

# SOCIAL INCLUSION AND SOLIDARITY IN STRICT POST-GRADUATION: EXPERIENCING THE LABORATORY “SCIENTIFIC WAKE FOR THE FUTURE” (PRIMARY AND SECONDARY EDUCATION)

Inserção social e solidariedade na pós-graduação stricto sensu: vivenciando o laboratório “despertar científico para o futuro” (ensino médio e fundamental)

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## ABSTRACT

**Objective:** To stimulate and awakening the interest of students of high school or elementary public schools in research and science through scientific initiation stages in the Postgraduate Program in Translational Surgery. **Method:** The target audience for the development of scientific activities were students enrolled in mid-level course (second year initially) and have approval of their participation in this project by the school and by legal guardians. The inclusion criteria were: physical proximity to the higher education institution, signing the consent form by the legal responsible for the students, and for the board of the school unit and the researcher. Initially, students performed diagnostic evaluation about the prior knowledge of biology, science and scientific research. From there, the classes were prepared based on the result of this test, then started the activities of Junior Scientific Initiation in basic education. **Results:** The school chosen for this initial phase of the pilot project was the State School Rui Bloem which has 13 classrooms for the second year of medium education in a total of 390 students. Of these, 160 (41%) were interested but only 16 (10%) were eligible to start the pilot project in Translational Surgery Laboratory of Unifesp. These students showed average yield of 50% in diagnostic test and should start the next training in cell and molecular biology laboratory and also to attend scientific meetings. **Conclusion:** In the initial phase of the project, was observed the great student interest in scientific career, but at the same time, a great need for improvement. The choice of public school was for access to university and proximity. In addition, these students have more shortcomings and deficiencies. But this does not mean that the fascination for scientific career cannot turn them into great researchers thus contributing to the economic, social and intellectual growth of our country through scientific research.

**Key Words** - Primary and secondary education. Search. Universities.

## INTRODUCTION

Although Brazil has made significant improvements over the past decade, with the substantial drop in illiteracy rate (around 2%) and at the same time, regular increase in average education (school enrollment) and attendance (IBGE, 2013), the situation is still not satisfactory. It is the 6<sup>th</sup> largest economy in the world and has 14 million illiterates (8.3% of the population) (IBGE, 2013). The literate, 32 million attended only until the 4<sup>th</sup> year of high school and 60 million have not completed fundamental school<sup>1</sup>.

The evasion in Brazil is an old problem that continues today. Despite this situation still exists in elementary school; currently, what draws attention is the number of students who often leave intermediated school<sup>2</sup> to work and help support families<sup>3</sup>.

Improving the quality and the inclusion of young Brazilians in high school is long-term project that requires, among other measures, to improve the quality of basic education, which prepares students for this higher level of education<sup>4</sup>.

However, our basic education is highly deficient; if it answered the requirements of the “old economy” will not promote the country as the new planet economy<sup>5</sup>.

The world today is home to two main features - technological innovation and sustainability - which require countries scientific and technological production and high end quality education, and leadership that has never been required at other times, which demand human resources corresponding to the new challenges<sup>5</sup>.

Innovation studies have indicated, systematically, the importance of the higher education system and more specifically the graduate to technological innovation. This contribution, which has been captured by using different methods and analyzed by many authors, can occur in several ways: producing research results, professional and skilled researchers.

There is a gap between the postgraduate levels and

quality of basic education in Brazil. On the one hand, the postgraduate has gained increasing recognition and the Brazilian scientific production and internationalization. But, the quality of Brazilian basic education is in worrying level.

There are experiences on this issue realized by other universities and graduate programs: 1) Fox Chase Cancer Center (FCCC) (<http://www.fccc.edu/research/high-school/>) have received high school students in its research centers; 2) Imperial College, London, young people from dozens of countries attending the famous British college, requiring science communication; 3) in Brazil, similar experiences are specific, such as the State University of Campinas (Unicamp), which promoted the “Science in the Holiday” program with 30 students from public high school of São Paulo, interested in internships in institution’s research labs; and 4) in Rio de Janeiro, the Federal Fluminense University, with its Polo University in Nova Friburgo offered a similar extension project (Consciousness in Science), which was focused on the integration of young high school public schools in the region, in molecular biology laboratories and general pathology.

Thus, the proposal of this study was developing a pilot project for integration of children and young students of primary and secondary education, public schools adjacent to the Federal University of São Paulo, in order to promote differentiated training.

## METHODS

### Target, inclusion and exclusion criteria

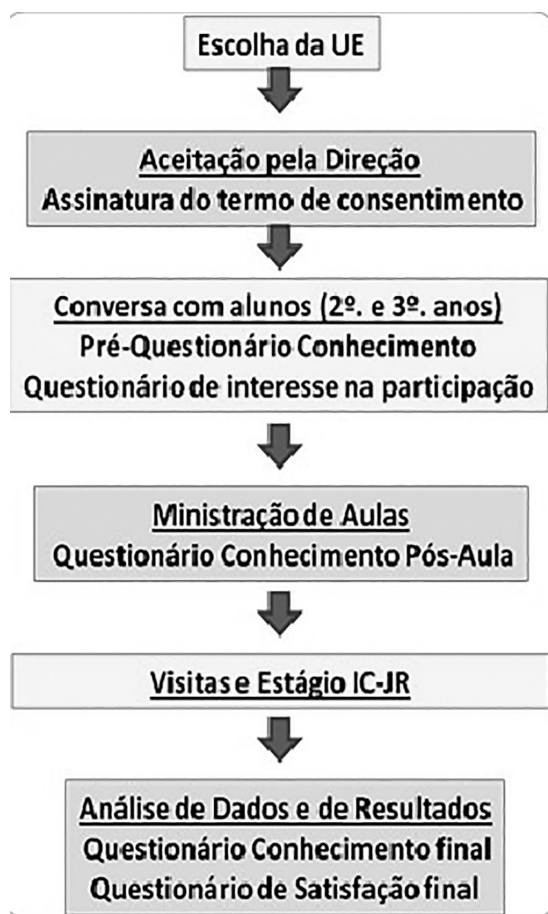
The target audience for the development of scientific activities of the pilot project (Figure 1) were students enrolled in the second year of high-level course of public school and who had approved their participation in this project by the school.

School inclusion criteria were: 1) the convening school should present physical proximity to the Unifesp; 2) signing the consent form by the board of directors and the heads

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of research units, as well as the student's parents or legal guardians; 3) have high school students on it.

School exclusion criteria were: 1) private schools (at first moment); 2) non-acceptance by the board, by the teacher or the student; 3) project drop-out by the school or students.



**FIGURE 1** - Scheme for the pilot project in Junior Scientific Initiation (IC-Jr) at Unifesp with high school students

The student inclusion criteria were: 1) students enrolled in high schools, which would have previously been selected by the school board; 2) signature Consent Term about their participation in the project as well as the consent form signed by legal guardians. Failure to sign the terms preclude the participation of the student. The student participation was voluntary; so, he could be out whenever desired.

#### First phase: assessment and activities

For initial assessment would be carried out a survey about the prior knowledge of biology, science and scientific research through questionnaires prepared by the university research group. The pilot survey results oriented the lesson activities, so that the content covered should correspond to general knowledge, also specific, within the reality of each group of students.

Junior Scientific Initiation (IC-Jr) internships should be held in Translational Surgery Laboratory I coordinated by Profa. Dra. Lydia Masako Ferreira, represented by Prof. Antonio Carlos Aloise, and Translational Surgery Laboratory II coordinated by Prof. Dr. Alfredo Gagnani Filho, represented by Profa. Silvana Aparecida Alves Corrêa de Noronha, in São Paulo.

#### Second phase: reviews and activities

General biology classes should be taught at the school as a way of pre-insertion in university laboratories, after the

consent of direction. The goal of the classes was to encourage students included in the IC-Jr, and also stimulate the student teachers linked on research groups from university.

The IC-Jr program would involve theoretical and practical activities on: molecular and cell biology, chemical reactions, biosafety, applied computer science, basic statistics and research ethics (human and experimental).

The theoretical activities would be schedule on six week hours (being stipulated two days a week in different shifts of classes linked to the school curriculum), followed by practical demonstrations (several laboratory techniques, molecular and cellular biology).

After the theoretical and practical basic course, students started monitoring the research projects, always accompanied by graduate (master/ doctoral/post-doctoral). Students could fulfill the workload in different days between school and research unit.

The IC-Jr program also counts with written results obtained in the projects, preliminar and final reports, as well as results presentation in conferences, symposia and area events.

It would be distributed courseware through handouts containing basic knowledge of Biology and Sciences and, also, instructional material about how a research lab in health sciences works.

After school to content leveling as well as for better information about scientific research (basic) in universities, would be the initial questionnaire applied again, one to assess the willingness on the part of students in active participation as IC-Jr and other knowledge. Knowledge questionnaire would select the best students hit rates, that is, those with the highest success rate not exceeding 50% would be selected initially. The other could be called second time. Lessons could occur on Saturday or during the week as convenience of school administration.

Students accompany the experiments and be instructed on how to use the glassware and reagents for scientific experiments. They could also be asked to write mini science projects and learn how to do research papers for the preparation of these experimental projects. The student should always be accompanied with professors and postgraduate students of the laboratory previously guided by the teachers responsible for dealing with IC-Jr students. Students also would count with informative material on basic knowledge about biology and science.

The IC-Jr could occur for a period of up to 12 months for students with MS develop initiation of research activities, with the dedication of a maximum of eight hours per week, under the guidance of teachers of the institution and the supervision of a teacher at the student home school<sup>6</sup>.

After school, visits and scientific stage would be applied to students a final post-questionnaire of scientific knowledge and also a satisfaction questionnaire about the stage of the program in IC-Jr in participating university.

## RESULTS

The survey showed that among the 160 students who expressed interest in participating in the research 16 (10%) answered the questionnaire (Figure 2).

Most of them (87%) cited one or more public and free universities that have research laboratories in science and health. In addition, most replied know what is scientific research (87%) and believed that the importance of science and research to the country's growth was high (97%).

Most students (97%) was linked or interested in the subject of Science/Biology. But, from these, about half (47%) said their note in these disciplines was usually above the notes of most students of the class.

All students said they were interested in learning more

## ANEXO 3

Pesquisa sobre participação no Projeto Piloto de Iniciação Científica Júnior com alunos do Ensino Médio da Escola Estadual Rui Bloem (Diretoria Centro-Oeste/SP).

Nome: \_\_\_\_\_  
Endereço: \_\_\_\_\_  
Série/sala/Período: \_\_\_\_\_

Por favor, responda:

1. Cite uma ou mais universidades públicas e gratuitas que reconhecidamente possui laboratórios de pesquisa e pesquisa na área de ciências e de saúde:

\_\_\_\_\_

2. Você sabe o que é Pesquisa Científica? Sim (  ) Não (  )

3. Para você qual a importância da ciência e dos cientistas (pesquisadores) para o país? (  ) Alta (  ) Média (  ) Pouco (  ) Nenhuma (  ) Não sei dizer

4. Você gosta de Biologia ou ciências? Sim (  ) Não (  )

5. Suas notas de Biologia ou Ciências geralmente são (ou eram): (  ) Acima da nota da maioria da classe (  ) Igual à nota da maioria da classe (  ) Menor que a nota da maioria da classe

6. Você teria interesse em conhecer mais sobre pesquisa científica? Sim (  ) Não (  )

7. Você gostaria de realizar estágio em laboratório de pesquisa? Sim (  ) Não (  )

8. Você gostaria de participar deste Projeto Piloto em Iniciação Científica Júnior? Marque o grau de interesse. (  ) Nenhum (  ) Pouco (  ) Médio (  ) Muito

**FIGURE 2** - Applied research students of the second year of high school at the State School Rui Bloem (Midwest Board/SP) on participation in the Scientific Initiation Junior Pilot Project

about scientific research and perform stage in the research lab. And in relation to participation in the pilot, most had great interest in participation (67%).

Of the 15 students, five underwent diagnostic test containing questions on general knowledge laboratory, molecular and cellular biology, English and Portuguese. The yield was about 50% accuracy on the issues. They begin a course on basic knowledge of research laboratory, molecular and cellular biology and initiation into scientific reading. After this phase, they can attend a junior research project for possible presentation of the results at the end of the year in congress in sciences or education.

On the next steps, will be taught theoretical and practical lessons to improve yield and scientific knowledge through scientific research internship at the Unifesp Post-graduate Program in Translational Surgery and the possibility of carrying out a scientific project for each student group.

## DISCUSSION

With the initial results of this pilot project we can conclude that the students of the second year of high school

were interested in attending research laboratory and the participation of the research project. They knew some public universities in the state who possessed academic research and believed in the importance of science and scientists as driver of knowledge and consequently the social and economic advancement of the country.

Studies like this have already been realized and are realized, both "purely" in high school, where researchers go there with the consequent presentation of the final results in science fairs<sup>7</sup>, and also when there is the possibility of direct insertion of high school student into the university as "simple adjuvant" (included in public-notice fundraised by various agencies in many universities). These two states are opposite states that end up not causing school interaction with the higher education institution.

With this type of intervention will be possible to closer the collaboration between high school and the university. This can bring more profound impact on the teaching of science and biology while showing students that the scientist's career may be promising both for them and the country, meeting what some educators advocate criticizing a student's entry in laboratories as mere internship or as job, without changing the social and educational policies that stimulate improvements in Science and Biology teaching<sup>6</sup>. On the other hand, the experience we propose is a reinvention that allows the scientific research be restricted not to individual actions on students who claim to be "scientists", but be a free research model with social purposes arisen from social sciences.

Thus projects like this for social inclusion in the less prestigious layers of society can contribute a lot to promising future, professional and intellectual enrichment of these students who are just starting their journey to a possible future of Brazilian science.

In short, in the initial phase of the project, we observe the great interest of the students for the scientific career, but at the same time, great need of improvement. The choice for the public school was the access to the university and proximity. In addition, these students have more shortcomings and deficiencies. But this does not mean that enchantment by scientific career will not turn them great researchers in future to contribute for economic, social and intellectual growth of our country through scientific research.

## CONCLUSION

The pilot project stimulated and aroused interest of high school students from public schools in research and science.

## RESUMO

**Objetivo:** Estimular e despertar o interesse dos alunos do ensino médio ou fundamental de escolas públicas na pesquisa e na ciência por meio de estágios de Iniciação Científica Júnior no Programa de Pós-Graduação em Cirurgia Translacional da Unifesp. **Método:** O público alvo para o desenvolvimento das atividades científicas foram alunos regularmente matriculados em curso de nível médio (segundos anos inicialmente) e que tivessem aprovação de sua participação pela direção da escola e responsáveis legais. Quanto aos critérios de inclusão: proximidade física com a instituição de ensino superior, assinatura do termo de consentimento pelos responsáveis dos alunos, pela diretoria da unidade escolar e pelo pesquisador. Inicialmente, os alunos realizaram avaliação diagnóstica acerca dos conhecimentos prévios de biologia, ciências e pesquisa científica. A partir daí as aulas eram elaboradas com base no resultado deste teste, para então iniciar as atividades de Iniciação Científica Júnior. **Resultados:** A escola escolhida para esta fase inicial do projeto piloto foi a Escola Estadual Rui Bloem que possui 13 salas de aula para o segundo ano do ensino médio com total de 390 alunos. Destes, 160 (41%) apresentaram-se interessados; porém, somente 16 (10%) foram elegíveis para iniciar o projeto piloto no Laboratório de Cirurgia Translacional da Unifesp. Estes alunos apresentaram rendimento médio de 50% na prova diagnóstica e deverão iniciar os próximos treinamentos no Laboratório de Biologia Celular e Molecular e também a frequentar as reuniões científicas. **Conclusão:** Nesta fase inicial houve interesse dos alunos do ensino médio e o projeto piloto apresentado estimulou e despertou interesse dos alunos de escola pública na pesquisa e na ciência. A escolha de uma escola pública foi para o acesso à universidade e proximidade. Além disso, esses alunos têm mais carências e deficiências. Mas isso não significa que o fascínio pela carreira científica não pode transformá-los em grandes pesquisadores, contribuindo assim para o crescimento econômico, social e intelectual do nosso país através da pesquisa científica.

**Descritores:** Ensino fundamental e médio. Pesquisa. Universidades.

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