

# SCIENCE EDUCATION FOR DEAF YOUTH IN BRAZIL – A NEW EXPERIENCE

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## Abstract

The difficulty of inserting the deaf students in regular schools is one of the major problem found by professionals working in education. The deaf community has been linguistically and socially marginalized with regard to education, especially in science. The aim of our work was to reduce the deficiencies concerning basic scientific knowledge of this group offering a specialized course in Biosciences. For that, we made use of an innovative methodology, which allowed these students to comprehend the advances in science and technology keeping a critical mind, learning scientific concepts, developing the method and scientific thinking rather than simply receiving information. - The target audience included high school students from the National Institute of Education to Deaf (INES-Brazil). The course was all experimental, without lectures, divided into modules and themes. The role of the coordinator was to assist the students, conducting the rationale and the implementation of experiments. The students themselves suggested how to address the problem and decided what kind of experiments will be conducted. This method makes students think and develop hypotheses and analyse the results obtained, gaining a critical knowledge. The course was taught using LIBRAS (Brazilian Sign Language) and was conducted in the presence of a translator. In first course, six students graduated, the course lasted about 900h and was able to develop in students a interest in Biosciences, as well as a better understanding of the construction of the scientific knowledge. They were also able to get the perception that the university is accessible, and they had an increased self-esteem, socialization, greater confidence and independence in all activities. Although, the main focus of this course was to prepare students to work in a research lab, we were concerned to inform students about all issues and current topics and themes in different areas whenever possible to insert this information with what was being worked at the moment. This new methodology in conjunction with the development of a new scientific language on signs, will allow the coexistence of deaf and hearing students in the same class, without major changes

Keywords: Deaf education, Science education.

## 1 INTRODUCTION

The history of deaf community struggle to demonstrate their intellectual and linguistic ability has been happening since the 80's. The delay for the recognition of sign language as the effective language for education process of these individuals impaired the teaching of the deaf ones. In Brazil, the recognition of Brazilian Sign Language (LBS) as a language of expression and communication among the deaf was only in 2002. Today, the deaf community is outside the scientific and technological knowledge in the area of Health, this gap can be explained by the fact that education is strongly based on theoretical class, needing a high degree of abstraction from the part of student to associate the phenomenon which leads the student to need a high degree of abstraction to associate with the phenomenon itself with the word spelled out. This process becomes even more complex when a second language is used, this is the case of Portuguese language for the deaf students.

One method of teaching and in learning the field of biological sciences is the Hands on. This practice allows the students to perform science as they construct meaning and acquire understanding. Another model is the Minds-on that focus on core concepts, allowing students to developed thinking processes and encouraging them to question and seek answers that enhance their knowledge.

In order to minimize the deficiency of scientific knowledge of deaf students, our group used a mixture of these two methods, which has been used by us in the last 25 years in short duration courses for hearing students from government school. The method used provides the development of scientific method, the knowledge absorption, developing the student's own perspective, without the need of theoretical exposition of the content, delegating to the teacher's role as mediator between the student

and knowledge. In this way the student is able, through experiments designed by himself, to answer his own questions, and to find scientific answer, instead of learning science in a passive way.

The objective of this pilot course in Biosciences was to evaluate if it was possible to cover such a broad range of subjects, in a totally experimental fashion, and this kind of course would be well accepted by the deaf students. We expected that this kind of course would provide the means of eventually create autonomous subjects capable of teaching fellow deaf students and also capable of working in a research lab.

## **2 METHODOLOGY**

### **2.1 Course Organization**

This course involved 7 deaf students from last year from high school from Instituto Nacional de Educação de Surdos (INES) – Rio de Janeiro – Brazil. (Fig 1)

The methodology of the extension course for deaf students was based on courses of short duration for hearing students called “Vacation Course”, originally developed by Prof. Dr. Leopoldo de Meis from Biochemistry Institute at Federal University of Rio de Janeiro-Brazil.

The present course is totally experimental. It is organized in modules covering most subjects in Biosciences. Given a subject, the students were free to ask questions related to it and to propose laboratory solutions to find the answers (Fig 2).

A menu related to Biosciences practice has been fully adapted for deaf students, where the possibilities of experiments could be comprehensive and all questions related to the issues could be answered experimentally in a period of two weeks for each subject. The course was designed observing the connection between modules towards the integration among the systems, in such a way that they could, feel that each subject was also part of previous one and the next one. At the end of each module, the students prepared a presentation in their own language, LBS. After students presentation, the teacher addresses issues not mentioned by the students and presents a lesson deepening knowledge acquired during those two weeks.

### **2.2 Course Evaluation**

Two kinds of evaluation were developed, a continuous and a final one. To verify the degree of comprehension and autonomy, at the students

#### *2.2.1 Continuous Evaluation*

Students presentations were evaluated by examining the learning development, beyond the resources used during the whole period.

#### *2.2.2 Final Evaluation*

During the course, the students are prepared to work in a research laboratory. And to teach fellow students. To evaluate their capacity to work in a research lab their autonomy in relation to other work environment, in the end of the course, they were divided into pairs and sent to a research lab they never been before, where they worked on a completely new line of research. These students were supervised by a researcher, who did not know them previously. Throughout all this process, the students were accompanied by a LBS translator. After a period of one week, the researcher in charge of the lab evaluated the student performance (Fig 3).

## **3 DISCUSSION**

The first class graduated in 2010 and from eight students, who began the course, seven completed the overall 900 hours. Although they were selected for their interest in science, the deaf students from high school came to the extension course with little notion of scientific knowledge and of the scientific process. However, these students quickly began acquiring concepts and procedures that extended beyond the area of Biosciences.

First of all, we observed that in the end of first module, the students behavior changed, they were able to use more resources and information about the subject. In addition to that, the students increased their ability to ask specific questions about the issue.

An important practice in science is to keep an accurate registry of what was carried out. The group quickly realized the importance of keeping a diary protocol of the experiments. Owing to their difficulty with Portuguese language, the students were free to write notes in the best way see fit .Most of them opted for schemes and drawings to help them.

An important issue in the learning process is the curiosity, which must be present all the time of work. We verified that after conducting experiments on a given topic, the students spontaneously accessed the internet, newspapers and magazines, looking for more information, which were now more understandable to them. However, the Portuguese language barrier remained as a problem, making it difficult to any further use of textbooks.

The Brazilian sign language is very poor in relative to scientific concepts. Along the course, new signs related to science were acquired by these students, which incorporated them to their first language (LBS). It became clear that, the use of scientific signs have facilitated the dialog among them and often the comprehension of certain scientific phenomena.

One evaluation demonstrated that autonomy, in addition to technical and scientific knowledge were reached. These students were able to develop experiments proposed by the head of lab in a different environment. Furthermore, they were able to organize themselves, two different short courses for deaf children from basic school: "embryogenesis" and "microorganisms". In both courses, the deaf students demonstrated their ability for passing the knowledge acquired (Fig 4). Not only changes in the context of scientific knowledge were observed in these deaf students, but also behavioral changes such as increased self esteem and a perspective for a promising future.

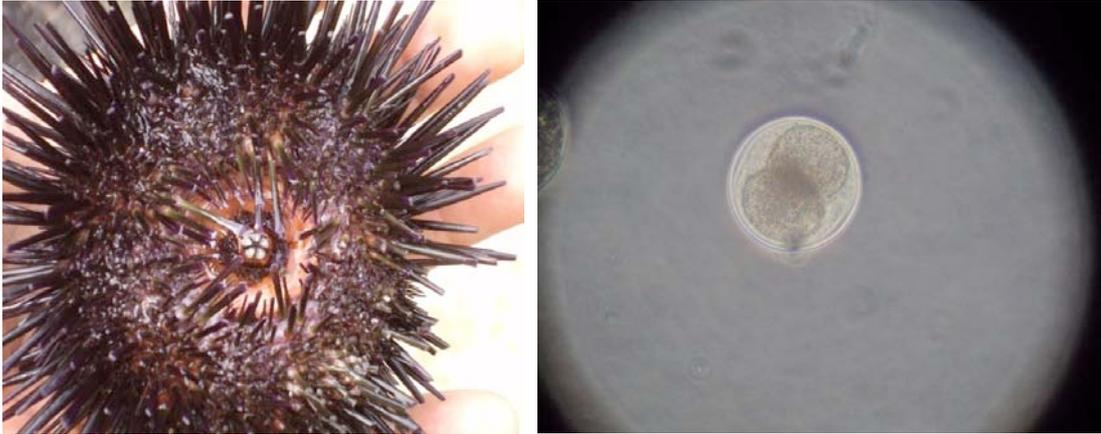
#### **4 CONCLUSION**

This method for learning science with inquiries, hypotheses and experimentation in Brazilian Sign Language (LBS) has proved to be effective in science education for deaf students. Most striking changes in self-confidence, socialization and autonomy in the activities performed were observed. Finally ours study showed that, this teaching method could be applied in any school, without the need of segregation of deaf and hearing students

#### **5 FIGURES**



**Fig 1- Deaf Students selected for the first course on Bioscience.**



**Fig 2 Deaf students using sea urchin to solve the question "how fertilization occurs?"**



**Fig 3 Students during their final evaluation in another research lab**



**Fig 4 Deaf students teaching a class to other deaf children from basic school**