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BEIJA-FLOR: WHEN THE APPROXIMATION WITH THE PROFESSIONAL CONTEXT OF FUTURE TEACHERS OCCURS AT THE INTERFACE BETWEEN TEACHING, RESEARCH AND EXTENSION

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Revista ARACÊ
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ABSTRACT
This text aims to analyze the impacts of the Beija-flor project on the training of teacher researchers, focusing on its pedagogical praxis at the interface between teaching, research and extension. The Beija-flor Circuit is a teaching and extension project that involves the internal and external educational community of the Federal Institute of Goiás. During the project, undergraduate students who are in internship or participate in programs such as Pedagogical Residency and PIBID are collaboratively guided by teachers from IF Goiano and basic education for the development of action research projects. These projects focus on strategies and didactic resources based on socio-environmental issues and the Sustainable Development Goals (SDGs). In this way, through supervised immersion in the school, the undergraduates problematize educational needs, raise hypotheses, elaborate and develop projects, culminating in the realization of pedagogical stations in the Beija-flor Circuit. These stations involve both the school where they carry out the internships and other institutions, covering, on average, eight schools and approximately 800 students per edition. The results show that the Beija-flor project strengthens teacher training by integrating teaching, research and extension, providing a practical immersion of the undergraduates in the school reality. The initiative encourages an investigative stance, pedagogical innovation and dialogue between teacher trainers and teachers of basic education. However, challenges, such as the difficulty of participation of working students and the need to expand the scope of the project, indicate ways for its improvement.

Keywords: Teaching praxis. Action Research Projects. Teacher Training. Extension.

Revista ARACÊ
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INTRODUCTION

There is no doubt about the importance of the relationship of the tripod: teaching, research and extension in a Higher Education Institution. In the case of the Federal Institutes of Education, Science and Technology (IFs), institutions that are part of the Federal Network of Brazilian Professional, Scientific and Technological Education (RFEPCT), this importance is further strengthened.

FIs play a fundamental role in the educational, scientific and social development of Brazil. One of its main characteristics is the inseparability between teaching, research and extension, an essential principle for the integral training of students (high school, higher and graduate levels, initial and continuing teacher training programs) and for the transformation of the communities in which they are inserted. Thus, the IFs, by offering all levels of education – from technical to graduate – have a close connection with the community, allowing educational practices to be directly aligned with local and regional demands.

For Pacheco (2011, 2020), the IFs represent an innovation in the Brazilian educational structure, being an original institution, created by Law 11.892 of 2008, uninspired by existing models, whether national or foreign. In this context, one of the main objectives of the IFs is to promote training at various levels of education, ranging from basic education integrated with professional training, to undergraduate and graduate courses. In this formative logic, the IF Goiano has substantially integrated the three dimensions – teaching, research and extension – enabling teaching beyond the traditional classroom, providing a more dynamic, critical and reflective education.

The articulation between teaching, research and extension has proven to be fundamental for the training of teachers in the IF Goiano, where these dimensions are substantially integrated, promoting a dynamic, critical and reflective educational approach. Gonçalves (2016) emphasizes that these dimensions cannot be treated in isolation, but must be seen as a continuous and interconnected process, essential for the development of social solutions and the training of students. Within this context, we have defended the idea that teachers, when investigating their pedagogical practice, are better able to innovate and adapt their methodologies, aligning themselves with the needs of students and educational contexts that are constantly changing, as stated by Paniago *et al.* (2020). In this way, the integration of these three dimensions contributes significantly to the

Revista ARACÊ
ISSN: 2358-2472

creation of a more innovative and contextualized teaching praxis, aimed at the continuous improvement of educational processes.

The proposal by Paniago et al. (2020) emphasizes the need for teacher training that is intrinsically connected to the real context of basic education, which can be seen as a challenge, but also a great opportunity. Nóvoa (1995, 2022), in turn, defends the need to invest in training that stimulates the professional development of teachers through reflection on problems of practice, to encourage the search for alternative contextualized solutions and to value the knowledge of professionals. The problematic situations that teachers are called upon to solve lead to their "reflective self-development" (Nóvoa, 1995, p. 27).

And yet, Nóvoa (2022, p. 7) warns that despite the defense of teachers as researchers, critical intellectuals, there is no appreciation of teachers' reflection and research on their work, because teachers "[...] they are presented as "researchers", or even "critical intellectuals", but they are replaced in their thinking by other professionals, especially academics, and are, also in this case, disqualified as "producers" of their knowledge". This justifies the importance of inserting research in teacher education (Paniago, 2020; André, 2016).

Thus, the approximation with the future professional context, through research, can also contribute to the formation of teachers capable of reflecting on their action – teachers who are researchers of their practices – a conduct that will enable this professional to become a reflective and critical educator, capable of mobilizing different knowledge and practices in their teaching praxis, as proposed by Alarcão (2011), as well as our productions (Paniago, 2017; Paniago et al., 2020). In this theoretical field, we also mention the teachers' movement as reflective and researchers, with emphasis on Zeichner (2008, 1993, 2010), Alarcão (2011), Vieira (2015), Marli André (2016), Pimenta e Lima (2017), Diniz-pereira e Lacerda (2009) and Nóvoa (2022).

This justifies the importance of analyzing a project that aims to make this articulation, because the Beija-Flor Circuit, in addition to being a consolidated event at the Rio Verde Campus of the Federal Institute of Goiano, reaching its IX edition in 2024, establishes the connection between research, teaching and extension. This project has stood out as a space for knowledge sharing, interdisciplinarity and integration between the various courses of the institution. With the active participation of students and professors,

Revista ARACÊ
ISSN: 2358-2472

the event strengthens the campus's commitment to academic training and the insertion of the community in the scientific and cultural environment.

The event involves the entire institution, covering technical, undergraduate and graduate courses. Among the participating courses, the following stand out: Degrees in Biological Sciences, Chemistry; the courses of Agronomic Engineering, Civil Engineering and Computer Science, in addition to the Bachelor's Degree in Animal Science and Administration, as well as Postgraduate courses.

The diversity of areas covered reflects the academic richness of the campus and enables a broad sharing of experiences between the different fields of knowledge. Despite the broad participation of the other courses, in this article, we will focus on the initial training of teachers, one of the fundamental axes of the Beija-Flor Circuit. The above justifies the importance of such research in analyzing to what extent this extension and teaching project effectively contributes or not to the training of teacher researchers and the approximation with the professional context at the interface between teaching, research and extension.

METHODOLOGY

The research approved by the ethics committee, under Opinion No. 5,282,771, adopts a qualitative approach, as proposed by Ludke and André (2017), seeking to understand the contribution of the Beija-Flor Circuit to the training of research teachers in the articulation of teaching, research and extension. For Lüdke and André (2017), qualitative research with a qualitative approach is concerned with understanding the phenomena from the perspective of the subjects involved, valuing the context and the experience of the participants. Unlike quantitative approaches, which seek generalizations and statistical data, qualitative research emphasizes the depth of analysis, exploring meanings, processes, and social interactions. In addition, the authors emphasize that this approach is flexible and dynamic, allowing the researcher to adapt his methods throughout the study. In the process of data collection and analysis, according to Lüdke and André (2017), the interpretation and involvement of researchers in the research field are part of the investigative process, as in our case, as we act as trainers in the disciplines involved in the Teaching Degree courses, of the subjects participating in this research. In this scenario, for the authors, methods such as observation, interviews, document analysis and narratives are often used to capture the perceptions and experiences of the participants.

Revista ARACÊ
ISSN: 2358-2472

Thus, in this context of data collection procedures, we used the written narrative of the researchers, obtained through observation and recorded in a field diary, as well as the narratives produced in portfolios by the students of the Teaching Degree in Biological Sciences and Chemistry, in the discipline "Research and Practice of Intervention in Education I and II", taught by the researchers themselves as professors. For analysis purposes, we are based on the Hummingbird Circuit, referring to the year 2023. The students will be identified by the initials of their names, to preserve their identity, and we will present the narrative of 10 students, as representative of the others.

The data analysis was carried out based on the assumptions of Lüdke and André (2017), who highlight the importance of interpreting the meanings contained in the narratives and qualitative records. Based on Lüdke and André (2017), we sought to make a thorough reading of the portfolios, highlighting for categorization purposes, the research projects signaled by the students with their respective objectives. To this end, content analysis was used, which allows the exploration of the written reports of the students and researchers, evidencing relevant aspects for teacher training. This method enables the identification of emerging categories, which reveal the impacts of the Beija-Flor Circuit on the professional development of future teachers. In this way, the analysis conducted is aligned with the perspective of Lüdke and André (2017), by valuing subjectivity, context and the construction of knowledge based on individual and collective experiences.

RESULTS: WHAT DO THE NARRATIVES OF THE HUMMINGBIRD'S ACTIONS REVEAL

The Beija-Flor Circuit is an institutional event created in 2014. For the collective of the team involved, the name "Beija-Flor" carries a strong symbolism. Just as this bird plays an essential role in pollination by transporting nectar between flowers, for us, the project represents the dissemination of knowledge, connecting academic and community knowledge and promoting the intellectual and social flourishing of the participants. In addition, we understand that hummingbirds are a symbol of transformation and resilience, since, despite their small size, they can travel great distances, adapting to different environments and overcoming challenges.

In addition, the connection of Beija-flor with nature and ecological balance reinforces the importance of sustainability and environmental education, making it a significant name for our purposes, aimed at environmental and ecological awareness and preservation of

Revista ARACÊ
ISSN: 2358-2472

biodiversity. In this way, the name "Hummingbird" is, for us, a metaphor that represents not only the lightness and agility of this bird, but also its fundamental role in the renewal and development of the environment, science, knowledge and technology.

Initially, Beija-flor was configured only as an event. In its first edition, held in 2015, the Beija-Flor project aimed to work on environmental education, arts and culture in the Botanical Garden of IF Goiano – Rio Verde Campus. This year, several activities were developed on campus, involving the families of the servers and society in general.

From the 2017 edition, the Beija-Flor Circuit expanded its reach, gaining a new configuration and consolidating itself as a teaching and extension project with records in extension actions, which imply a trajectory of at least six months, of work to culminate in the circuit. With this, it won the adhesion of basic education schools in Rio Verde, as well as teachers in training and practice, exploring concepts of science, environmental education, diversity, art and culture.

Under the coordination of the Rosa de Saberes Education Center[9], the project has brought the training practices of the IF Goiano closer to Basic Education schools and society in general. In this context, students from the Teaching Degree and Chemistry courses have been the main protagonists, to the extent that, in addition to contributing to the organization of the event, they also develop research projects in the disciplines that make up the curricular matrix of the courses. This process occurs, especially, during the disciplines of Research and Practice of Intervention in Education I and II, as well as in others taught by the trainers, which coincide with the same semester of the Beija-flor Project.

Under the guidance of Rosa de Saberes teachers and campus teachers, advisors of the Teaching Initiation Programs – Pedagogical Residency Program (PRP) and Institutional Teaching Initiation Scholarship Program (PIBID) –, students carry out their investigative activities both within the scope of Beija-flor, as well as in other practices in Basic Education schools. This is because, in general, at the time when the Hummingbird occurs, students are in the Supervised Curricular Internship period or participating in the PRP or PIBID.

Thus, the editions of the Beija-flor Circuit, with their respective objectives, contribute to the training of teachers for sustainable development, with themes based on SDGs 1, 2, 3, 4, 6, 11, 12, 13 and 15.

[9] The Rosa de Saberes Education Center integrates research group activities, Training of Teacher Researchers of Pedagogical Praxis of IF Goiano. As can be followed at the link: Rosa de Saberes Education Center.

Revista ARACÊ
ISSN: 2358-2472

- I Beija-flor Edition (2015): Explore environmental education, arts and culture in the Botanical Garden;
- II Hummingbird Circuit (2017): Healthy eating and the environment – Discuss the importance of healthy eating and a conserved environment;
- III Beija-flor Circuit (2018): Interdisciplinary Teaching Practices for Science Education and Ethnic-Racial Relations – Promote practices of insertion into the professional context of undergraduates through projects focused on the environment, science education and ethnic-racial relations**;**
- IV Beija-flor Circuit (2019): Pedagogy of Science from the perspective of Environmental Education – to promote the experience in Environmental Education activities that incite questioning and learning through investigation;
- V Beija-flor Circuit (2020): Kids Botanical Garden – Reflection on socio-environmental and cultural issues.
- VI Beija-flor Circuit (2021): Cultural and socio-environmental interactions in the pandemic – Providing cultural, socio-environmental interaction and revealing talent;
- VII Hummingbird Circuit (2022): Socio-environmental pedagogical stations in the Botanical Garden – Provide family, society and school integration from a perspective of socio-environmental awareness;
- VIII Hummingbird Circuit (2023): Environment, Technology and Diversity – Reflect on the impacts of technology and science on the environment and society;
- IX Hummingbird Circuit (2024): Water: Source of Life, Sciences, Sustainability – Raise awareness of the importance of the relationship between science, technology and the environment, with a focus on water conservation.

All editions are launched on the website of the Rosa de Saberes Education Center.

About the initial training of teachers, Beija-flor is not a simple Exhibition and/or Punctual Cultural Fair, but the result of action research projects based mainly on the SDGs: 1 – Poverty Eradication; 2 – Zero Hunger and Sustainable Agriculture; 4 – Quality Education; 6–Clean Water and Sanitation; 11–Sustainable Cities and Communities; 12–Responsible Consumption and Production; 13–Action Against Global Change; and 15–Life on Land.

Revista ARACÊ
ISSN: 2358-2472

These results, aligned with the themes of each year, enable the participants of Beija-flor (mostly students of Basic Education) to actively experience the various pedagogical circuits offered and make a living immersion in the world of Science and Technology, reflecting on their impacts on society and the environment. In addition, Bachelor's degree students develop research skills through the elaboration and development of research projects, deepening their academic and pedagogical training.

NARRATIVES OF UNDERGRADUATE STUDENTS

As stated, the action research projects developed by the undergraduates are linked to the themes of education for sustainable development and address the pedagogy of content (Paniago, 2017, 1999; Shulman, 1987). In other words, from this generating theme, the licentiate students problematize situations that involve the teaching of Science, Chemistry and Biological Sciences through immersion in the daily life of the school in the light of academic knowledge, seek alternatives, mobilizing strategies and didactic resources for teaching-learning. Thus, for a semester, they, under the guidance of teachers from the Campus and basic education, organize action research projects in the disciplines that make up the matrix of the courses, developing them in basic education and the practices of Beija-flor.

With this reflection, Pimenta and Lima (2017) contribute, when they defend the importance of research practice in teacher training and praxis, pointing out that teaching, understood as a social practice, necessarily implies research, because it is in the problematization of reality and in the search for answers that the teacher builds knowledge about his practice and the teaching and learning processes. In the same direction, Bezerra *et al* (2023), in a research on immersion in teaching at PIBID, problematizes the training of reflective teachers and argues that pedagogical praxis is included as the basis of the reflective teacher's training process, as well as an alternative for emancipation, the fight against social inequalities, and social justice.

In this way, based on the theme of education for sustainable development, the undergraduates mobilize teaching approaches, based on theoretical approaches, such as active methodologies and *Maker Education*, so that they also explore the potential of the existing laboratories on campus. For example, we have the Rosa de Saberes Education Center, Rosa de Saberes Education Center; we have the *labmaker station*, created in 2020, after approval called SETEC, Public Notice 35/2020, phase I and II, which has

Revista ARACÊ
ISSN: 2358-2472

several pieces of equipment, (3D pen 3D printer, Notebooks, Arduino/Robotics Kit). With *labMaker*, we introduced Maker Education, an approach that enhanced the actions of the Beija-flor Project, as our group has been working to study it, including with an umbrella project registered on Plataforma Brasil. In addition, there is the support of the Goiás State Research Support Foundation (FAPEG), via FAPEG public call No. 09/2023 - SCIENTIFIC AND TECHNOLOGICAL RESEARCH AID PROGRAM - PRÓ-LICENCIATURAS, which made it possible to enhance the actions of production of didactic materials and development of research projects by undergraduate students.

So, for the development of action research projects, the undergraduates make use of the campus laboratories and produce didactic materials as a way to enhance the didactic actions at school and socialization in Beija-flor. In general, several teaching materials have already been produced, ranging from pedagogical games to prototypes of cells, viruses, boards, human body, robots, for the teaching and learning of Science, Chemistry and Biological Sciences. For more information, access the website[10] of the Rosa de Saberes Education Center. After the elaboration and realization of the projects in the basic education schools, under the supervision of the undergraduates, the undergraduates organize the pedagogical stations for the Hummingbird.

In 2023, the VIII Beija-flor, the object of study of this research, was attended by more than 800 students from basic schools. The students were able to visit and participate in the activities proposed by 23 stations, addressing topics ranging from the production of soap using cooking oil, composting, extraction of essential oils, water treatment to waterborne diseases. Thus, according to the analysis of the portfolios, we present, in the following table, some of the projects, with their respective objectives.

[10] Innovative Teaching Practices - Maker Culture Actions (google.com)

Revista ARACÊ
ISSN: 2358-2472

Table 1 - Research projects developed in the Beija-flor 2023 edition

Project Name	Objective(s)
Plant anatomy: identification of plant characteristics using secretory structures.	Arouse the curiosity of children and adolescents through the analysis of secretory structures in plants, about fundamental questions that commonly invade us: "where does the smell of this flower come from?" or "why this potty plant?" even "why in addition to flowers, leaves also have smell?".
Challenges and strategies in the teaching of the discipline of scientific initiation: a case study in elementary education	To provide recommendations and proposals for didactic strategies that can improve the quality of teaching in the discipline of Scientific Initiation, promoting greater interest, participation and understanding of students.
The game running on the periodic table as a strategy in chemistry teaching	Make the teaching of chemistry playful and through the use of *maker* culture, enhancing the memorization and learning of the content from the theme of the game.
Teaching-learning of genetics in active methodologies in biology.	Provide teaching-learning moments for genetics content in the final years of elementary school from *Maker education*.
Green chemistry: reuse of cooking oil for soap production.	Sensitize students on the correct disposal and reuse of cooking oil.
Construction of space rocket replicas and discussion about the accumulation of space waste.	Involve Basic Education students in the process of building rockets; Define what space junk is and how it is formed; To propose a contextualized method for the teaching of Science.
From the morphology of mint to its essential oil: biology and chemistry teaching practices.	To provide teaching-learning moments in an interdisciplinary way from the clonal mint garden.
Ments	Address the physiology of the mint leaf and present the benefits of its essential oil for health and for the food, pharmaceutical and cosmetic industries.
Venomous Animals	Reflect on venomous animals. Myths and truths about poison, the role of venomous animals with the environment.
Igarapé	Discuss the path that water takes to the tap of their homes; water treatments; waterborne diseases, parasitic. Prototypes of parasites printed on a 3D printer. Microscope viewing.
Shoo disease	Raise awareness among students about the importance of the vaccine to fight diseases and save lives.
Ecological Trail	Immerse students in the ecological trail of the botanical garden.
Playing Against Misogyny, Sexism, and LGBTQIAphobia	Sensitize and raise awareness among students about the themes of gender and sexual diversity. Provide an opening for the presentation of reports of experiences on the subject in question. Reflect on the necessary fight against LGBTQIA+ practices in the school context.
Recycling Food/Compost	Reflect on the composter and elucidate the types of composting
Do you know the fauna of the cerrado?	Disseminate and teach, through the station of the Didactic Laboratory of Animal Biology, children and young people a little about the animals of the cerrado, explaining about the biome and which animals we find in it.

Source: authors

As we can see, based on the projects exposed above and other elements of the narratives, the projects developed at Beija-Flor not only articulate teaching, research and

Revista ARACÊ
ISSN: 2358-2472

extension, but are also aligned with the Sustainable Development Goals (SDGs), showing how these academic practices can be directed towards social and environmental transformation. These projects, by involving basic education students in practical learning experiences, promote critical reflection on global reality and needs. At the same time, the Bachelor's degree students carry out an immersion in the school, where they diagnose demands, prepare proposals and develop projects both in the school environment and in Beija-Flor. This process stimulates the development of research skills, forming future research teachers committed to educational transformation.

With this, the integration between teaching, research and extension is at the heart of each project. By providing Undergraduate Students with the opportunity to develop action research projects under the supervision of basic education teachers and undergraduate courses involved, the projects create a collaboration network between IF Goiano and schools, generating a positive impact both on the training of undergraduates and on local educational communities.

Thus, the Beija-flor project has been consolidated as a space for articulation between teaching, research and extension, promoting the training of research teachers who develop innovative and socially pedagogical practices. The projects developed by undergraduate students within this initiative show the commitment to reflective pedagogical praxis and to the construction of knowledge in a collaborative way. In addition, these projects dialogue directly with the Sustainable Development Goals (SDGs), addressing topics such as quality education (SDG 4), health and well-being (SDG 3), responsible consumption and production (SDG 12), and life on land (SDG 15).

For example, the proposal "Plant anatomy: identification of plant characteristics through secretory structures" illustrates this connection by arousing the scientific curiosity of Basic Education students through the observation and investigation of plant morphology. The project not only promotes the development of scientific thinking, but also stimulates the approximation between the school and the IF Goiano, encouraging research and expanding the scientific view of basic education students. A narrative in the portfolio shows the process of dialogue with the basic education school for diagnosis and definition of the theme to be worked on for socialization in Beija-flor:

> Initially, data collection was concentrated in the 9th grade classroom, since, during the work and internship, the student had greater participation and observation in this class, composed of about 32 students. Based on what was observed, we carried out a project on plant anatomy and proposed the realization of practical

Revista ARACÊ
ISSN: 2358-2472

> laboratory activities, with the aim of deepening the knowledge about plant anatomy, in particular, the functions performed by the secretory structures present in different parts of plants. And then he would be presented at Beija-flor. (Narrative in Portfolio, GBR student, 2023).

In the field of new theoretical pedagogical approaches, the proposal "The game running on the periodic table as a strategy in the teaching of chemistry" demonstrates how playfulness can enhance learning. By integrating the *maker culture* in the teaching of Chemistry, the project enables undergraduates to experiment with innovative strategies to make content more accessible and interactive, promoting the development of pedagogical practices aligned with contemporary demands in education. In this sense, the narratives of the group of this project indicate that:

> The project developed aimed at three moments, namely: practical classes in the laboratory where students learned about glassware and simple mixtures, creation of a periodic table for students to delve into the chemical elements and their characteristics, and a visit to the XIII Beija-Flor Circuit that addressed diversities, technologies and the environment. Inspired by the *maker* culture, the second moment of the action plan was the creation of a periodic table by the students, in which they would create periodic tables in cardboard and use different artifices to represent the chemical elements. This activity explored the students' practice of drawing and the creativity to represent the elements in a way that they know them. (Narrative in Student Portfolio J, 2023)

Likewise, the initiative "Green chemistry: reuse of cooking oil for soap production" brings a critical reflection on waste disposal, fostering sustainable practices and encouraging socio-environmental responsibility. The narrative in the portfolio, by the students of the Green Chemistry project, illustrates their action in practice:

> We carried out the green chemistry project, demonstrating to the students the reuse of cooking oil for the production of soap, it was presented with samples and awareness of the use of reagents. The station aimed to bring students a critical look at the incorrect disposal of cooking oil, signaling the impact that this action generates on the environment. The students of the internship school were present and a great interest in the class in a different environment was noticed. In this theme, the students pointed out doubts and questions, we clarified them so that they understood the content. (JA student portfolio, 2023).

Thus, the narrative of the JA student, representative of her group, evidences the interface between teaching, research and extension in the training of research teachers. In teaching, students apply concepts of Green Chemistry, promoting environmental awareness and active participation of students. In extension, the action impacts the school community by bringing sustainable solutions for the disposal of cooking oil. The research

Revista ARACÊ
ISSN: 2358-2472

skills are manifested in the production of the project itself, in the observation of the students' interest, in the formulation of answers to their doubts and in the analysis of the effectiveness of the methodology used. In addition, the portfolio works as an investigative tool, by allowing future teachers to reflect on their practice, identify challenges and improve their didactic strategies, thus consolidating the posture of research teachers

The extension is also strengthened with projects such as "Ecological Trail", which provides immersive experiences in the Botanical Garden and promotes the appreciation of the Cerrado's biodiversity, contributing to environmental education and respect for local ecosystems. Similarly, "Do you know the fauna of the Cerrado?" seeks to disseminate and teach about the animals of this biome, integrating scientific knowledge into the socio-environmental context of the community. In fact, the Ecological Trail of the Rio Verde Campus favors the whole society, an ecological immersion aimed at environmental awareness. Undoubtedly, Beija-flor is an action with great potential for the curricularization of extension in undergraduate degrees. This can be an important tool in this process, as it seeks to integrate extension into the academic curriculum, allowing future teachers to develop skills and experiential knowledge in environments that simulate or directly involve basic school.

The Igarapé project, which discusses the path of water to the taps of homes and the treatments necessary to ensure drinking water, is an educational action that directly reflects SDG 6 – Drinking Water and Sanitation. The analysis of waterborne parasitic diseases, associated with the use of technologies such as 3D printers to create parasite prototypes, highlights the integration between technological innovation and public health, in addition to sensitizing students about the importance of preserving water resources and access to quality water. The possibilities of training research teachers are also highlighted, as students problematize the theme, elaborate a project, collect data and propose solutions. To illustrate, the formative experience of a licentiate student in this station resulted in an article, in which they narrate the impacts on their training,

> The *Igarapé Station* was designed by a group of PRP students who work in different schools, consequently, the regencies, actions and projects they were developing in their respective schools differed.
> The name of the station was the last action to be defined. The inspiration for the name came from some definitions and translations which say that one of the meanings linked to the word Igarapé is "Path of the Waters" and also served as a tribute to the Tupi-Guarani language, one of the original languages of Brazil. Finally, after much writing and much work, the *Igarapé Station* came to life. In it, the

Revista ARACÊ
ISSN: 2358-2472

importance of water was shown and elucidated, as well as its treatment and the processes that are part of this purification for later consumption.
At this stage, the problematization revolved around how what was proposed in the project will be implemented and which will be developed as a station in the Circuit, so that the activities allow the active participation of basic education students. After all, at Beija-flor, we receive many students and they need to immerse themselves in the reflections woven in each season. To this end, a room was set up with a decoration that sought the immersion of students in a natural environment, with a replica of a tree, Ipês, waterfall, referring to the waters, sound of nature and soft colored lights.
About 150 (one hundred and fifty) students from basic education passed through the station. Everyone was able to experience different perceptions, from sound, colors, activities and knowledge about water, its importance, the importance of its treatment, in addition to waterborne parasitic diseases. It was also possible to learn about maker culture and innovation and how it allows, in a physical and material way, to give life to models, objects, replicas, which allow to streamline and facilitate learning, as well as the daily lives of many people. The Beija-Flor circuit is an important moment for the training of research teachers, as it allows them to develop skills specific to scientific writing." (Narrative in Student Portfolio S, 2023, Villas Boas, 2023).

FIGURE 1 – Undergraduate students in the Beija-Flor Circuit

Source: Authors, 2024

Another example of training of teacher researchers, through the articulation of teaching, research and extension, is the project on rocket construction and the discussion on space junk, because, in addition to integrating science and engineering in a fun and educational way, they carry out diagnosis at school, identify the need for improvements in science teaching and involve students in the construction of replicas of rockets. in which they not only learn physics and engineering concepts, but also discuss global issues such as space junk and the challenges of accumulating waste in the environment. This type of contextualized approach makes learning more interesting and relevant for basic education students, in addition to promoting a deeper understanding of contemporary environmental and scientific problems, and, above all, signals that the licentiate students problematized

Revista ARACÊ
ISSN: 2358-2472

the teaching observed in the school and sought solutions, as elucidated in their narratives in the portfolio:

> In diagnosis at school, we noticed that the teaching of Science has been approached in the classroom with the use of limited readings, tiring lists of exercises and a form of cumulative evaluation. In a world with such advanced communication technologies, traditional classes demotivate students, who almost always cannot connect the topics worked on with the reality of everyday life. [...] So, we decided to do the project. When working on the project with the students, the first part addressed the definition of space junk and its origins: how debris is generated and where it is currently found. Students will be encouraged to explore the categories of space junk, which mainly include satellites, rockets, and small debris, such as metal fragments and dust, that transit around planet earth. (Narrative in Portfolio, student M, 2023).

In addition to the commitment to science and sustainability, the projects developed at Beija-flor also address relevant social and cultural issues. The project "Playing against misogyny, sexism and LGBTQIAphobia" exemplifies the importance of the debate on diversity in the school environment, encouraging the construction of a more inclusive and equitable education. This proposal is aligned with SDG 5 (Gender Equality) and SDG 10 (Reduction of Inequalities), by creating a space for reflection and combating gender violence and discrimination in the educational context.

By promoting actions that integrate teaching, research and extension, the Beija-flor project enables Undergraduate Students to develop skills of investigation, planning and teaching practice, training teachers who are more critical and prepared for the contemporary challenges of education. In addition, by establishing dialogues between undergraduates, Basic Education teachers and students, the project fosters a collaborative learning network, essential for the construction of a more innovative, inclusive and socially just education.

Continuing, we mention the Xô Doença project, which sensitizes students about the importance of vaccines to fight diseases and save lives, is aligned with SDG 3 – Health and Well-Being. By informing students about the impact of vaccines on disease prevention and the promotion of effective public health, it also contributes to raising awareness and combating misinformation, which is a central challenge today. This educational approach is crucial to form responsible citizens, prepared to adopt collective health practices.

In summary, the projects in the Beija-flor edition not only strengthen the integration between teaching, research, and extension, but also address global and local issues with a focus on sustainability, public health, and inclusive education. By connecting students with

Revista ARACÊ
ISSN: 2358-2472

relevant scientific and social practices, these projects contribute to the training of research teachers and conscious citizens, aligned with the challenges and objectives of the 2030 Agenda.

In addition, the projects, by focusing on the organization of new teaching methods, are based on active methodologies and *Maker Education*, approaches that encourage practical learning and the active participation of students. In this context, Undergraduate Students have the opportunity to explore the potential of the existing laboratories on campus, using tools such as 3D printers, prototypes and other innovative technologies. This practice of exploring campus resources not only favors the development of interdisciplinary and creative skills, but also reinforces the importance of practical learning as an essential part of teacher education.

In this way, the Beija-Flor Circuit reaffirms its role as an integrating space, fostering the articulation between teaching, research and extension. In the context of teacher training, this initiative contributes significantly to the strengthening of teaching degrees, preparing more qualified educators committed to the transformation of education in Brazil. In addition, Beija-flor provides the opportunity for the entire campus to work collectively, promoting collaboration between technical high school, undergraduate and graduate teachers. This articulation favors the development of a reflective institution, as proposed by Alarcão (2011) in Escola Reflexiva, by encouraging the sharing of knowledge and experiences between different levels of training. The project, by involving teachers and students from different areas and modalities, strengthens a collaborative pedagogical practice, allowing participants to question, evaluate and restructure their methodologies, towards the construction of a more critical, inclusive and innovative education, committed to contemporary social and environmental demands.

Last but not least, we mention the portfolio narrative as a fundamental pedagogical alternative for the development of investigative skills in the training of future research teachers. By recording experiences, challenges and reflections on the project's actions, future teachers exercise a critical and analytical look, essential for educational research. The portfolio allows undergraduates not only to systematize the observations made in the classroom, but also to collect data on the interaction with basic education students, the effectiveness of the methodologies used and the impacts of teaching and extension activities. This process contributes to the construction of an investigative posture, stimulating the review of practices and the continuous improvement of teaching based on

Revista ARACÊ
ISSN: 2358-2472

the analysis of evidence. In addition, it is an excellent tool for collecting data and evaluating the performance of undergraduates. Bierhalz, Mena and Stoll (2020) contribute by elucidating the use of the portfolio in Bachelor's degree courses as an alternative that allows undergraduates to evaluate their learning path, as well as being an evaluation tool, which contributes to reflective training. In the same direction, Gatti *et al* (2019, p. 187) state that procedures, such as teaching cases, reflective diaries, portfolio, classroom observation, which focus on "practice as an object of analysis, are considered creative processes of investigation, explanation, interpretation, and intervention in reality".

FINAL CONSIDERATIONS

By way of final considerations, we can say that the Beija-flor project stands out for its contributions in three main aspects: the integration between teaching, research and extension, the strengthening of the training of research teachers, and the dialogue between peers, including teacher trainers and teachers of basic education.

First, the analysis reveals that the project integrates teaching, research and extension, articulating these three dimensions in a practical and innovative way. By involving Undergraduate Students in extension activities, Beija-flor allows them to experience immersion in the school educational community, in the light of the academic knowledge studied. Research, in turn, is incorporated into praxis practice, allowing future teachers to problematize school situations, develop projects, develop and evaluate new teaching methodologies, while extension enables this knowledge to be disseminated directly to communities and schools. Thus, the project strengthens pedagogical praxis and enriches academic training, by bringing undergraduates closer to the reality of teaching, creating a cycle of continuous learning between theory and practice.

In addition, Beija-flor strengthens the training of research teachers, by providing a practical experience in the campus laboratories, where Undergraduate Students and basic education teachers can explore new pedagogical and technological tools. This contact with research allows the undergraduates to develop an investigative posture in their teaching practices, stimulating critical thinking and innovation in the educational process. In addition, the project trains teachers to become active researchers in their areas of expertise, fostering the production of new knowledge and pedagogical practices.

Finally, Beija-flor promotes dialogue between peers, creating a space for collaboration between teacher trainers and basic education teachers. This constant

Revista ARACÊ
ISSN: 2358-2472

exchange of experiences, knowledge, and pedagogical challenges is essential for the construction of a collective and interdisciplinary pedagogical praxis. The project facilitates communication and integration between different levels of education, allowing campus and basic education educators to support each other, share teaching strategies, and discuss the challenges and solutions that arise in everyday school life. This interaction results in more dynamic, collaborative pedagogical practices adapted to the needs of the school community, strengthening the role of education as a tool for social transformation.

In this way, the Beija-flor project contributes to the construction of a reflective and integrated education, in which teaching, research and extension are inseparable elements in the training of research teachers, while promoting an enriching dialogue between the different educational actors, committed to the continuous improvement of the pedagogical process.

The investigation of its impacts makes it possible to understand how the activities developed help in the construction of a critical and reflective teacher profile, capable of facing the challenges of education. In addition, this analysis allows for the continuous improvement of the practices and strategies of the event, ensuring that it increasingly meets the training needs of future teachers and reinforces its connection with the educational and social reality.

However, despite the contributions evidenced, some challenges are imposed for the consolidation and expansion of the impacts of the Beija-flor project in the initial training of teachers. One of the main obstacles refers to the need to ensure the continuity and sustainability of the initiative, especially in the face of frequent changes in educational policies and funding for teaching, research and extension actions. The maintenance of the involvement of the participants, both of the Undergraduate Students and of the teachers of basic education, also presents itself as a point of attention, requiring strategies that ensure active participation and long-term involvement.

In addition, a specific challenge to be considered is the profile of Undergraduate Students, since many need to reconcile studies with work, which limits the time available to participate in extension actions, or even teaching and research projects. This reality imposes the need to think of flexible strategies that enable greater inclusion of these students, such as activities at alternative times, the use of digital platforms to monitor actions, and the offer of incentives that value participation, such as certifications and academic recognition.

Revista ARACÊ
ISSN: 2358-2472

In the scenario of challenges, we consider that the expansion of the project's reach to a greater number of schools and communities is a point that deserves attention, ensuring that its benefits are not restricted to specific contexts, but effectively contribute to the democratization of knowledge and the training of teachers in different educational realities.

Thus, for the project to continue fulfilling its mission of strengthening teacher training and promoting reflective and transformative teaching, continuous articulation between training institutions, schools and educational managers is essential. Only through this collective effort will it be possible to enhance the impacts of Beija-flor and consolidate it as a reference initiative in the articulation between teaching, research and extension in teacher training and other areas of knowledge in general.

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Revista ARACÊ
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