resources that extend students' academic trajectories. Consequently, the PIBIC program emerges as a vital contributor to training human resources, benefiting not just research-oriented careers but also the conventional job market. By developing skills that aid in personal, academic, and professional growth, PIBIC equips students to better navigate various challenges.

PIBIC supports the IC policy implemented across educational and research institutions by allocating scholarships directly to these institutions. These institutions are responsible for selecting the research projects and participants for the program. Beyond the CNPq, various other research funding bodies contribute to IC. Notably, the Research Support Foundations (FAPs) in several Brazilian states also finance IC initiatives, such as the Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico (FUNCAP) in Ceará.

In this regard, according to Fava-de-Moraes and Fava (2000), IC offers various benefits to the student, among which we highlight: (a) escape from routine and curricular structure, differing in oral and written expressions; (b) overcoming fear and panic of the new through autonomy supported by the guidelines of the advisor; (c) better performance in selections, continuity and completion of graduated degrees; (d) better capacity for critical

⁶ Translation: "From one perspective, IC is seen as a holistic process that integrates various educational experiences during undergraduate studies. This approach aims to foster students' engagement with research and, consequently, their scientific training. It includes participation in training programs, studies on scientific methodology (both within and outside formal coursework), and organized visits to research institutes and industries. From a second perspective, IC is defined more narrowly as the development and execution of a research project under the supervision of a university faculty member. This project can be undertaken with or without a scholarship, providing students practical research experience." (Massi; Queiroz, 2015, p. 7, editorial translation).

analysis, intellectual maturity, and discernment to face difficulties in professional life; and (e) bring innovations during project development, which can guarantee creative and original problem solving abilities.

The benefits of the PIBIC program were further illuminated by a 2016 study conducted by the CGEE, which evaluated various of its aspects, particularly its influence on graduate degree training and the professional integration of current students and alumni. The report (CGEE, 2017, p. 44)⁷ remarks that “[...] os bolsistas avaliam muito positivamente as habilidades e competências que a bolsa lhes permitiu desenvolver”. The report also found that 52% of students expressed satisfaction with having completed all the activities proposed by the program, linking the support, guidance, and opportunities provided by both the program and their advisors to effective use of the scholarship and the practical application of the skills acquired in their professional fields.

These benefits are crucial for integrating student training, particularly as they transition to master’s and doctoral programs and bridge the gap between undergraduate and graduate studies. Additionally, they encompass skills and techniques that arise from addressing the challenges inherent in scientific work, thus empowering student agency. The development of critical thinking is a significant aspect of the program experience for most participants, as highlighted by the CGEE study (2017). This process of critical reflection includes promoting the dissemination of project results and presenting the university’s outputs to the broader public, particularly those generated within the PIBIC projects.

It is also noteworthy that CNPq ([201-]) sponsors additional initiatives aimed at fostering scientific initiation for students in higher education and high school, enabling them to engage broadly with science. For higher education, notable programs include the Institutional Programa Institucional de Bolsas de Iniciação Científica nas Ações Afirmativas (PIBIC-Af), the Programa Institucional de Bolsas de Iniciação Científica de Desenvolvimento Tecnológico e Inovação Científica (PIBITI), and the Programa de Iniciação Científica e Mestrado (PICME). These programs are designed to enhance technical training and foster scientific and technological innovation.

At the high school level, programs such as the Programa de Iniciação Científica da Olimpíada Brasileira de Matemática (IC-OBMEP), Programa Institucional de Bolsas de Iniciação Científica para o Ensino Médio (PIBIC-EM), and the Programa de Iniciação Científica Júnior (IC-Jr) primarily aim to cultivate a scientific vocation among students and challenge the misconception that research is exclusively conducted within university settings. This limited perception may stem from inadequate dissemination of these initiatives, leaving much of the Brazilian population unaware of their scope and impact.

⁷ Translation: “[...] the fellows highly value the skills and competencies that the scholarship allowed them to develop” (CGEE, 2017, p. 44, editorial translation).

METHODOLOGY

This paper conducts both exploratory and descriptive research. Exploratory research, according to Gil (2008), seeks to provide a deeper understanding of concepts and ideas, offering a comprehensive view of the subject under study. In contrast, descriptive research aims to detail the characteristics of a specific population or phenomenon. The theoretical foundation of this study was established through a bibliographic survey, forming the basis of our literature review.

The methodology implemented encompassed documentary research, which enabled researchers to draw informed inferences from the data and organize this information in alignment with predefined objectives. This approach proved particularly effective due to its strategic application in analyzing data from PIBIC reports. Additionally, we employed a case study methodology, focusing on a specific instance that is representative of a broader category. This method allows for a thorough and comprehensive examination of one or a more subjects, facilitating detailed analyses and the generation of hypotheses concerning the phenomena observed. (Gil, 2008)

Furthermore, this study incorporated specific strategies for data analysis, which, according to Holanda, Ribeiro, and Jesus (2020), involve examining, categorizing, tabulating, or recombining evidence in alignment with the research objectives. Yin (2015, cited in Holanda, Ribeiro, and Jesus 2020, p. 693)⁸ identifies three analytical strategies, which are described as follows:

- Baseada em proposições teóricas: seguir as proposições teóricas que levaram ao estudo de caso. Essas proposições refletem o conjunto de questões da pesquisa e as revisões feitas na literatura sobre o assunto e as novas interpretações que possam surgir.
- Pensando sobre explicações concorrentes: definir e testar explicações concorrentes; proposições originais talvez possam incluir hipóteses concorrentes.
- Desenvolvendo uma descrição de caso: desenvolver uma estrutura descritiva a fim de organizar o estudo de caso.

For this paper, we employed an analytical strategy anchored in theoretical propositions, reflecting the objectives established and insights derived from both the theoretical framework and the collected data. We utilized reports from approved and completed PIBIC projects from the program call of 02/2016-PIBIC 2016/2017, 03/2017-PIBIC 2017/2018, and 02/2018-PIBIC 2018/2019, as provided by the Pró-Reitoria de Pesquisa e Pós-Graduação (PRPPG) of

8 Translation: “• Based on theoretical propositions: the case study followed theoretical propositions that reflected the research questions and revisions made in the literature on the subject, along with new interpretations that might emerge. • Considering competing explanations: defining and testing competing explanations was vital; original propositions might include these competing hypotheses. • Developing a case description: developing a descriptive framework was crucial to organize the case study.” (Yin, 2015 apud Holanda; Ribeiro; Jesus 2020, p. 693, editorial translation).

UFC⁹. This dataset spanned three academic periods, with data tabulation and organization occurring from August 2019 to July 2020, and the analysis phase conducted between August and October 2020. The data encompassed the following dimensions:

- a) Academic units (campuses, centers, institutes, and faculties of UFC);
- b) The field of knowledge under which the project was registered;
- c) Titles and subtitles of the projects (if applicable); and
- d) Types of scientific communication employed by the projects, including patents, articles, books, book chapters, and presentations at conferences. Further analysis by the SAS also noted the inclusion of abstracts in these categories.

It is important to note that within the PIBIC/UFC projects the presentation at academic conferences are usually oral communications of the research findings. Consequently, a single research output could be documented both as an paper published in a journal and as a communication at conferences, with each instance being counted separately. To illustrate the distribution of these communications, we present **TABLE 1**, which details the total number of approved and completed reports from the PIBIC/UFC projects:

TABLE 1 – Universe of reports from the PIBIC/UFC projects

Period of the PIBIC/UFC project reports	Quantity of the PIBIC/UFC project reports	%
2016/2017	697	32,4%
2017/2018	742	34,5%
2018/2019	710	33%
Total	2.149	100

source: Research data (2020).

However, not all projects in the dataset were associated with scientific productions. Therefore, aligning with the objectives of our study, we filtered out projects that did not report any publications. This exclusion led to the removal of 1,255 reports from the initial pool of 2,149 PIBIC/UFC reports, corresponding to 58.4% of the total. Consequently, the research sample was narrowed to 894 project reports (41.6%) that met the publication criterion.

Upon defining this scope, we focused on data pertaining to SAS, segmented into six area as described in the data sample: Public Administration and Business, Accounting and Tourism; Architecture, Urbanism, and Design; Communication and Information; Law;

9 At Universidade Federal do Ceará the PIBIC is managed by the Coordination Office of the Pró-Reitoria de Pesquisa e Pós-Graduação (PRPPG) with the assistance of the Internal Committee, predominantly composed of PhDs, responsible for the management and evaluation of the program (Universidade Federal do Ceará, [20—]). The objectives of the program align with those of the CNPq, emphasizing the development and nurturing of students' vocations for scientific research, which is one of the most desired outcomes. Furthermore, the program significantly impacts the human, professional, and academic development of the scholarship students through their experiences in the program.

Economics; and Multidisciplinary/Interdisciplinary/Social Applied and Humanities Sciences. From this categorization, the final sample comprised 195 project reports that had been concluded and submitted to the PRPPG over the specified three periods, as detailed in **TABLE 2**.

TABLE 2 – Number of PIBIC/UFC project reports related to Social Applied Sciences fields with and without scientific publications

Area	2016/2017						2017/2018						2018/2019					
	Pr	%	Pc	%	Sp	%	Pr	%	Pc	%	Sp	%	Pr	%	Pc	%	Sp	%
Adm	16	26,2	06	21,4	10	30,3	18	24,7	16	42,1	02	5,7	12	19,7	08	24,2	04	14,3
Aud	0	0	0	0	0	0	09	12,3	05	13,2	04	11,4	10	16,4	06	18,2	04	14,3
Ci	18	29,5	14	50	04	12,1	15	20,5	10	26,3	05	14,3	15	24,6	10	30,3	05	17,9
Di	12	19,7	03	10,7	09	27,3	09	12,3	02	5,3	07	20	09	14,8	05	15,2	04	14,3
Ec	11	18	01	3,6	10	30,3	16	21,9	03	7,9	13	37,1	12	19,7	03	9,1	09	32,1
Mul/Int	04	6,6	04	14,3	0	0	06	8,2	02	5,3	04	11,4	03	4,9	01	3	02	7,1
Total	61	100	28	100	33	100	73	100	38	100	35	100	61	100	33	100	28	100

Source: Research data (2020).

Legend: **Pr** – SAS IC projects; **Pc** – IC projects with scientific publication; **Sp** – IC projects without scientific publication; **Adm** – Public Administration and Business; **Aud** – Urbanism, and Design; **Ci** – Communication and Information; **Di** – Law; **Ec** – Economics; **Mult/Int** – and Multidisciplinary/Interdisciplinary/Social Applied and Humanities Sciences

TABLE 2 shows the distribution of the 195 projects across the three evaluated years: 61 projects (31.2%) for 2016/2017, 73 projects (37.4%) for 2017/2018, and 61 projects (31.2%) for 2018/2019. These are SAS undergraduate research research (referred to herein as “Pr”). This subset represents approximately 11% of the 894 undergraduate research projects with scientific productions and 50.7% of the 195 projects associated with SAS. Furthermore, 99 projects (50.8% of the 195) yielded scientific productions (PC column in the table) in the selected areas, with distribution as follows: 28 in 2016/2017, 38 in 2017/2018, and 33 in 2018/2019.

For data analysis, we employed a mixed-methods approach, encompassing both quantitative and qualitative methodologies. This allowed us to investigate the typologies of papers published in national and international journals and conference proceedings. We utilized the Qualis Journals/CAPES classification system, a well-established evaluation criterion within the academic community, available on the CAPES Plataforma Sucupira. The following pragmatic steps were applied:

1. Identification of the title and, where needed, an internet search for the International Standard Serial Number (ISSN) for verification and/or data supplementation;
2. Search by title and/or ISSN on the Plataforma Sucupira, applying the “2013/2016 quadrennial classification” as the evaluation criterion (most recent official data available); and

3. Comparison of the journal/proceedings' evaluation area with the field of knowledge registered for the project.

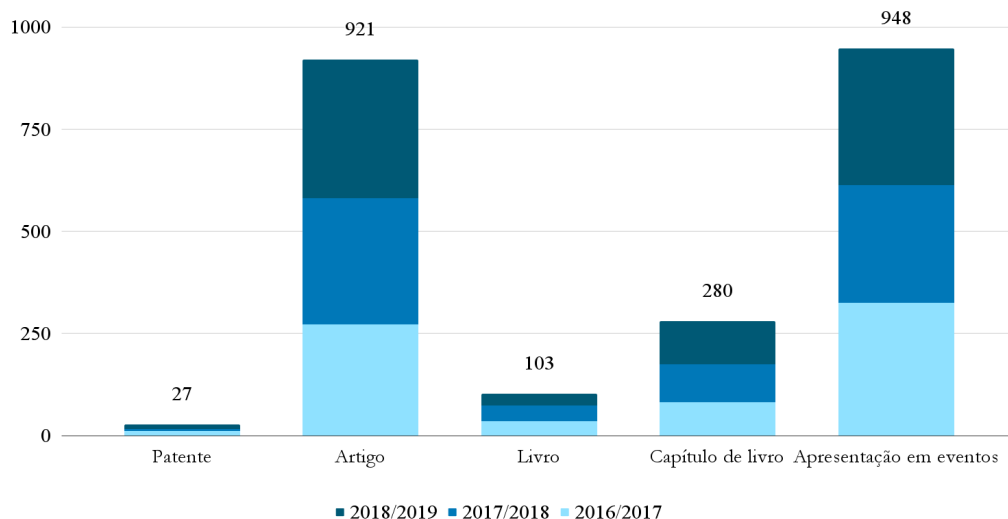
RESULTS ANALYSIS AND DISCUSSION

The data derived from the PIBIC/UFC project reports reveal a clear presence of scientific outputs within the Social Applied Sciences (SAS) field. These outputs primarily consist of journal papers and conference proceedings. Notably, SAS projects demonstrably address social needs, highlighting their engagement with human and societal issues regardless of the researchers' affiliations. While the characteristics of projects with and without publications remained consistent across the study periods, a significant rise in outputs was observed during the 2017/2018 academic year.

From the initial selection of 894 PIBIC/UFC projects, a total of 2,279 scientific productions were documented over the three years examined (725 in 2016/2017, 735 in 2017/2018, and 819 in 2018/2019). These figures encompass patents, articles, books, book chapters, and conference presentations, as documented in final reports and observed during data tabulation, as presented in **CHART 1** below. Among these productions, 246 were conference proceedings and 330 were journal publications (both international and national). Notably, proceedings hosted 432 outputs, while journals published 489, together constituting roughly 41% (921) of the total 2,279 outputs.

CHART 1 further delineates that academic papers (40.4%) and presentations at conferences (41.6%) are the most prevalent forms of scientific communication used by researchers. The prominence of academic paper comes with no surprise and reflect their commonality within scientific communities. Moreover, as noted earlier in section 2 of this study, this typology tends to appear more frequently in journals and conference proceedings, both in terms of the volume of publications per year and the number of works per issue.

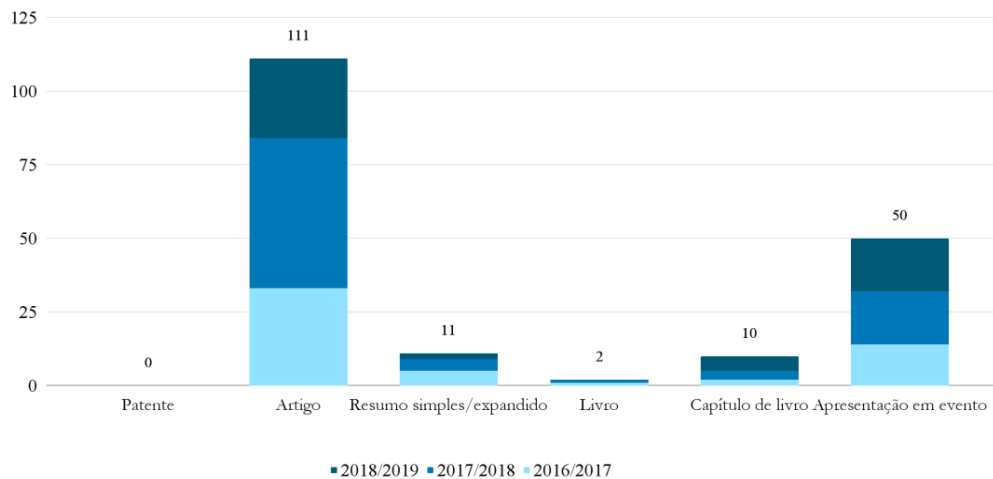
CHART 1 – Typologies of scientific productions identified in the PIBIC/UFC project reports for the periods 2016/2017, 2017/2018, and 2018/2019 (values corresponding to the total projects)



Source: Research data (2020).

From the initial selection of 894 PIBIC/UFC projects, a total of 2,279 scientific productions were documented over the three years examined (725 in 2016/2017, 735 in 2017/2018, and 819 in 2018/2019). These figures encompass patents, articles, books, book chapters, and conference presentations, as documented in final reports and observed during data tabulation. Among these productions, 246 were conference proceedings and 330 were journal publications (both international and national). Notably, proceedings hosted 432 outputs, while journals published 489, together constituting roughly 41% (921) of the total 2,279 outputs.

CHART 2 – Typologies of Scientific Productions Identified in the PIBIC/UFC Project Reports for the Periods 2016/2017, 2017/2018, and 2018/2019, Linked to the Applied Social Sciences



Source: Research data (2020).

The findings depicted in **CHART 2** contrast with those reported by the *Web of Science* (2019), which notes that researchers in the fields of Arts, Humanities, Social Sciences, and Applied Social Sciences frequently produce books or normative documents. These formats are less represented in database, yet Brazilian research in these areas notably achieves higher citation rates than the global average. Despite this, the prevalence of book chapters in our sample aligns with Cunha and Cavalcanti’s (2008) description, suggesting that this medium allows for exhaustive discussions on specific subjects and is favored in the Human and Social Sciences for it allow for a more in-depth analysis.

It is crucial to note that no patents were found in our sample, corroborating the trends identified in science and technology literature: patents are predominantly derived from health and exact sciences. In contrast, Applied Social Sciences traditionally lack a history of research that leads to patents. Although the precise reasons for this absence are unclear, it is recognized that the disciplines within SAS are traditionally professionalized (CGEE, 2017), and therefore, rarely pursue initiatives aimed at producing research outputs in this typology. Nonetheless, this absence does not imply a lack of innovative elements within these projects. On the contrary, innovation remains essential for the progression of science. Indeed, PIBIC research projects have the potential to produce substantial outcomes and introduce fresh insights into established issues, thus embodying the essence of innovation.

In line with our research methodology, we will now proceed to map, identify, and describe the dates and outputs of academic-scientific conferences proceedings and papers published both nationally and internationally, evaluated through their Qualis Journals/ CAPES classification.

Our analysis of 99 PIBIC projects with documented outputs revealed that 88 reported producing papers and abstracts disseminated on various platforms. It's important to note that these numbers may not directly translate to 88 in our further analysis. If a project produced papers and abstracts for both conferences and journals, each instance was counted separately making it the simple sum unfeasible. Furthermore, the data on scientific outputs reflects the scientific production recorded by PIBIC/UFC researchers, as verified during data compilation. Any discrepancies between these reported outputs and the actual figures were addressed by adjusting the final totals used in our analysis.

Accordingly, **TABLE 3** details the number of PIBIC/UFC projects and scientific outputs that recorded publications in conference proceedings and journals in their final reports. Notably, the most frequent types of publications were papers and abstracts, particularly in academic conference settings – a result that aligns with the expectations set by the theoretical framework of this study. The analysis reveals that there are 91 project reports mentioning publications, with 50 projects (54.9% of the total) in conference proceedings and 41 projects (45.1%) in journals. Altogether, these accounted for 126 scientific outputs during the periods reviewed, with 77 in proceedings (61.1%) and 49 in journals (38.9%).

TABLE 3 – Quantitative of PIBIC/UFC projects and scientific productions by scientific communication vehicle for the periods 2016/2017, 2017/2018, and 2018/2019 linked to Applied Social Sciences

Scientific communication media	Period	Applied Social Sciences											
		PIBIC/UFC Projects						Scientific Production					
		Tot.	%	PI	%	PN	%	Tot.	%	PI	%	PN	%
Conference Proceedings	2016/2017	14	15,3	02	2,2	12	13,2	25	19,9	04	3,2	21	16,7
	2017/2018	19	20,9	01	1,1	18	19,7	33	26,2	02	1,6	31	24,6
	2018/2019	17	18,7	0	0	17	18,7	19	15	0	0	19	15
Total		50	54,9	03	3,3	47	51,6	77	61,1	06	4,8	71	56,3
Journals	2016/2017	16	17,6	03	3,3	13	14,3	16	12,7	03	2,4	13	10,3
	2017/2018	13	14,3	03	3,3	10	11	19	15	03	2,4	16	12,7
	2018/2019	12	13,2	02	2,2	10	11	14	11,2	02	1,6	12	9,5
Subtotal		41	45,1	08	8,8	33	36,3	49	38,9	08	6,4	41	32,5
Total		91	100	11	12,1	80	87,9	126	100	14	11,2	112	88,8

Source: Research data (2020).

Caption: **Tot** – Total; **PI** – Publications in international scientific communication vehicles; **PN** – Publications in national scientific communication vehicles

The data suggest a distinct preference among PIBIC/UFC researchers for producing and disseminating their work at conference proceedings. This preference likely stems from the nature of these academic events, that allow a more informal communication style and nearly synchronous debate with the scientific community. Such environments act as incubators for new ideas and their refinement, fostering interpersonal relationships that facilitate the renewal of knowledge and integration of insights into the social fabric, as Targino (2016) has observed.

Referring back to **TABLE 3**, there is a noticeable production increase in the 2017/2018 period, yet the data also indicate a consistency in publications across the years examined. This consistency underscores the sustained flow of scientific communication into the corpus of specialized knowledge (Vasconcelos, Farias, & Farias, 2019). Additionally, the data reveal that, despite the predominance of national publications, there is a significant international¹⁰ presence: 11 project reports, representing 12.1% of the total, noted research-derived works published in international venues, totaling 14 scientific productions or 11.2% of the overall output.

The presence of international production demonstrates that the outputs from PIBIC projects transcend the barriers of Brazilian science, thereby contributing to achieving excellence in research. Regarding national publications, the number of projects with production published in conference proceedings and journals shows similar variations across the selected timeframe, with a total of 80 projects (87.9%), indicating that researchers maintain a consistent level of submission to both types of venues.

Reflecting on the total scientific productions identified in the PIBIC projects within SAS, which corresponds to 183, there are 126 outputs published in proceedings and journals, representing 68.9%. This accounts for more than half of the production in this context and can be seen as indicative of both the program's characteristics and the publication profiles of SAS projects, with a focus on communications aimed for Brazilian audiences. It is important to note that the remaining 57 publications from the aforementioned total were subtracted because they lacked detailed descriptions or had insufficient descriptions allowing a proper publication identification, or they described other types of outputs not selected for the purposes of this paper, such as undergraduate theses.

During the data tabulation and analysis phase, we observed a significant proportion of publications resulted from collaborative efforts and invitations to contribute to multi-authored edited volumes, particularly in the development of book chapters. This trend suggests a robust level of interaction among scientific communities, facilitating the dissemination of Science and Technology (S&T) information relevant to the study's theme. It is worth noting that this collaborative nature is initially reminiscent of the PIBIC program, which, by bringing together researchers from diverse academic backgrounds, fosters similar patterns of collaboration within the scientific community.

Furthermore, the dissemination of research findings provides researchers with recognition for their efforts. As previously highlighted by Droescher and Silva (2014) and

¹⁰ We highlight that the international publications included in our sample, which encompass both conference proceedings and journals, are those that are edited and published abroad. This inclusion reflects entries made by researchers in their final reports, underscoring the global reach of the scientific communication detailed in our analysis.

Targino (2016), this recognition motivates researchers to publish their work, thus enhancing their visibility and establishing their reputation within their field. This visibility also facilitates the formation of partnerships that perpetuate the scientific cycle. Consequently, we contend that the scientific output from PIBIC/UFC effectively fulfills one of the program's key objectives: the development of human resources for Brazilian research. This achievement benefits not only the advisors but also extends to the students involved, enhancing their visibility through the execution and publication of their research.

In accordance with the methodology outlined, we conducted a mapping of the conference proceedings and journals listed in the sample using the CAPES Plataforma Sucupira. This involved searching for the titles recorded in the data to identify both their Qualis strata and the knowledge areas associated with each publication. We assigned the label 'Not located' to those entries that could not be identified during the search.

It is important to note that some of the proceedings from the PIBIC projects were published with an International Standard Book Number (ISBN). Unlike traditional publications, these do not have a designated Qualis stratum but rather a scale level that allows researchers to summarize the characteristics of the publication and assign a specific stratum. Consequently, only a few of these are registered on the Plataforma Sucupira, as there is not yet a developed system to evaluate these type of scientific production (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, 2019).

To avoid redundancy in the titles of publication outlets, each title was considered only once per period. After tabulation, we identified a total of 47 proceedings titles, comprising 15 national and international publications in 2016/2017, 17 in 2017/2018, and 15 national publications in 2018/2019. For the journals, a total of 45 titles were found, with 16 national and international publications in 2016/2017, 19 in 2017/2018, and 10 national publications in 2018/2019.

Furthermore, of the 44 titles of conference proceedings published nationally, those that correspond to the knowledge areas identified by researchers in the PIBIC project reports are primarily in interdisciplinary (13.7%) and urban and regional planning/demography (3.9%). It is important to emphasize that the total count of 52 is based on the total amount of proceedings examined, even when title duplication occurred. We also observed that some studies presented at conferences are subsequently published in journals, as many conferences have partnerships with academic journals. This recurrence underscores that patterns of scientific communication flow and the dynamics within the academic community were reproduced in the PIBIC/UFC project sample.

Regarding their Qualis classification, there was a predominance of the designation 'Not located,' which applied to 42 titles (80.8%), followed by stratum C (19.2%), the only one observed among the ten evaluated outlets. As for the proceedings published internationally, it was not feasible to present them, since none of the three identified titles were located on the Plataforma Sucupira. We understand that both situations likely arose because these publications were issued under the ISBN identifier.

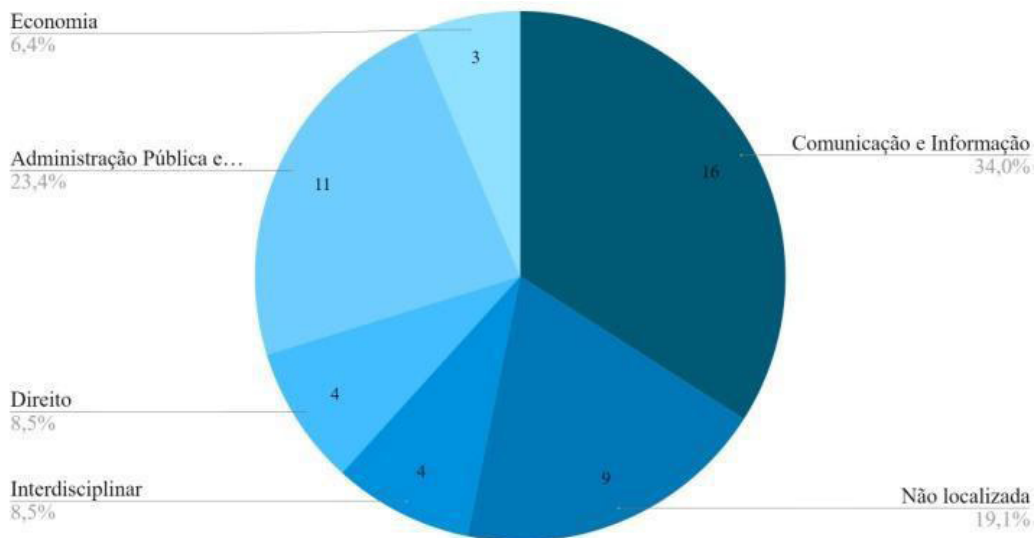
In the case of the four internationally published journals, the results covered three fields: “Communication and Information,” “Interdisciplinary,” and “Economics,” with Qualis classifications of A1, B1, and C (for two projects), respectively. It is noteworthy that there is an international journal classified in the highest stratum (A1), indicating a significant relevance of scientific communication in IC. However, it remains unclear whether the scholarship holders were involved in drafting the papers derived from their research.

Although some descriptions by PIBIC/UFC researchers did not explicitly state whether there was joint publication with PIBIC scholarship students, those mentioning it made it clear co-authorship in peer-reviewed scientific communication outlets. Therefore, we can assert that the critical thinking, skills, and expertise developed in students through participation in the program – as detailed in the CGEE study (2017) – also enrich the experiences of a portion of the PIBIC/UFC scholarship holders. A student’s propensity for research should not be overlooked as a significant factor in their IC experience. However, the encouragement and integration of these potential young researchers into scientific and academic practices have the capacity to retain human resources within Brazilian research community.

Regarding the 41 journal titles published in Brazil, **CHART 3** maps knowledge areas, highlighting the diversity within the selected analytical frame. Similar to the numbers of conference proceedings, which totals 47, with “Communication and Information” being the most prominent, accounting for 16 publications (34%). The category “Public Administration and Business, Accounting Sciences and Tourism,” unique to the FEAAC sample, includes 11 publications (23.4%) and follows the same standardization previously noted.

It is important to note that a significant portion of the journal productions classified under the ‘Not located’ designation – seven out of the nine in this category – were identified in the *Revista Encontros Universitários UFC*. This publication serves as the outlet for abstracts from Encontros Universitários, a conference held at UFC that plays a central role in integrating the academic and higher education community. Participation in these meetings is mandatory for all scholarship holders, including those in the PIBIC program, and currently, the journal does not possess a Qualis classification. This explains and justifies the relatively high percentage of entries in this category.

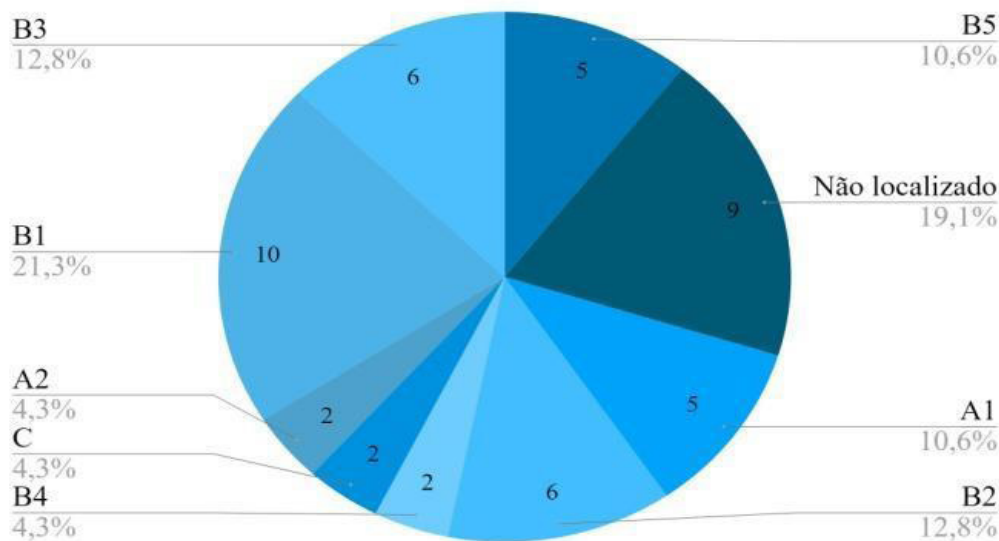
CHART 3 – Knowledge areas of the journals published at the national level linked to the Applied Social Sciences in PIBIC/UFC projects



Source: Research data (2020).

Regarding the Qualis classifications of these journals, the highest frequency observed was for the B1 stratum (21.3%), followed by the ‘Not located’ designation (19.1%), B2 and B3 (12.8%), A1 and B5 (10.6%), and finally A2, B4, and C (4.3%). This distribution, illustrated in **CHART 4**, showcases the diversity of journals in which PIBIC research results are disseminated. It highlights the potential use of these studies in the development of new knowledge within their respective fields and among the scientific communities to which the researchers and students are affiliated. Furthermore, this diversity aligns with the benefits identified by Favade-Moraes and Fava (2000) and the CGEE report (2017), emphasizing the positive impact of such dissemination on scientific advancement.

CHART 4 – Qualis identified in the journals published at the national level linked to the Applied Social Sciences of PIBIC/UFC projects.



Source: Research data (2020).

Considering the six selected knowledge areas, we observe their presence within the evaluation scopes of both journals and conference proceedings. This reflects a strategic preference for outlets where the results might most effectively contribute to the broader body of scientific knowledge. Our data indicate that nearly half of the 195 projects (50.7%) recorded at least one publication in their final report. While this figure represents a significant contribution to scientific output, it is important to recognize that some publications may have occurred after these reports were submitted to the PRPPG. Thus, the actual publication rate could potentially be higher, suggesting an even greater impact of the program as a producer of scientific information.

Among the communication typologies employed by PIBIC/UFC researchers exploring themes related to SAS, we noted a preference for publishing papers and presenting at national conferences. Journals and conference proceedings serve as the primary dissemination mediums, with proceedings often being the dominant channel for scientific output. In the case of journals, those ranked as Qualis B1 and, for proceedings, those ranked as stratum C, were particularly favored. The year 2017/2018 saw the highest number of projects and productions, a trend that persisted throughout the study period. Despite this, the data showed consistency in the values over the targeted timeframe, especially in terms of the proportion of project reports indicating productions and their respective quantities.

The predominance of these communication outlets and strata is understandable, as higher-strata outlets often impose more stringent restrictions on undergraduate participation in the publications and conferences. However, the presence of A1 and A2 journals underscores that the results of IC research contribute significantly to their respective fields, enhancing the development of the sciences and, by extension, the collective knowledge.

Moreover, we posit that the preference exhibited by researchers for specific communication typologies aligns with trends already recognized by academic communities, particularly in terms of reach and, occasionally, the ease of access to these forums. Conference presentations facilitate rapid exchanges of information in Science and Technology and a better opportunity for debates and academic exchange among the participants. Although these interactions are typically informal and somewhat transient, they nonetheless play a crucial role in fostering new studies within the academic scientific community and, frequently, the broader society.

While participation in international venues is markedly less common than national ones, it remains a significant aspect of the program. We did not investigate the direct contributions of students to these international endeavors, as it falls outside the scope of our research. However, when it occurred, such involvement undoubtedly provides the PIBIC scholarship holders with enriching experiences – such as publishing in foreign languages – that enhance their prospects upon transitioning from university to other professional environments, whether at a graduate level or the conventional job market.

Moreover, SAS does not rank among the most prominent areas in the PIBIC/UFC research projects, accounting for only 9% of the total 2,149 projects. However, a closer examination of its specific segment reveals a robust presence of scientific productions that have been published and communicated to peers across various academic and scientific communities. These contributions directly affirm the program's objectives by facilitating both professional and personal development for the students involved.

CONCLUSION

The development and dissemination of scientific communication are pivotal in the cycle of science, considering that such cycle is built upon knowledge that is both fallible and subject to change. This process is enriched through diverse interactions among researchers, educators, students, and the broader scientific communities, along with their networks. Such interactions foster the exchange of information, leading to increasingly specialized and comprehensive investigations.

From the perspective of IC projects, particularly those under the PIBIC program, mapping their outputs provides an effective means to assess the use and impact of resources allocated to educational institutions, especially within public universities. Therefore, this study aims to outline and diagnose the presence of scientific outputs within PIBIC projects within SAS, and to explore the communication outlets employed by the program's researchers for disseminating their findings.

We have identified scientific publications in PIBIC projects; although their representation is less prevalent compared to projects without such outputs, the presence of these publications within the program's scope remains significant. Empirically, a discrepancy is noted between the actual scientific outputs and the potential outputs of SAS projects. It seems that for some

projects, the funding period of 12 months may be inadequate for completing and publishing the proposed research. Consequently, a more detailed investigation into the causes of these publication gaps is necessary to identify underlying factors beyond mere time constraints.

In our analysis of the communication methods employed by the program's researchers, we noted a predominant reliance on papers and presentations at conferences to disseminate the research findings of IC projects. These are primarily published in conference proceedings and journals, which we have chosen as our focal points for analysis. The publications, rated as Qualis B1 and C, demonstrate interdisciplinary characteristics that correspond with the program's fundamentally multidisciplinary nature.

Thus, mapping the scientific publications within the program's framework is crucial for understanding the channels through which researchers make their results known. Journals and proceedings of higher strata not only exhibit greater citation and usage rates but also, the presence of IC-derived outputs within these publications underscores their quality and effectiveness, thereby demonstrating the value of the investments made in scientific initiation.

The process of scientific communication encompasses both the production and dissemination of knowledge, driven by a collective ambition to advance specific fields. Therefore, our aim is not to comprehensively address all aspects of scientific production within the outlined scope. Instead, we seek to integrate diverse perspectives from Information Sciences on this particular subject, thereby enhancing the field's presence in this area of study. Furthermore, we believe this study has contributed to mapping the scientific outputs from PIBIC research projects and the channels through which they are disseminated. We posit that these outputs may be representative of the contributions made by UFC for the Applied Social Sciences, helping to meet institutional demands and requirements of related fields. They generate crucial information in Science and Technology that contributes to both scientific and social development.

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ACKNOWLEDGMENTS

We thank the National Council for Scientific and Technological Development (CNPq) for funding the research through the Institutional Scholarship Program for Scientific Initiation of the Federal University of Ceará (PIBIC/UFC).