IFPI IN THE DIFFUSION OF TECHNOLOGY AND INNOVATION IN THE RURAL COMMUNITIES AND SETTLEMENTS OF JOSÉ DE FREITAS DO PIAUÍ

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INTRODUCTION

The municipality of José de Freitas is located in a microregion in the city of Teresina and has an irregular surface of 1,538.17 km^2, which is surrounded by the municipalities of Lagoa Alegre, Cabeceiras do Piauí, Altos, Campo Maior, Teresina and União. According to 2010 Demographic Census, its population is 37,085 inhabitants and is distributed in 21,601 residents in the urban area and 15,484 in the rural area (IBGE, 2010), so that, approximately 41.75% of the population is located in rural communities and settlements.

José de Freitas is also located in Entre Rios Territory, which has been outstanding in recent years for the promising development in the areas of beekeeping; animal husbandry of sheep and goat; the plantation of cashew, sugar cane and banana; and also corn, beans, cassava, watermelon and others. Following this trend, much of the municipality area is used for agricultural practices, mainly for rice, beans and corn production (IBGE, 2017), essential grains for the Small Family Farmers.

Most of José de Freitas population has a low-income profile, in which less than 10% of the population has an occupation or permanent job (IBGE, 2016). In the face of this, many families are maintained by Family Farming, which in some cases involves the participation of all family members in the food production. However, even with this constant and traditional practice, throughout its history, agriculture has been renewed and has improved its techniques that are not often known or used on daily basis by the family farmers and small farmers, which creates even more difficulties to provide food for their families.

Based on this information, the Federal Institute of Education, Science and Technology of Piauí (IFPI[2]) decided to establish an advanced campus

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[2] Initials of "Instituto Federal de Educação, Ciência e Tecnologia do Piauí", in Portuguese.

in José de Freitas with the objective of developing educational actions of teaching, research and extension aimed at the strengthening of organic and sustainable agriculture production. To do so, the institution would try to educate the population with technologies and innovations that, in addition to being inexpensive, are linked to the production of family farmers as well as propose practical solutions to the problems faced by small producers. So, from this perspective, the institution could also contribute to the socioeconomic, technical and educational development of the municipality.

THE CAMPUS ESTABLISHMENT

In 2014, the IFPI and the *Empresa de Gestão de Recursos do Piauí* (EMGERPI)[3] signed the Term of Assignment to free use of a property in the municipality of José de Freitas – PI. The assignment of this property with an area of approximately 23.3 hectares allowed the *Campus Avançado José de Freitas* to be established in the old structure of the Firmo Cunha Agro-technical School, which was close to Barragem do Bezerro, one of the largest tourist references in the municipality of José de Freitas.

At the time, in the campus, there were three buildings, distributed by the administrative area, a library, an auditorium, a computer lab, four classrooms, two bathrooms, one male and one female, and five ruined dormitories. However, as the structure had been reused from the old school, which dates from 1994, the building was in a precarious and unattractive conditions to the community that the campus wanted to offer it , as shown in Picture 1:

[3] It is close to the meaning of "State of Piauí Resources Management Company", in English.

Picture 1 – The entrance of the school. The administrative area. The classroom area

As it was necessary to start from somewhere despite the challenges of dealing with a somewhat depreciated structure and working with few human and material resources, on May 9, 2016, with the Brazilian Ministry of Education's authorization, the *Campus Avançado José de Freitas* started offering technical courses for high school students. The first course to be offered was the Technical Course in Agriculture for the second school semester of 2016, with 40 new vacancies for new students.

With this offer, the first class of the Technical Course in Agriculture had started with 34 students regularly enrolled, in which 24 effectively completed the course. It presented to be a success, above the average of the Federal Institutes of Education in Brazil, that was approximately 47% in 2017, according to data from the Nilo Peçanha Platform.

Between the beginning of the classes in the First Technical Course Class in the second school semester of 2016 and the graduation of this same class in the second school semester of 2017, vacancies for new students were offered in the first school semester of 2017 for the Technical Course in Agriculture and Technical Course in Agroecology, with 40 vacancies each. The courses respectively obtained 39 and 37 initial enrollments, but suffered a high dropout rate that caused a loss, in the first semester, of 34.3% of the number of new students. During 2017, these numbers averaged approximately 50% dropout rates for students enrolled initially in these two classes.

The high dropout rate of these classes had a significant impact on the total number of students. At the beginning of the first school semester of 2017, there were 105 enrolled students in the two technical courses; at the end of the same period, without graduating students, there were only 64 students in total. It is worth mentioning that in the period between the campus implementation and the end of the first school semester of 2017, the number of IFPI permanent employees remained the same: three teachers and three Educational Administrative Technicians (TAE[4]). Due to this limitation of human resources, it was not possible to offer courses in the second school semester of 2017, which negatively affected the campus statistics even more.

The presentation of these information has fundamental importance for the understanding of why it was necessary to change the institution's strategies in the municipality of José de Freitas and, mainly, for the perception that it was extremely important to adopt new methodologies that would integrate the students into practice, while providing a more critical view of the social, environmental and economic impact that their future technical professions would cause in the municipality. Thus, at the end of May 2017, management changes were made on the campus, which led the institution to have a special focus to the actions that then should happen in both the educational and social spheres.

Since then, there has been a constant and gradual diffusion of innovative technologies and techniques, developed and disseminated, among the students, by the José de Freitas Advanced Campus, to the purpose of being used at low cost by the population, small producers and family farmers. The intention was that the intended activities could contribute to

[4] Initials of "Técnicos Administrativos em Educação", in Portuguese.

the socioeconomic development of the municipality, especially affecting the rural communities and settlements of José de Freitas, besides it could contribute to the efficiency of the teaching-learning process of the technical courses students.

DIFFUSION OF TECHNOLOGY AND INNOVATION

One of the first strategies used to boost the role of the José de Freitas Advanced Campus was to do several institutional meetings to government buildings, entities and authorities in the municipality to the purpose of establishing partnerships for the development of IFPI activities in José de Freitas.

During these meetings, the extension projects and the courses developed by the *Campus Avançado José de Freitas* were presented to the institutions, which increased the disclosure and had opened new possibilities of action for IFPI. Due to these partnerships, the campus expanded its material resources, thereby enhancing the practical activities of the courses classes. While the resources increased, the development of extension, research and innovation capacities turned to be more effective to the students, as until then the campus did not have its own financial resources.

To provide the development of these capacities, projects related to activities of teaching, research and extension were proposed to the students. In these projects, the students, guided by IFPI teachers, were encouraged to have an active profile in the actions carried out by the campus. The goal of this initiative was to strengthen the students' relationship with the specific technical knowledge of the Agriculture field, while these students were protagonists in the diffusion of technologies and innovations.

Some projects were made only within the scope of teaching, such as the "Oficina Didática Agrícola[5]", in which students had contact with some agricultural mechanization procedures, such as selection, operation, maintenance, safety, income and cost of using machines and implements (FERRAZ, 2017a), as shown in Picture 2:

[5] It is close to the meaning of "Agricultural Didactic Workshop", in English.

Picture 2 – Activities developed in the "Oficina Didática Agrícola" teaching project

Another teaching project was the "Chocadeira Artesanal[6]" Project (Picture 3), which had the purpose of presenting a low cost alternative for food production, considering that the construction of the brooder could be done by reusing materials.

In the project, the construction of the handmade brooder required only the use of a 24-liter Styrofoam box, an egg support screen, styrofoam containers for water storage, glass for internal viewing, a 15w incandescent bulb, wires, a plug and a thermostat to control the temperature between 37.5 and 38 °C (FERRAZ, 2017b).

Due to the need to have the thermostat, the total cost of the brooder was approximately R$ 100,00: still much lower than the market, which was around R$ 400,00[7].

The development of the project proved to the students and the community that with the proper use of few materials and the application of the knowledge acquired in the technical courses classes, or in the on-campus extension courses, and in related researches, it is possible to produce an efficient brooder that can brood 12 chicken eggs.

[6] It is close to the meaning of "Handmade Brooder", in English.

[7] The amounts were approximately $25.82 for the handmade construction versus $103.30 for a purchase at market value of the brooder.

Picture 3 – Handmade brooder. Students enrolled in the project. Presentation to the Rector and Institutional Development Prorector of IFPI

As for teaching and extension projects, one of the of greatest prominence and impact project developed at the José de Freitas Advanced Campus was the "Sisteminha Embrapa"[8] Project, or just "Sisteminha", as it is briefly called. The project was due to a partnership between IFPI and Brazilian Agricultural Research Corporation (EMBRAPA)[9], where students could be trained to implement low-cost food production modules, which intended to guarantee the food security of low-income families in rural communities and settlements areas of José de Freitas (GUILHERME, 2005 *apud* ALMEIDA, 2017b).

The project was well received by the students and the community in general, once it started from a teaching perspective for students in technical courses and became an extension on-campus course for family farmers.

During the classes of this on-campus extension course, the technical course students, the participants of the extension course and the teacher/coordinator of the project carried out the construction stages of the "Sisteminha" modules. Thus, at the same time as the practical classes demonstrations of project implementation were made, students and farmers ended up effectively implementing the first production modules on campus and in rural communities and settlements, since such practical classes resulted in the construction of the fish farming and poultry farming modules, as shown in Picture 4:

[8] It is close to the meaning of "A little system developed by the Brazilian Agricultural Research Corporation (EMBRAPA)", in English.

[9] Initials of "Empresa Brasileira de Pesquisa Agropecuária", in Portuguese.

Picture 4 – On-campus Extension course. Construction of the fish farming and poultry farming modules at the José de Freitas Advanced Campus

Another project with great impact for the population of José de Freitas was the "JF + Verde"[10] teaching and extension project. The purpose of the project was and continues to be the afforestation of the urban areas of José de Freitas – PI, the trees recovery and the achievement of improvements to the life quality of the population, as well as contribute to environmental education. To this purpose, the project proposes to plant, until 2021, 2,500 trees in several areas of the city, such as squares, streets, avenues, the entrance of the municipality in PI 113 road, in tourist spots, in schools, in public agencies and others (MOURA; MOREIRA, 2018).

The adopted methodology had focused, initially, on the technical part and the improvement of the practice of producing tree and fruit tree seedlings; on the training of students enrolled in the project, with lectures about environmental education; and on the carrying out itinerant actions in public and private schools, non-profit entities and non-governmental organizations in the municipality.

The presentation of lectures in schools and the development of small local interventions, as shown in Picture 5, had demonstrated the impact of environmental awareness in students and in the community, given that after learning about the harm caused by the most common tree in the municipality, *Azadirachta indica* (known as neem, nimtree or Indian lilac), the population began to perform the substitution of this tree for seedlings of *Tabebuia* and *Licania tomentosa* distributed free of change by the José de Freitas Advanced Campus.

[10] It is close to the meaning of "JF Greener", in English. JF are the initials for "José de Freitas", in Portuguese.

Picture 5 – On-campus extension course. Lectures in schools. Small local interventions

Within the framework of the teaching, research and extension projects, the José de Freitas Advanced Campus made researches that were used as a way to integrate theoretical knowledge and practical knowledge, with a didactic and teaching purpose, to then disseminate this knowledge to rural communities and settlements, through extension projects and courses, which contributed to the consolidation of the researches.

In this process, technical course students, IFPI permanent employees and the population of José de Freitas were all involved in an integrated and beneficial way for the socioeconomic, educational and technological improvement of the municipality.

In addition, these projects had a significant impact on the development of students' potentialities and attitudes towards their actions as individuals, citizens and professionals, considering the social context in which they are inserted.

One of the researches that were developed in the campus and had integrated the aspects of teaching, research and extension was the Research Project on "Efeito de Acibenzolar-S-metil (ASM) como Indutor de resistência do pulgão Aphis craccivora Koch 1854 em fava Phaseolus lunatus"[11], or, briefly, Research on "Effect of ASM as a Resistance Inductor for Aphids".

The project was contemplated by the Programa Institucional de Bolsas de Iniciação Cientifica Júnior (PIBIC Jr.)[12] and had consisted of a

[11] It is close to the meaning of "Effect of Acibenzolar-S-methyl (ASM) as Inducer of resistance of aphid Aphis craccivora Koch 1854 in Fava Phaseolus lunatus", in English.

[12] It is close to the meaning of "Program of Scientific Initiation - High Schools (PIBIC-EM)", in English.

research on the ASM resistance inducer, with a view to the study of the faster activation of the natural defense mechanisms of plants against pathogens and insects. The intention of the study was that the ASM could act as a very promising alternative for the control of diseases and pests in the plantations (PORTELA, 2017a).

Initially, the study had only one student enrolled, however, throughout the research, more students showed an interest in voluntarily collaborating with the project for the purpose of learning and assimilating the theory studied in the course classes. Due to that, the research reached a larger audience and acted as a teaching tool. In addition, the results obtained with the development of studies and experiments were disseminated both in rural communities and settlements as well as in municipal events, as shown in Picture 6:

Picture 6 – Research lab. Experiments. Presentation of the research in a municipal event

From integrated actions such as this one, it was possible to promote the training of students, aiming at the development of new ideas related to the technical knowledge discussed in the classroom. Due to this, the students were main characters and had turned their ideas into products and services while they were engaging even more in the activities developed by the campus.

Another research that also involved teaching and extension activities was the Research Project on "Agrofloresta como alternativa para a agricultura sustentável"[13], funded by the State of Piauí Research Support Foundation (FAPEPI)[14] and developed by the Advanced Campus José de Freitas.

The purpose of the project was to propose models of agroforestry that were efficient and compatible with the region of the municipality of José de Freitas, in order to generate positive impacts on the environmental and socioeconomic conditions of the rural producers, considering that the municipality has an area of 21 hectares used for the cultivation of forest species and for crops and grazing for animals (IBGE, 2017).

Observing these data, the research sought to promote improvements and advances in agricultural production through practical and technical knowledge of agroforestry management in the José de Freitas Advanced Campus area, so that the results obtained could serve as a model for the construction of other agroforestry systems in the municipality (FERRAZ, 2017c).

As well as the Research Project on "Effect of ASM as an Inducer of Aphid Resistance", the research on agroforestry systems had initially only one student member. However, during the research, all the students of class I of the Technical Course in Agroecology and class III of the Technical Course in Agriculture got involved in the accomplishment of the studies and experiments. So, the students used practical classes on the agroforestry system as a way to better understand the operation of the research and its importance, since the crops harvested in the system started to be used for the production of snack for all students of the campus technical courses.

At the end of the research, with the "1º Dia de Campo sobre Agrofloresta"[15] event, all the students involved in the activities, with the professor/research supervisor, presented the results of the studies

[13] It is close to the meaning of "Agroforestry as an Alternative for Sustainable Agriculture", in English.
[14] Initials of "Fundação de Amparo à Pesquisa do Estado do Piauí", in Portuguese.
[15] It is close to the meaning of "1st Field Day on Agroforestry", in English.

and experiments to the rural communities and settlements of José de Freitas, and also for other students and the IFPI permanent employees, as shown in Picture 7:

Picture 7 – Students working in the development of the project. Presentation of the outcomes in the event

In addition to constantly seeking vocational training for students, the Advanced Campus José de Freitas offered extension courses to provide certification for small farmers and family farmers in the use of techniques for sustainable agriculture and organic production.

Most of the students in the extension courses did not have enough schooling or time to complete the technical courses, so they attended short time courses as a way to become updated and perform their activities more efficiently and better cost-benefit.

Among the many courses developed at the campus, there were the extension courses in "Produção de mudas frutíferas enxertadas"[16], "Processo produtivo na Agricultura Orgânica"[17] and "Processo de Produção em Hortas Orgânicas"[18]. These courses were carried out as a capacity building for the

[16] It is close to the meaning of "Production of grafted fruit trees", in English.
[17] It is close to the meaning of "Production process in organic agriculture", in English.
[18] It is close to the meaning of "Production process in organic horticulture", in English.

participants of the homonyms extension projects, proposed by the teachers of the technical courses at the IFPI – José de Freitas Advanced Campus as a way of approaching the institution of the community, as shown in Picture 8:

Picture 8 – On-campus extension courses for small farmers and family farmers

The main purpose of the extension course in "Produção de mudas frutíferas enxertadas" was to provide theoretical and practical subsidies related to the implantation of plant nurseries and the production of seedlings of fruit species. The intention of the extension course was to instruct the local labor for the production and sale of seedlings, providing knowledge and enabling income generation for the small family farmer (PORTELA, 2017a). Thus, at the same time that the extension course students were instructed to generate income, they were acquiring the knowledge to produce quality fruit trees adapted to the José de Freitas region.

The extension course in "Processo produtivo na Agricultura Orgânica" aimed to provide family farmers with an awareness of the need to preserve and better used of natural resources. The extension course used basic concepts that guide organic agriculture in order to facilitate the development of the daily activities of producers working in organic production, emphasizing the importance of field work being carried out with sustainable development (ALMEIDA, 2017a).

The extension course in "Processo de Produção em Hortas Orgânicas" was developed with the purpose of approaching topics related to the role of the horticulture in the school and the preparation of gardens, taking into account information such as location, tools, preparation and fertilization of flower beds and other care (MELO JÚNIOR, 2017). In addition, the course carried out practical experiments in the community and school gardens, reaching a public formed by horticulturists from

the Bezerro neighborhood, the Municipal School Agripina Portela, the Sindicato dos Trabalhadores da Agricultura Familiar (SINTRAF)[19] and the Municipal Department of Agriculture.

The three extension courses had the collaboration of the technical courses students, so that it was possible for the students to have a better understanding about the fundamentals and the productive processes. The extension courses related theory to practice and potentiated the knowledge and the control of more suitable agricultural techniques and processes for application. This is also compounded by the fact that the courses enabled students to improve the ability to develop, implement and maintain agricultural projects under technically feasible conditions.

As a result of this greater integration between the students and the practice, the campus was also able to focus on the development of innovative techniques for cultivation, performing experiments on adaptation and improvement in the plantation of papaya, grape, cassava, cocoa, strawberry and others. The results obtained from these plantations were later disseminated to the population of José de Freitas through lectures, events and visits.

Among the events that the Advanced Campus José de Freitas held or participated in, the most important were the Creole Seeds Fair, the VIII Family Agriculture Fair, the Revitalization of Barragem do Bezerro, the Commemoration of World Water Day, the Commemoration of National Soil Day, the Celebration of the World Environment Day and the Commemoration of the José de Freitas' Anniversary.

In each of these events the students once again took on the role of main characters and were responsible for presenting the projects developed at IFPI by them and the teachers in order to benefit the community and bring positive impacts to the municipality, as shown by the events in the Picture 9:

[19] It is close to the meaning of "Union of Family Farming Workers", in English.

Picture 9 – Presentation of teaching, research and extension projects at municipal events

CONCLUSION

As shown above, the development of integrated teaching, research and extension actions had fundamental importance for the development of the students of the technical courses and for the training of rural communities and settlements of José de Freitas. At the same time, these actions helped the fulfillment of the José de Freitas Advanced Campus and all the IFPI mission in promoting an education of excellence, directed to the social demands.

During this process of formation and transformation, the positive acceptance of rural communities and settlements to the technologies and innovations developed by the campus, which, in addition to being inexpensive, were related to the production of family farmers and offered practical solutions for the difficulties faced by the small producer.

The participation of the students in technical courses was also very important during this process, once they constantly searched for trainning and improving their research, extension and innovation skills in order to contribute to the activities developed by the campus, thus preparing themselves better for their future technical works.

During this journey carried out by the entire community that is part of the José de Freitas Advanced Campus, it was noticed that in addition to the campus activities contribution to the socioeconomic, technical and educational aspects of the municipality, the sum of these factors drastically reduced the statistics of evasion and guaranteed the permanence and success of the students of the technical courses in Agriculture and in Agroecology, as shown in Picture 10:

STATISTIC OF PERMANENCE (2016.2 – 2018.1)

SCHOOL SEMESTER 2016.2

TECHNICAL COURSE CLASS	INITIAL SEMESTER	REGISTERS	FINAL REGISTERS	% OF SUCCESS
Agriculture	2016.2	34	29	85,3%

SCHOOL SEMESTER 2017.1

TECHNICAL COURSE CLASS	INITIAL SEMESTER	REGISTERS	FINAL REGISTERS	% OF SUCCESS
Agriculture	2016.2	29	26	89,6%
Agriculture	2017.1	39	26	66,6%
Agroecology	2017.1	37	24	64,9%

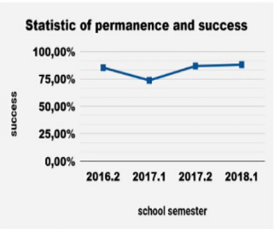
SCHOOL SEMESTER 2017.2

TECHNICAL COURSE CLASS	INITIAL SEMESTER	REGISTERS	FINAL REGISTERS	% OF SUCCESS
Agriculture	2016.2	26	24	92,3%
Agriculture	2017.1	26	21	80,8%
Agroecology	2017.1	24	21	87,5%

SCHOOL SEMESTER 2018.1

TECHNICAL COURSE CLASS	INITIAL SEMESTER	REGISTERS	FINAL REGISTERS	% OF SUCCESS
Agriculture	2017.1	21	20	95,2%
Agroecology	2017.1	21	18	85,7%
Agriculture	2018.1	29	24	82,8%
Agroecology	2018.1	43	38	88,4%

PERMANENCE AND SUCCESS	
SCHOOL SEMESTER	RATE
2016.2	85,30%
2017.1	73,70%
2017.2	86,80%
2018.1	88,00%



Picture 10 – Statistic of permanence and success

The result of the efforts of the students, the permanent employees and the employees of the José de Freitas Advanced Campus allowed the campus to develop and offer a better structure (Picture 11), as well as allowed the campus to have more human resources (7 teachers and 4 TAE) to offer to the population of José de Freitas and to the students of the technical courses, that already reached 114 students in the first school semester of 2018.

Picture 11 – New structure of the José de Freitas Advanced Campus

These facts lead to the conclusion of the importance of the professionalizing school within the municipality, considering that the IFPI has been one of the main responsible for the diffusion of technologies and innovations in José de Freitas – PI, which has proved to be of mutual benefit to this educational institution and the community in which it is inserted.

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