"Flying Higher": Understanding the Meanings Given to Scientific Initiation in Brazil

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Abstract

This article discusses how Brazil's Institutional Scholarship Institutional Scholarship Program for Scientific Initiation in High School (PIBIC-EM), which is designed to encourage young people to enter science careers and to increase the celerity of scientific training, is understood by the grantees as a mechanism that facilitates their access to higher education and, consequently, to improved class status. The authors consider the fundamental theoretical framework concerning the analysis of public policies on careers in science, as well as relevant ideas regarding the role of education in the acquisition of cultural and relational capital. The authors present the idea that during participation in the program young people develop modus operandi that break certain class conditionings, anticipating futures that otherwise would be difficult for them to envision. The article is based on a study that included documentary analysis, as well as in-depth interviews with grantees in four public schools and seven supervisors in the PIBIC - EM at the Federal University at Santa Catarina (UFSC) campuses of Florianópolis, Araranguá and Curitibanos in southern Brazil . The conclusions point out the positive influence of the program in strengthening opportunities for professional trajectories for students from low-income families

Keywords: scientific research initiation; time; education; science.

1. Introduction

In Brazil, unequal and limited social, economic and cultural opportunity continues to be the most important explanatory variable of the level of academic access, permanence and success of low-income students. Brazilian students from this social background usually do not aspire to enter higher education because university enrolment, particularly at the public universities considered the best in the country, has not historically been a realistic opportunity on their horizon, which is strongly determined by class. In fact, as widely recognized by research (Zago 2006), higher education in Brazil is highly selective. Socially represented as prestigious institutions, universities are understood to be remote opportunities for most lower class Brazilians who do not feel they have the qualifications to access these institutions. This is why higher education is usually understood as a privilege for the few and most Brazilian youth abandon their studies before reaching higher education.

It is understandable that the greatly expanding access to primary and secondary education in Brazil in recent years has not reduced "problems related to quality of education" (Zago 2006, 232).

Nevertheless, some recent policies seem to have created opportunities for individuals from the lower social classes to think about different futures, at least for those students with better academic performance. One example of these political measures is the Institutional Scholarship Program for Scientific Initiation in High School (PIBIC-EM), which was first implemented in 2010.

This is a program designed to promote initiation in scientific research. It provides 3- to 6- month grants to high school students so they can conduct research that is part of a broader research project supervised by a university-level

professor. The program was conceived as part of broader measures to develop science and technology in Brazil. Its primary goal is to encourage young people to enter academic life, by promoting their early access to scientific research while still in high school, providing them training in skills that can help them progress in a research career. The program also helps scientific institutions attain excellence in scientific and technological research.

This program is beginning to show another parallel effect as it begins to empower low-income students to access and develop a trajectory in the field of science. Moreover, the program may fuel important levels of confidence that lead students to question the "magic barriers" (Bourdieu 1998) they assume to be imposed by their social class. By participating in the program, these students begin to have early contacts with the world of higher education, and these contacts may positively influence their professional prospects and personal futures.

The article will emphasize that this program is understood by the grant recipients as a mechanism for facilitating access to public higher education and, therefore, a program that can promote inter-generational social mobility.

Based on these ideas, and considering that studies on the subject are still highly focused on the immediate impacts of the program, especially regarding the development of research skills (Fava-de-Moraes 2000), this text describes and discusses not the reliability of these consequences, but mainly, how and to what extent students think of the program as a mechanism for class mobility. Thus, the objective is to analyse student's experiences and representations, as well as their social aspirations and expectations about their participation in the program.

The text combines information from official documents with data provided by interviews with students from four public schools and seven supervisors in the PIBIC-EM at the Federal University at Santa Catarina's (UFSC) campuses in Florianópolis, Araranguá and Curitibanos.

To analyse the grantees' experiences and visions of the future, it is first important to look at the institutional situation in which the Scholarship Program for Scientific Initiation in High School emerged. This general framework allows better understanding the nature of the main discourses that justify the implementation of the program, making it possible to discern some of the main policy traits inscribed in them. The article is divided into three additional sections. Part two contextualizes the initiation to scientific research, from an institutional and a political point of view, presenting the main concepts in use. Part three presents the research methodology used. The final section analyses the present day situation, discussing the study's main conclusions.

2. Theoretical Framework

2.1 Institutional contexts

In Brazil, the use of so-called scientific initiation (SI) programs to immerse high school students in scientific research is fairly recent, dating to 2003. In fact, this program can only be fully understood by considering how graduate studies programs are evaluated and funded in the country. It is also necessary to consider changes in laws referring to what is known as the *average time to graduation.* This is a law that defines the standard length of time for completing masters and doctoral degrees. The Institution for the Improvement of Higher Education Personnel (CAPES) was established in 1951 by the Ministry of Education. However, it only began complete activities 15 years later, to meet the expectations for graduate programs of the new military regime (1964-1985), which considered graduate studies to be a key vehicle for building Brazil as a "Great Power "(Ferreira Jr and Bittar, 2008).

In the early 1990s the CAPES Foundation became responsible for developing national plans for graduate education, and for various regulatory roles for higher education in general. It also became the principal agency for funding and evaluating research. In conjunction with the National Council for Scientific and Technological Development (CNPq) and some state level Foundations for Research (FAPs), such as FAPESP in São Paulo state, CAPES also began to provide financing for undergraduate students. As funders, these agencies extended their control over research results and time limits for completing a degree. In this way, CAPES also began to have direct influence on graduate studies in two important ways (Bianchetti, 2002; Bianchetti et al, 2012). Firstly, by establishing a compulsory time limit for students to finish the degrees. Secondly, by imposing a reward and punishment system that determined that each delay would lead to a negative evaluation with impacts on the evaluation of the institutions, students and supervisors.

It is understandable that parallel to these measures, other institutions and governmental agencies began to develop programs that sought to prepare students to complete their degrees with celerity and encourage the commitment of novice researchers at the undergraduate level.

One example of these efforts is the Institutional Scholarship Program for Scientific Initiation in High School (PIBIC-EM) which provides scholarships to high school students, to: "Awaken the scientific vocation and encourage potential

talents among students from public elementary, high school and professional schools, promoting their participation in scientific or technological research activities, guided by a qualified researcher in higher education institutions or institutes/ research centres" (CNPq, 2011). These policies have sought to develop a "scientific vocation", seeking to attract youth with better academic results to scientific careers (Vieira, 2007) and prepare them for graduate studies.

The policy measures were gradually oriented towards promoting the development of young students' *savoir faire* for research, as CNPq affirmed. In this sense, PIBIC-EM may be seen as a measure that fosters students at an early age to attain higher "qualifications" in research during their undergraduate studies.

2.2 Precocity and undergraduate research

Several authors who have analysed the individual trajectories of researchers and scientists, have emphasized the positive correlations between the degree of density of the professional trajectories and the level of scientific productivity each researcher achieves. Indeed, Dietz and Bozeman (2005) concluded, in a study about productivity in the academic careers of engineers and scientists, that the number of relationships each investigator develops in the early stages of their careers and the rate at which he or she publishes scientific articles, are directly and positively related to the productivity of these researchers in later stages of their careers. These authors write that "Early career experiences through graduate assistantships and postdoctoral research experiences will result in higher productivity." The presumption is that these early experiences will provide opportunities to build S & T human capital "(Dietz and Bozeman 2005, 354).

Other studies in different contexts have had similar conclusions. They reveal the positive relationship between early scientific research, academic recognition and a scientist's productivity (Onofrio, 2010).

2.3 Class, horizon and aspiration

One of the central tenets of social theory is that the socialization process is highly relevant in the definition of life trajectories. In Western societies, there is increasing interest in theories that discern the role of variables besides class in conditioning individual trajectories, at professional and personal levels. Some authors and schools have even proposed that the "death" of class is the major emerging quality of post-modern societies (Pakulski and Waters 1996). That is, societies in which social behaviour is mobilized around other variables, such as lifestyles, emotions, aesthetics aspirations, and others.

Even if these approaches hold true for some societies, it is a fact that "synthesis theories", which propose that social paths are a result of a complex connection between social structures and individual agency, are still enormously relevant to understanding life paths in most societies. Thus, it may be affirmed that, despite the increasing level of agency and reflexivity an individual can show in life, social paths are still closely connected to a set of objective and subjective conditions that shape life chances.

Brazil is strongly marked by a high level of social inequality and has enormous geographical disparities in terms of social and economic development. Therefore, theoretical frameworks that indicate how class permeates life trajectories and affects personal decisions are still extremely relevant, since they allow problematizing the impacts of educational policies, not only on social mobility, but also in terms of the transformation of students' aspirations.

Theories of social stratification have sustained that through a gradual process of socialization, class of origin imprints on individual minds , the type of aspirations and expectations that are in keeping with an individual's objective living conditions. Lawe (1971) affirms that aspirations, always recognizing individual and social factors, are the fruit of interactions deeply influenced by family and class of origin. Bourdieu and Passeron (1964, 1971) have also argued that school contributes to the reproduction of social inequalities. Golthorpe (1987, 2010), Lasker and Taylor (1996), Werfhorst (2002), Glass (2003), Hertz (2006) and Devine (2004) have emphasized the weight of class in determining the "horizon of possibilities" that determine what can be projected, imagined, desired, expected.

Nevertheless, as stated above, despite the conditioning effect class has on people's ability to project and anticipate their future, it becomes pertinent to highlight their ability to mobilize strategies that may or may not radically change the more expected trajectory, a type of process that is well expressed by Lahire's concept of "unlinked trajectory" (2008).

With these considerations, this article posits the hypothesis that the initiation to scientific research is perceived by students not only as relevant for early promotion of their careers in science, but also as a concrete way to establish new opportunities in life.

3. Research Method

The text is based on the analysis of selected documents produced by CNPq, as well structured interviews with nine grant recipients from four public schools and seven advisors in the PIBIC-EM at the Federal University at Santa Catarina (UFSC) campuses in Florianópolis, Araranguá and Curitibanos. The documental information, as well as interviews, which were recorded, were subjected to content analysis, using a set of predefined categories. This text will discuss three of them - anticipatory socialization, unlikely trajectory and career prospects – because they provide a better understanding of the importance given by students and their families to participation in the program.

The interviews followed a previously defined guide, based on issues considered relevant. The interviews are particularly rich because they reveal the students' linguistic repertoires. As Bourdieu (1983) described, speech is a performative act that reveals, more than content, a specific *habitus*, which serves as a form of social and identity affirmation. In this case, the responses are not only marked by the type of language used by youth in general. They also reveal difficulties in several competencies, including vocabulary, grammar and sentence structure.

Considering that our study reflects on processes of cultural differentiation, the translations attempt to remain faithful to the style of language used by the respondents.

Before presenting the results, it is important to highlight some of the main characteristics of the interviewees, namely their class of origin and the educational level and occupation of their parents.

Table 1 – Parent's level of education and occupation

Case	Father's (level of education)	Mother's (level of education)	Father's professional activity	Mother's professional activity
01	EMI	EMI	General Service	General Service
02	EFI	EMC	General Service	General Service
03	EMC	EFI	Air Force officer	Housewife
04	EMC	ESC	importer	Working of financial sector
05	EFI	EFI	Farmer	Farmer
06	EMC	EMI	unemployed	Retired
07	EMC	EFI	Farmer	Retired
08	EFC	EMC	Attendant	General Service
09	EMC	EFC	Farmer	Farmer
10	EFC	EMI	Retired	Commercial
11	EFI	EFI	Stonemason	Maid

EFI – Elementary school incomplete EFC – Elementary school complete. EMI – High School Incomplete. EMC – High School complete. ESC- Higher Education complete.

The table indicates that in general, the educational level of the parents is low. However, as other author's have indicated, this lack of cultural capital leads to a strong valorisation of education as a means for their children to improve their opportunities and raise their class status.

Table 2 – Siblings level of education

Case	Siblings that had finished or are still in high school	Siblings that had finished or are still in higher education
01	1	-
02	1	-
03	1	1
04	-	1
05	1	1
06	1	-
07	3	-
08	-	2
09	-	1
10	-	-
11	-	-

4. Results and Discussion

4.1 Anticipatory socializations and unlikely trajectories

The interviews show that the decision to participate in the IC-EM is rationally driven. Entrance in the program is understood as a way to anticipate access to higher education and take the first steps towards a degree. Access to the program is seen as a way to avoid the "most probable trajectory" (determined by class origin) and design a future with more and different opportunities.

In spite of the confidence they gain by participating in the program, prior information they have about difficulties they will probably face in higher education make them want to participate in the program to gain whatever advantage it may offer. The narratives of the participants indicate a considerable level of anxiety, as they try to anticipate as much as possible what may be useful to them. The responses indicate that access to the university is intentionally sought by the grantees who say that participation would give them a better "sense of how it will be", "because I would have a foot inside. I would already have contact". The excerpts below express the relationship between the notions they have about scientific initiation and their aspirations for social mobility. They reveal an interest in investing in mechanisms for social promotion, to be better prepared to confront a world that is foreign to them, to which they feel they do not belong, which they refer to as "that world". The frequent use of the time related adverb "already" emphasizes the importance they place in the program as a stepping stone towards higher education that will help them meet its demands. Here are some of their declarations:

> E 1: [participating] means having greater facility to enter a university, considering that society, [knows about the greater difficulties] people coming from public schools have accessing the university. So, I got interested because it would allow me to have a foot inside, I would already have contact. I could already learn more about that world that is the university, which is a higher education course.

> E 8 : It is because here we have more contact, we have a better notion about what the university will be like because there is a great difference between that and high school, it requires more education. (...) One needs to work much harder. So, this gives us a notion [of that].

> E 2: It's a rewarding project. It is scientifically good in terms of what you learn, learning from research, you can be more in touch with different people, it gives you another approximation with the university, deconstructing some ideas that we may have.

> E 5: I think that it will help me to get into the university. We also have more knowledge to be able to take the tests.

> E 3: Well, I have actually learned that research is work that we do here at school and it is really quite different from the work that we will face in the future. Here, we research anything and then hand it in and the job is finished. It's different from a university, where you have to do everything you are learning. Making references, doing an abstract, it can't be ctrl c ctrl v. It's more complicated. And that's what I'm learning; I really understand the meaning of true research. Research of a higher level, I would say.

The student's narratives are rich in details about what they need to do to break with their most probable trajectory. They speak about their need to learn, conform and become familiar with a habitus or an ethos that will guarantee that they have the skills they need to be accepted in the "world" of higher education. As they say, participation in the programme allows them to "fly higher". The knowledge of and awareness they have about the need to follow certain rules that are important in academic and scientific contexts may be noticed in the expressions they use when approaching the interviewer as a participant. They say that the program serves as a test because it allows them to "approach" the university; to "learn" and "deeply understand the significance of research", and how to handle "research at a higher level".

4.2 Parental involvement

The participation in IC-EM is a very significant way to show how students' families seek ways to transgress their social origins and compete for an increase in economic and cultural capital that they see as relevant for attaining a higher class status. The interviews show that students and their families became involved in breaking the *habitus* (Lahire, 2005). They approach IC-EM as a phase during which they can prepare for college entrance exams and an academic career.

Some of these students are influenced by the experience of relatives who had participated in the program and

overcame similar challenges. They stated that:

> *E 7: I thought, I was curious to know how it worked, you know, because some of my cousins did it, you know, and I was curious about doing it. I like science, so I wanted to enter on my own, to have experience in this to know and see how it works. And I have many ideas to put into practice.*

> *E8: My sister has also did the PIBIC. Then, she talked about what it was like in school, and the director spoke to people… and I was there..*

Entrance into the program is a form of passing a "magic barrier" (Bourdieu 1998) as part of a wider life project that thus attains different significations.

The verbal forms used by the speakers demonstrate the strength of the positive expectations they have about the experience, as well as the support they have from their families. Indeed, the break they operate with their traditional class destinies is also constitutive of their parents' representations, because they design the future for their children from their own biographical time.

The excerpts below allow mapping the family mediations and investments made to assure that the children will continue on to higher education. These investments include close involvement with their children in the activities; the interest they reveal in the activities undertaken by their children in the program, including the establishment of relations with professors at the university. Above all, they are committed to ensuring their children's participation in the program, by allowing them to have time to study and thus be better prepared for higher education.

The statements make clear that the parents see the university as a prestigious institution, which they are used to seeing from a distance. Parents thus use the program to have some acquaintance with cultural and social capital, by engaging in relations with some of the most relevant actors in the university, such as professors. This practice shows how parents are engaged in the aspirations of their children and are able to obtain from this closer proximity to the university world and to a set of subjective dispositions that help to modify their self-positioning and to sense that they have shifted to another position. This practice of seeking access to university space corresponds to the inclusion of parents in a different temporality, a space-time that is beyond their normal living spaces, a space- time that remains in limbo.

The statements below also express the fact that families - fathers and mothers - are the main agents of promoting the goodwill the students need to enter and remain in the program.

> *E 10 : My father goes with us when we do the research there. Sometimes he stays there walking around the university and talking to other professors. As he already knows, the professor talks to him and my dad really likes that. I get in the car and [he asks] : " what - yeah, what did you do today? " . I also say to my mother: "Mother, I'm home" and then she [asks : " okay – did you do any experiments with onions or lettuce ?" You know, they like it a lot. They really love it. All the courses I take, courses I think that can be very helpful.*

The desire to enter the program to be able to have a chance to break with the most probable class destiny is a key element of their discourses:

> *E 1: I did not give up because my mother gave me lots of support. I was able to save all the scholarship money. I don't ... since I don't need so much help at home, I managed to stay in the project and save the money.*

Family members often assist so that grantees can give priority to IC-EM. This is observable in the statement below in which a student explains that not only do the students make an investment, but they are also pushed by their parents to enter the university, which is perceived as a distant world, something separate from their reality (in this case, the Federal University at Santa Catarina, Brazil).

> *E 9: The PIBIC is cool. In reality it's a new experience, really cool. Like: everyone in the family had. When I was going to leave SENAIi, between choosing SENAI and PIBIC, I had liked SENAI. So I asked my family: "what do you think, stay in both of them"? But it wouldn't work. I had to choose one or the other. I went to talk with my mother, with my father. And they said: 'What do you plan to do? Something to become an electrician or to take a step to go to UFSCii Or do something like that. I don't think its so great to be an electrician, so my father said I should give up on being an electrician: "Go continue in IC-EM".*

4.3 Career prospects

The IC-EM grantees who attend public high schools expect that pursuing an academic career will allow them to break down social, economic and cultural barriers.

Of the four fellows (two of whom were former fellows) in the program for two years, two want to want to be researchers and to aspire to an academic career. Of the five fellows who had been in IC-EM for three months, three want to pursue an academic career, and plan to continue working in research.

It seems that that the longer the participation in the program, the greater the interest in continuing with a scientific career – something that becomes part of their plans for the future. Although it is represented as something quite distant, it is something they begin to envisage as possible, once they enter the program and begin to generate higher expectations. These results convey one of the ideas commonly found in studies about scientific careers: that young people have strong interest in careers in science (Hermanowicz, 2009, 7).

Table 3 – Career expectations of IC-EM grant recipients

Case	age	EP	Time in IC-EM	Expectation
01	18	yes	2 years	Follow academic career
02	18	yes	2 years former-recipient	Is now studying design but wants to follow a research career
03	16	yes	3 months	Military career Follow academic career Follow research career
04	17	yes (E1)	2 years	Follow academic career
05	15	yes	3 months	Follow academic career and do research
06	17	yes	2 years former recipient	Follow academic career and do research
07	15	yes	3 months	Follow academic career and do research
08	15	yes	3 months	Follow academic career and if possible do research
09	15	yes	20 months	Follow academic career but is not sure about doing research
10	16	yes	3 months	Follow academic career Does not want to follow a research career
11	15	yes	3 months	Follow academic career and is interested in research

4.4 Interviews

The excerpts below demonstrate the importance given to participation in the program not only because it facilitates access to a university but because it actually fosters reconstructing and changing the common trajectory, establishing different expectations for the future:

> *E 4: It helped me to see more, I have other perspectives. I now have ideas that I did not have before. Now, when I look at the future I do not see it as impossible to have a masters or PhD as people who had studied with me think. People that could not transcend, could not denaturalize (...).*

> *E 2 : (...) I had already planned to take the college entrance exam, I already planned to go to a university, but I saw, by being close to the people, that the university was very, was something completely, that the project brought close, the idea of going to college in the future. So I think this is very enriching and the project let me grow a lot.*
> *living far with the staff, that the university was too, was something entirely different.*

These excerpts also indicate that participation in the IC-EM is understood as a mechanism that allows them to construct perceptions and dispositions favourable to the process of professional education that takes a long time, yet can offer greater gains in terms of economic, social and cultural capital. To participate in scientific initiation is one of the phases of education that provides these subjects with very low socio-cultural capital, some empowerment, because it makes them feel intelligent and intellectually challenged (Charlot, 2000). It makes them feel capable of constructing life projects in fields different from those defined by their social background. The IC-EM allows the grant recipients to develop strategies that deviate from their social destinies, and establish otherwise "unlikely trajectories," (Lahire, 1997) that are strengthened and envisioned upon their entrance to the university (Zago, 2006).

Their belief in the opportunities created by participation in the program is so strong that by the end of the interviews, the recipients express that by participating in the program, they believe they can develop strategies that

deviate from their otherwise "likely trajectories".

5. Conclusion

The purpose of this text was to discuss how the Scholarship Program for Undergraduate Research in Secondary Education (PIBIC-EM), when open to all societal strata, can provide young people from lower classes the opportunity to access, remain in and complete higher education and begin an academic career. The study we made does not actually prove the actual effect of participation in the program on a student's trajectory. What the study highlights is another very important pattern: the positive effect that participation in the program has on enhancing subjective variables that help students progress in academic life, invest in their studies, and enter university, and thus devise a different future.

Hermanowitcz (2007, 625) argues that "by situating subjective careers in the times and places in which they occur, we are drawn to how those careers 'play out' over the course of the lives of the people leading them". Indeed, in the light of some theoretical frameworks, notably those of Bourdieu and Passeron (1961), Zago (2006), Lahire (1997) and (Dubet 2005), we can confirm the consistency of the assumption made in the beginning of the text: that participation in IC-MS is understood by students who have entered the program as a chance to go beyond the opportunities found in their inherited life trajectory, mainly by accessing and persisting in an academic career, which can provide them the chance to "fly higher", and go beyond traditionally expected trajectories.

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