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Reception of Students in the Museum of Sciences
A look under the perspective of Extended Scientific and Technological Literacy

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Abstract. *This work reports part of a research that analyses a program of school service developed by the Science Museum team, Newton Freire Maia Park (PNFM), a institution maintained by the Department of Education of the State of Parana (SEED), that is working for the dissemination, popularization and spread of the science and technology. The program, entitled " Small Scientists - Great Citizens"(PCGC), is designed to assist the first grades students from elementary public schools, using the methodology that involves the School, the Centre of Science, the students and their teachers. Supported on one of the authors' professional experience who acted as general coordinator of the Program from 2004 to 2007, the study was developed through a qualitative research whose data were obtained by the participation of the professionals of education who visit the museum under the guidance of PCGC. As well as the monitors who are the professionals of the PNFM, involved in the program. The theoretical context was upheld by the concept of scientific enlarged literacy of informal and learning education in Museums, and in Science and Technology Centers. It stands out still in the theoretical context, the discussion around how the knowledge produced by science is interpreted into museum's knowledge in the interior of the Science Museum, and the importance of considering, in such discussions, the students' alternative conceptions in spite of the phenomena reproduced in the Science Museum, under one sociointeractionist view. The results of the investigation indicated that the discussion and preparation of the visit with the teachers in the schools, the reception of the students in the Science Museum and the posterior development, in schools activities after the visiting, demonstrated these as being differential actions that incorporated a methodology which approximate the school's practice from the museum's. The analyses also showed the necessity of deepen the PCGC's discussion of practice, in order to intensify the dialogue among students, teachers and monitors, in the sense to establishes a more spatial reflection about the concepts of science and technology experienced in the museum PNFM towards a Scientific and Technological Enlarged Literacy (ACT).*

Keywords: Science, Scientific Literacy, Science Museum.

1. Introduction

Nowadays, according to Cazelli et al [3] and Marandino [14], the investigation about the exhibitions of cultural and educational activities in the Science Museums has been intensified, revealing the results that point toward the museums and science centers as active learning environments.

These results converge more and more to the idea of Museums as being spaces for knowledge production and the use of methodologies specifically applied to this context. It is causing a certain preoccupation of several professionals of Education and Museology concerning what kind of education and learning consolidate in these spaces.

The object investigation of this work approaches one of these methodologies,

prepared and applied in a Science Museum in Curitiba, known as Newton Freire Maia Park (PNFM), that resulted a work of dissertation for Master's Degree under the title "Small Scientists-Great Citizens: considerations on one school service Program in the Science Museum". This work was presented in 2007 in the Post Graduation Program in Technology (PPGTE) of Federal University of Technology – Paraná (UTFPR) in Curitiba, Brazil.

Among other inquired questions, the research investigates how the teachers of the first grade's students in elementary schools accompany them through a guidance visiting to the Science Museum, realize the relation between the school and museum's environment, under the theoretical optic of the Scientific Enlarged Literacy (ACT).

2. Formal and Informal Education

According to Gaspar [9], the process that occurs primarily at school is due to Education. It is divided in courses with levels, degrees, programs, curriculums and diploma, showing itself up in general, with the outstanding characteristic of school curriculum organization for each discipline.

The production of school's knowledge, linked and controlled by Educational Policy, historically directed and orientated for reproduction and control's intentions, is being brought into effect through the discipline organization of the school curriculum used in the formal education. Macedo and Lopes [13] comment that the attempt of school curriculum organization with no adoption attitude of the division of the knowledge in discipline does the criticism to this curriculum. This is based on the arguments that the division in discipline would not be able to integrate the knowledge, allowing a global understanding of it or producing higher approximation of the day by day students' knowing, making the significant knowledge learning difficult.

The same authors recognize that the attempts of school curriculum organization not by discipline, as in the case of the transversal curriculum, do not present actions able to substitute the discipline's hegemonic idea. However, they argue that this hegemony does not stop the production of different mechanisms of integration by creation of the integrated disciplines, or else by articulation of the isolated ones.

Meantime, Gaspar [9] states that, even in the civilizations considered as culturally advanced, the day by day life always demanded much more than the knowledge formally presented in the school discipline.

So, the informal education is analyzed by the author in a context where the curriculum, the place or the evaluation are not being put as presuppositions of the education. In informal education, the essential interaction process is the socio cultural, in which the subjects, in many occasions, do not have consciousness of their participation in the educative process. Teaching and learning, in the informal education, take place spontaneously and, almost all initiatives aimed to an institutionalized informal education are quite welcoming. However, these initiatives bring some doubts and concerns, unbelief and restrictions, mainly related to the Science's learning. For him,

> *It is not difficult to understand the reason of such unbelief and restrictions, just observe accurately the children's visiting to a scientific dissemination centre. They run from one side to another, stop for a moment here and there, laugh, shout, frightened themselves, feel annoying, enchanted, in an incessant activity and almost always disarranged. Even when they are followed by their parents, teachers or in supervisors visits, they tend to disperse themselves a lot, because there are so much stimulus, even though where there are some kinds of logic or pedagogic order to the presentations, that is not frequent. (GASPAR) [9].*

The informal education in the Science Museum presents interesting features. Programs of school service in the Science Museum involve several actors; teachers, officials, mediators, and so on. Such actors try to act in the mediation process between the scientific, the museum and the school knowledge.

In the analysis of the pedagogic mediation as a (re)construction process of knowledge, Alice Lopes [12] considers on the transformation process of scientific knowledge, in something substantially different from the science of reference.

So, in the context of the referred school reception programs, the scientific school

knowledge and the scientific museum's, will be mediated in a work of social interaction that valorizes the previous knowledge of the students.

3. What is the objective of the (formal or informal) scientific education?

The modernization of the society and redefinition of time and social space operated by the phenomenon of the globalization, impose new educational demands that, according to Cazelli and Franco [2] bring repercussions as in the interface of the education with the work's world, as with the practice of citizenship.

The last advances in science and in technology lead up to the context a world population that needs one understanding of the science and technology of a huge range, in order to interpret facts of daily life itself.

In this context, as said Gouvêa and Loyally [10], the defense of the theory of scientific and technological literacy has a tendency to become strength from some decades till now. This defense has already existed in the agenda of discussions and decisions of several countries, mainly in those ones which detain the hegemony in the world's scientific production, but only in mid 90's was presented in Brazil.

Etymologically, the term being literate, or stop being an illiterate, can show some possible interpretations, but they usually lead to a reasoning acquisition of reading and writing process. Chassot [4] refers to the term as to acquire the technology of reading and writing and to be involved in social reading and writing practices. So, when the individual acquires these processes that the author calls the writing and reading's technology, ascends to a social condition in that the opportunities will be multiplied. This social, cultural, economic and politics condition can be designed by the term 'literacy', as Magda Soares [17] comments:

> *Etymologically, the word literacy comes from Latin littera (letter), with the suffix - cy, that denotes quality, condition, state, fact of being (...) i.e. literacy is the state or condition that assumes the one who learns to read and write. The idea implicit in this concept is that the writing brings social, cultural, politics, economical, cognitive and linguistic consequences, for the social group it is introduced or for the individual who learns to use it (SOARES) [17]*

The scientific and technological literacy, if compared to this state of "literate", it takes the meaning of acquisition of the linguistic structures referring to the science and the technology. That means, the state or condition the citizen uses to understand the scientific and technological language; this state facilitated by the acquisition of the technology of reading and writing, but not of straight dependence of this acquisition.

According to Durant [5], it is possible to discuss three approaches for the understanding of the scientific literacy. The first one concerns to a citizen being familiarized with the contents of science, in the sense of the quantity of understood scientific concepts idea in which it would reach limits besides the formal education in science. It would be a factual knowledge with the objective the individual being consciousness and doing interpretation of the events motivated by the current science.

The second approach is related to how the science works in its method and the scientific process. So, the scientific education that follows this approach defends a pedagogy of learning science by practicing the scientific method, aiming at the understanding not only of the basic principles, but also the processes they were established.

The same author reveals the preoccupation of formal and not formal pedagogy regarding the resolution of problems by adopting a scientific attitude. This one aims at a range of disinterested curiosity, open mind, objectivity and the habit of doing judgment basis on facts. The hypotheses formulation and its submission to critical tests in the controlled experimentation would be a form of experience science and by this way, seek for its understanding.

These two approaches, according to Durant, are unsuitable for the objective to understand the science's current questions, which involve in great scale, processes of construction of new knowledge, for:

> *Frequently, the new knowledge is uncertain, many times controversial. In other words, the scientific experts can be undecided about things; they can even disagree each other on questions of proofs or interpretations. In this*

> *case, the public can be helped by a certain quantity of factual basic knowledge; but, this knowledge in itself, is probably insufficient to understand what is happening. Because what is happening, is the appearance of a new knowledge; and, to understand that, people have to know something about the gestation or the embryology of science. (DURANT).[5]*

As for the scientific method and the scientific attitude treated in the second approach, the author emphasizes that, a scientist hardly follows the linearity that generally is attributed to the scientific method, and, neither, it is given him a "scientific attitude" as a gift on his birth. In fact, the author aware us of a science that follows the scientific method's linearity and appropriates itself of justifications and affirmations based on scientific attitude, it has a small chance to be considered as true science, assuming much more the form of pseudo science.

The third approach suggested by Durant [5] is a scientific literacy that looks for knowing how science "really works", exceeding the frontiers of its understanding as purely knowledge and an idealized process. So, knowing how science works really applies the acceptance of a scientific community's existence, who are liable to certain rules, participating in generally limited discussions, and who constantly evaluate their pairs according to their own party political ideals of this community.

It means to say that, the popularization of scientific knowledge is an adequacy process of a language used by scientific community with the objective of public intelligibility. It happens that, the preparation of this language is of extreme complexity, so the mission to turn the complex into intelligible, will always be a difficult mission. The consequences of an incomplete translation can assume as truth myths, for instance, that the scientists, individually, discover the scientific laws. One scientific literacy approach that proposes a science's view as historical and collective construction, never will be able to affirm such mistake, since a scientist will never be able to come to conclusions or discoveries by himself, without the interference, analysis, approval and contributions in his research.

Another aspect treated in the third approach of Durant [5] is the fallibility of the science, always present in real context of the scientific research process and, however, it is very often absentee in the common sense of people who are not part of the scientific community. So, there is an atmosphere of almost supernatural credibility in the scientists, who would produce an incontestable knowledge in the idealized vision. Once again, the myth of infallibility is present on the external context to the scientific community. A scientific literacy that intends to build a relation between the non specialists and this community, in order to supply the consciousness of the scientific process, must be considerate the mentioned facts emphasized above by Durant [5].

4. ACT – An enlarged referential system

Fourez [6], quoted by Auler and Delizoicov [1], referring to ACT, it uses the expressions "limited sense" and "enlarged sense". So, the authors sign two perspectives for the understanding of "scientific and technological literacy": the reductionist and the enlarged one.

In a reductionist perspective, the public would be treated with the starting presupposition of ignorance, regarding the scientific and technological questions, transferring the responsibility for not understanding these questions to the public and not to the science. A science considered neuter and devoid of values, the only and privileged, in that the scientific knowledge is translated as infallible and without contradictions. So, in the reductionist perspective, we have a great approximation with the two first approaches described by Durant (2005) [5] that includes the quantitative and factual knowledge and the understanding of scientific method, discussed previously.

The formal or informal Science teaching, while making use of a reductionist and inebriant speech, can be easily adopted in inadvertent form and even naive by educators and institutions who, in many occasions, search for an educative, progressive, emancipatory and democratic process. It can get them on a different direction, according to Auler and Delizoicov [1], for whom

> *More and more, the idea of democratization of Science and Technology consolidates itself as a pre-requisite for the practice of citizenship, of democracy (...) We lift the hypothesis of which, while claiming the spread, and popularization of knowledge, facts, information, scientific*

> *concepts, with honest justification of its needful for the democracy's practice, it is possible to contribute, in fact, for the reducing of the plenty exercise of democracy, reinforcing technocratic postulations. (AULER and DELIZOICOV). [1]*

In an enlarged perspective, the same authors emphasize the search for a real comprehension among the science, technology and society's interaction, in a world criticism reading where the demystification of constructed myths in this relation must have a fundamental importance in the educative role.

The ACT under this 'enlarged' point of view is pretty closer to that Paulo Freire's referential point, stated about the surpassing mythological vision, where education has a relation with the "critical knowledge of reality". Freire (1992) affirms that it is necessary to practice the control on the technology and put it to the human beings' service. The ACT understood under the enlarged perspective, considers the concept of technology in a sense of denying the technocracy's vision of technological determinism.

The objective of one appropriate scientific and technological literacy, that finds problems and challenges, is to interact socially, politically and culturally in the world we live in. The perspective of the enlarged ACT, reveals us the necessary rupture with the myths' reference to the science and the technology, and the display of these myths in the formal and non-formal educative processes, for what we could reflect about them.

The enlarged ACT proposes to be necessary to emphasizes in educative processes, the social, economical, cultural aspects and those ones of the world of work, inseparable of the technical aspects that influences the researches in science and technology. As proposed by LIMA FILHO [11], when he says that it is also necessary to consider that education is just one of the social relations involved in this complex and, on this way, it has limitations. Thus, the production and property relations also have influence over the available information and how the knowledge is produced, resulting in an ideological speech about science and technology.

Fourez [7] calls as ideological speech, a practice that is known by itself as a representation of the world, but in fact, has more a legitimate character than a descriptive one. The author affirms that the science, in spite of used in many opportunities as reinforcement to legitimate the ideological speech, is an important instrument to do the criticism to the propositions of this speech.

The ideological speech presented in "translation" processes of science concepts for an intelligible knowledge not always (or hardly ever) it is revealed to a citizen. For Fourez, “the scientific translations of one ideological focus, remain ideological as therefore the used point of view (i.e., the discipline source or the paradigm), originated itself in a well determined context." (FOUREZ) [7].

In this sense, the author points out two possibilities of ideological speech. The first one, is designated as “ideological speech of first degree”, and it appears insofar as one has the consciousness of the historical character, that means, ideological character of the speech. The limits of this speech are assumed in a condition of not ignorance of the ideology inserted in the same one, where the basis concepts are built and there is a consciousness of the decisions that implicate all the scientific practice.

The second possibility, designated as “ideological speech of second degree”, acquires non-historical characteristics and notions with eternal objective and character, where the most part of signs of construction are suppressed. It presents as natural options that, in fact, are particular, in manipulated process of representation of eternal science, with objective and neuter answers.

The scientific dissemination, under a second degree speech perspective, generally assigns to the scientific knowledge, an unequivocal power. Alice Lopes [12], in agreement with Fourez [7], show us that the access to the scientific knowledge is translated in access to a certain dose of power, that reinforces the instrumental reason, acts in a coercively way on non-scientific knowing, builds a speech able to illegitimate them and, in this way, it contributes to the reproduction of the social relations existent in the capitalist society.

But there is also a power in the positive sense that can supply arguments for an against-hegemonic action of groups in tune to popular interests. For Alice Lopes [12],

> *(...) the dominant and hegemonic knowledge, is not always sustained in a scientific knowledge,*

> *but it is in a common sense that sometimes sustains itself in the pseudo-scientific rationality. So, the scientific knowledge's domain is fundamental to help the destruction of dominant speech, of a great deal of his ideological mechanisms that linger in function of the general ignorance of scientific notions. [12]*

The scientific spread must be attentive to the ideological speeches it will do once in agreement with Fourez [7] and Alice Lopes [12], science is useful only when, somehow or other, it reaches the everyday life, masking the distance between ideological global representation and the scientific individual concept that interpret it. In this way, the ACT must consider the scientific speech as ideological, at least in first degree.

The instruments of scientific spread, like the Science Museums, must be attentive so that, inadvertently, do not assume an ideological speech opposing to their own convictions. These institutions can assume a social emancipatory's role to undone the scientific ideological speech and the valorization of the scientific knowledge as form of popular and democratic power.

5. Museum of Science - School Partnership

The program “Small Scientists - Great Citizens” (PCGC), is destined to assist students of the initial series of elementary education, in using a methodology that involves the School, Science Centre, the students and their teachers. It has been developed by the Science Museum's team in Newton Freire Maia Park (PNFM). This institution has been maintained by the Department of Education of the State of Paraná (SEED), responsible for the diffusion, popularization and dissemination of science and technology.

The PCGC's organization has as the basic principle, the participation of all teachers of the involved schools who want to make part of it. In summary, the process begins with the contact of the school with the PCGC's management and its interest in visiting the Museum. The teachers are orientated to begin the discussion of this visiting, in school itself, choosing a subject they would like seeing developed in the visit to the Museum.

When the subject is defined, the team of the PNFM/PCGC prepares the requested presentation while the teachers prepare the students' visiting. After the preparation period, as of the school as the museum, the students are received by the team that orientates the visit in accordance to the subject previously chosen. As the process is completed, the students go back to school to participate in a discussion and do tasks about the subject.

Following this presupposition, the dialogue between the teacher and the team is first act to be contemplated in the methodological process project's implementation. From this dialogue it must result the conclusions about: the subject to be developed, how to discuss it, what resources of the museum collection must be used for it, which are the critical aspects in the subject and the date of the students' visiting to the Science Museum.

The chosen subject can be the school's demand of the students themselves or a pedagogic work's demand effectuated in the classroom. As soon as the subject is defined, a service's project is written based on the school's bibliography and in the spaces of Museum that will be in more accordance. A period of inquiry in the classroom and school work is essential for a good use of the proposed subject. This period must be seen as instigation to the object of study, where the student is provoked to asking questions. Many questions can be answered in the research's phase, but it is interesting to emphasize the surprising beneficial character in relation to the PNFM's visiting. When the student's doubt is solved in the visit to the Exploratory, originated in school work, it values this work and the visit itself. (ROCHA, et al).[16]

The assistance's team of the PCGC program considers of extreme importance the primary dialogue with all the teachers who want to participate the visiting with their students. In this sense, the activities are preceded by an exhibition about the complete program scheduled previously the visiting and realized exclusively with all the teachers interested in to schedule the visit to the museum. In these meetings, the team presents their methodology, they quote examples of previous assistance, and they talk to these professionals of education about the concepts of science and technology and discuss the possible subjects to be chosen.

All the teachers also receive a guidance about the Science Museum's collection, with the objective to be in contact with this before the students, as well as, they are invited to stimulate the students, a prior inquiry about the proposed subject, turning it attractive for them, and bringing this to discussion. However, it must be done without the necessary deepen avoiding to exhaust the curiosity of the students.

The access to essential information, for example, the available texts in the PCGC / PNFM[1] sites that describe this methodology, the scientific production of the team related to the research of this program, examples of projects, and other important information to the teachers.

After this dialogue, the teachers will schedule by electronic mail. This procedure has as presupposition that the subject to be developed in the visit has already been previously defined. Through the electronic mail, the teachers, the school, or the Department of Education, send the school project with the proposed subject. So, the team gets up to date with the activities already done in school context and which are the questions that the students are producing about it, as well as some aspects of the reality of the interested schools.

After receiving this material, the team will meet to organize the student's reception procedure, preparing their own assistance project. This project will contain an itinerary inside the Museum's space. As well as this procedure, this project will prepare a previous speech beginning with the students' questions.

Figure 1 – PCGC

According to the project of the PCGC's Program (PNFM) [15], the described proceeding is based on the pedagogy theory of projects, adapted to the context of the school assistance in the Science Centre. However, it is important to emphasizes, that the education in Museum and Science Centre has an informal character, where the "contents" must not be treated like they are in school. In this way, form, the pedagogy of projects intends to be used by the museum, concerning the methodological structure. Meantime, the objectives of teaching and learning, which are inherent to the formal processes of education, are not priority elements of evaluation in the PCGC Program.

Figure 2 – PCGC' activities.

So, the assistance's methodology to the PCGC students, summarizes itself to a direction that starts in school, goes to the planned activity in the PNFM and it returns to school, in a cycle leading by the pedagogy of projects adapted to one perspective of spreading and popularization of the science among children.

6. Investigation

The investigation, supported on the qualitative research's principles, considered as element of analysis, the observation of the construction's stages and the service for public schools in the PCGC Program. The two-year professional experience of one of the authors, acting straightly with the Program's team since its preparation in January, 2005 up to January, 2007, constituted in one of the main sources of data.

[1] http://www.parquenewtonfreiremaia.pr.gov.br

Another source came from two questionnaires[2] applied to the professionals of formal and informal education, involved in a dynamic of the PCGC; of one report of evaluation of PCGC, referring the year of 2006 and another general one of PNFM of 2004, 2005 and 2006. Completing the sources of data, examples of students' productions were considered after the PNFM visiting.

6.1 The Teachers' Reports

According to the teachers' information, the investigation of the Program, was carried out following a questionnaire[3] about: 1) the reasons in which the teachers decided to do Science Museum's visiting; 2) the first impact in the beginning of the visiting concerning the Museum's geographic space as a whole one; 3) how was the preparation of the students before the visit; 4) what happened after the visit; 5) was there any contribution to the ongoing studying course for teachers and, finally; 6) what about the conceptions of science and technology of these teachers.

[2] The first questionnaire search for referred information to the teachers (encoded by " P "), about how these professionals understand the dynamic of PCGC. In this case , these teachers received, (through the Municipal Secretary General Offices and / or Schools), the questions (approximately 2 months after the visit). They were sent, through electronic mail, around 100 questionnaires, of which they brought 54 printed reports back or written by hand. The second questionnaire was given to the coordinators (encoded by "M") responsible by the assistance and PCGC's methodology. On this one, 15 questions were applied to the professionals of formal education, and 17 questions to the coordinators of the PNFM/ PCGC.

[3] Questionnaire delivered to the teachers:
1) When you knew the reason for visiting the Exploratory, did you consider this important? Can you comment your impressions about it?
2) Were the objectives of the visit clear for you?
3) What was the selected theme for the visiting?
4) Is this subject relevant to your classes?
5) Did you notice the students' impressions when they first entered the PNFM Exploratory? Would you like to report any detail that calls your attention?
6) Could you report one positive aspect during the visit?
7) And could you point out a negative one?
8) Did you think the predetermined objectives were reached??
9) Could you do a brief report of how your students have perceived the proposed theme during the visit?
10) In a brief report, how have the students perceived the theme after the visiting? Can you report some students' comments?
11) Was there any activity done in the classroom that was motivated by the PNFM Exploratory visiting?
12) How do you evaluate the whole project?
13) Did your conception about the proposed theme change?
14) What is your conception of Science?
15) What do you understand as the term 'technology'?

6.1.1 The Results

The results were interpreted considering six categories of analysis: the reasons for the visit; the first impact; the dialogue and the preparation before and after it; the ongoing professional development course of teachers (T) and the teachers' conceptions of science and technology.

1) The reasons for the visit: it is noticed, in 54 reports, that there was basically three categories of answers, concerning to the reasons that the teachers and their students went to the PCGC, described below:

a) Theoretical reinforce of the worked contents in the classroom, considering the visit to the Museum as research class (in 25 reports), as showed in the example:

> *(...) In this day, the children who were already conscious of what they would study in the research class, were excited to the use of a different methodology from that one in the classroom, because they will see closer what they studied in school (...) (T1).*

b) The visit to the museum as the main motivation, which means, the curiosity about the museum space itself (in 13 reports), as in the example below:

> *It takes a long time I wish to visit the Exploratory (since I saw a report about it on TV). I was so happy to take my 3rd grade class there. On that report's time, I got in touch with them, and was informed that the visits were only possible to the 5th grade students on (T2).*

c) The investigation's exercise as a possibility to improve the teaching and learning process and the contextualization of the school themes (in 16 reports), as observed below:

> *The best way to learn a content is making the children use their own scientific work procedures, that means, let them to investigate and discover the reality as it is. Rediscovering history and its importance to our lives, its the mix of curiosity and learning, is a collective work that based itself on the students' knowledge experiences and on the power of investigation. In this project's development, hypotheses were raised, conclusions were thought, and theories were adjusted, so, allowing a different glance facing the transformations of the scientific one. By this*

process the student today, will rethink the transformation of the man through time (T3).

2) First impact: the words: "excited", "amazed", " astonished", "admired", "curious", "surprised", "anxious", "enchanted", "vibrant", "fascinated", "interested", or " dazzled", which were found in the reports, reveal the visual appeal of the Exploratory, in a first impact, as described below by the teacher:

They liked everything, they looked around feeling amazed with that, because in our school there are so many children who don't have the opportunity not even to go out to a common park and everything that is different to them, took their attention. They liked mainly the project's models ("maquette"), by the richness of details showing the reality with so perfection (T4).

This example is a synthesis of the absolutely most of the reports, showing that the Exploratory really presents a so appellative character in relation to Physics, Technology and Science. There is the possibility to understand the museum geographic space as scientific fiction, or as an apology to the "wonderful mechanics".

3) Dialogue and preparation before the visit: the dialogue, according to the PCGC's methodology, must be stimulated in school by the teacher, before the visiting. It is hoped, with these questions, an investigation about the results of the PCGC's methodological process that has the objective, through the mediation, an interactivity of the student with the Science Museum's collection. Three categories of answers appeared in the questionnaires. The majority (37 reports) pointed out the presence of dialogue and communication between the students and the monitors, and only four reports indicates the opposite. In thirteen answers, there is an intense praise to the monitors and their attention to the students, but these reports don't reveal details about the dialogue between them and the students. For instance:

A positive observation point was the children's questioning to the monitor and vice versa (T5).

The children's participation, their behavior, and their attention. My students' apprehension (T6.)

The monitors' explanation was very clear, with an accessible language for the students. Time was not enough, so "we wanted more". (T7)

The questions that try to investigate if there was a preparation by the teacher, before the Exploratory's visiting identify two categories. One of them points out to the work done before (42 reports). The other one shows more "open" answers, not referring to the theme proposed to the classroom's space (12 reports), as showed in these examples:

Before the visiting, we had already worked with the theme in the classroom so, the students had already prepared for listening about the theme. And during the visiting, they were participative and open-eyed (T8).

I didn't know the objectives defined before. I just knew about the matter during the visit (the water's subject I knew a day before because I asked a teacher who told me just the theme) (T9)

4) After the visiting: the questions which try to analyze the Exploratory's after visiting, investigating the impact of this visit over the school daily routine, and the activities developed starting by the experiences, show in the answers that, the school activity was influenced after the visiting. Around fifty teachers reported the use of activities that linked the experiences in the PCGC, in their classes, as well as the participation more effective for the students' initiative, like the examples showed:

According to our team, we believe that this researching class brought us fundamental directions in our pedagogical practice seeking for a transformed action, allowing that the acquired information during the learning process become daily actions to the recreation of a educational reality based in the responsibility and in trusty to construct a better world. We are sure that, it was so important for all of us and it transformed the learning just existed into a potential knowledge (T10).

I noticed they had an interest in visiting again with their relatives and they commented they enjoy so much learning in a different way. I think this project is pretty interesting, of a great worth to education, and it should be easier for all to participate (T11).

5) The ongoing professional development courses for teachers: It analyzes how they

concern the Exploratory visiting with their own ongoing professional development courses. Around thirty four answered that the experience contributes to improve their knowledge, and twenty of them, don't think so. There are examples of these reports:

> *Yes, for also as a teacher, I have a total lack of information about the contents. It's one thing to search in a book, and it's another thing to update your knowledge while is learning (P12). For sure, we must always keep an open mind to new knowledge and, listening many things in the PNFM, I noticed the importance of knowing to appreciate my role in society, that is, to work for the environment (T13).*

6) The teachers' conceptions of Science and Technology: the questioning results can be synthesized in two groups of answers. The first one, is registered in forty nine of the answers, and points out to the concepts of science related to the great discoveries, systematized knowledge, theories' verification, showing a scientific character and non-historic in which, in some cases, reveal the confusion between science as a process and science as Science's learning, as mentioned the examples below:

> *The systematized knowledge; the phenomenon observation and classification; all of this based on true information (T14).*

> *Science is synonym of education knowledge. It goes toward great scientific discoveries. It is the science that develops uses for technology (T15).*

The second one conceives science as a human and fallible activity, historically constructed with the objective of the nature's and social relations' studying. This concept is registered in five answers, as the example below:

> *Science is a historic process that establishes new relations with the natural and sociocultural phenomenon through a more elaborated new reading and interpretation of nature (T16).*

In relation to technology's concept, it can also be established in two groups of answers. On the first group, reported in fifty three answers, technology is conceptualized as a product of science, advances and benefits, study of the technique, modern techniques, machines, modernization, are examples:

> *As a result of science, technology can be understood as all the knowledge acquired by man that favors the welfare and also propitiate the search for all that we don't know, and don't overcome (T17).*

In the second group, only in one of the reported answers, the technology's concept is as a human, historic and social activity, of a processing character and not always considered as a synonym of benefits and modernity. Are examples:

> *Created forms by human beings to facilitate and transform life. According to Vygotsky, "the language between the man and the world create tools which are improved through the history, and through them, man overcome the world and his own behavior". The historical evolution of technology begins with his own existence and the use of materials for its survival, with the use of stone, bone, wood, etc. After that, it emerges the agriculture, the cattle, the weave, and at last, the technology was and it will be present in human's life (T28).*

As regards to the investigation about the monitor's experience in the Science Museum, the results reveal an intense commitment of the group that periodically meet in order to study and discuss some questions of methodological precepts, teaching and learning, and the own school scientific and museum knowledge. Besides this, in reporting to the research, the PCGC's team comments that, after beginning the practice of this dialogue with all the teachers, the whole process was benefited, showing a commitment more evident by these professionals.

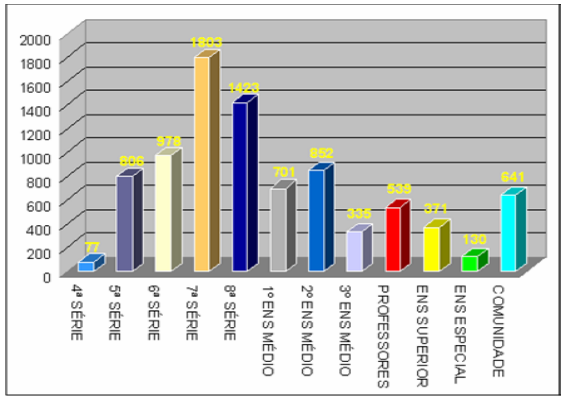

Figure 3 – Students' reception to the visiting in 2004

In relation to the number of children who had the access to the Science Museum in

orientated programs, based on data of figure 3 and 4, we can notice a valorization of participation of the children in the 1st to the 4th grades elementary school, from 2004 to 2006.

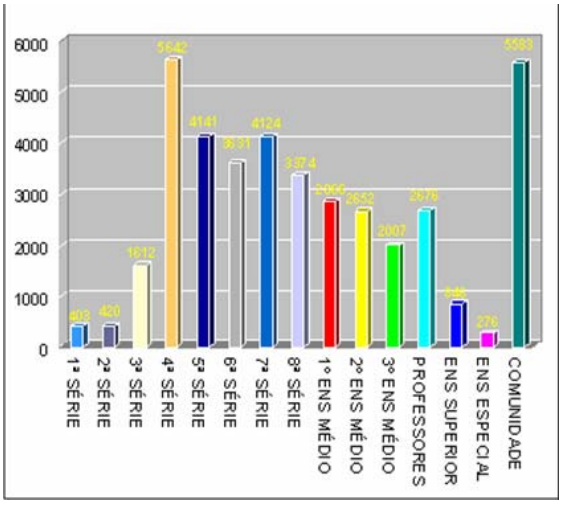

Figure 4 – Students' reception to the visiting activities in 2006

It is noticed that between 2004 and 2006, the number of children assisted in PCGC increased from 77 to 8077, revealing that the Science Museum analised, started to assist, in 2006, around to 21% of the Museum public in PCGC.

7. Conclusion

The research concerning the PCGC's Program shows that the planning of the directed and mediated visiting made by the monitors, was the responsibility of the technical team of PNFM. They worried about the exposition and mediation for the public as much as possible. So, the strategies such as the use of analogies, questioning, representation, and many others, are identified in the mediation's practice in order to stimulate the dialogue among the participants.

The investigation also tried to know about the criticism's consciousness about social, economical, cultural and environmental impacts originated from the science and technological advances. It is considered in this analysis, that aims to a true educational working enlarged ACT, the involved professionals must know the philosophic discussion about the science and technological concepts.

Observing the collected data that search for the identification of how these professionals face the discussion referred, it is noticed, unfortunately, there is a confusion between the scientific knowledge produced by scientists and that one experienced in school and in the Science Museum. Thus, it is considered that, the PCGC assists to children in the Science Museum with an efficient and innovative methodology; permits teachers work in an easier way in formal scientific education; contributes to the teachers' scientific educational development, but it is necessary a deeper discussion about the educational objectives in Science; the concepts of science and technology; the philosophical discussion about the educational process of production in science and technology.

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