



Rede de Informação Tecnológica Latino-Americana
Red de Información Tecnológica Latinoamericana
Latin American Technological Information Network

ASSESSMENT OF THE CTC PROGRAM

SCIENCE AND TECHNOLOGY WITH CREATIVITY

IN THE CITY OF BELO HORIZONTE – MINAS GERAIS

NOVEMBER 2007

PARTIAL REPORT

1ST EDITION

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Presentation

The quest for solutions to problems faced by global society, in which bad wealth and knowledge distribution weakens social results of the bold conquests in the area of science and technology, results in everyone's inclusion in a common fight, potentially capable of reverting the scenario of difficulties faced nowadays. Among the strategies to be adopted, the equality in the access to quality education for all has an essential role, in a context in which children and teenagers are necessarily the subject and the object of effective and innovative programs and actions.

As everyone knows, RITLA – Latin American Technological Information Network – has been making efforts in order to assess educational programs developed in the area of science and technology. Its major goal is to build a panel of experiences that can provide subsidies to public policies committed to the reversion of the low indexes of the quality of education that have been characterizing most Latin-American countries.

The mission assumed by RITLA gains special relevance, especially when we consider the scarcity of assessment studies in the aforementioned area. This happens because, although the importance and pertinence of Science education today are formally known, the assessment of its contents and its impacts is not yet inserted or is inserted incipiently in the main actions carried out with this purpose.

Therefore, based on the verification that the majority of the population is still excluded from the creation processes and the benefits of science and technology, then knowledge and the diffusion of proposals committed to promoting the introduction, understanding, appreciation and qualification in these areas, from the early years of the school life, present themselves as a unique strategy in the sense of contributing to break the disparities previously mentioned. And more: new effective vectors can be constituted for the so desired (and little practiced) public commitment of offering equal opportunities so that all citizens can surpass the sphere of dream and reach reality. In a global society increasingly influenced and shaped by the fast technological transformations, in the basic learning needs and knowledge necessary in education, not only for the future, but also for the present, science and technology education has a leading role because it is essential for the construction of a fair and prosperous world, capable of being inserted in the molds of responsible sustainability required today.


Therefore, this is the intention that guided the elaboration of this report: to make this a possible path for education administrators of the public sphere, as well as other institutional partners committed to reverting the low education quality of the country, so that, when they become aware of the results reached with the adoption of actions such as the Science and Technology with Creativity Program (CTC), they can perform their roles, making choices, guaranteeing proposals and making decisions in agreement with the principles that guide the suppositions of construction of a democratic education.

Based on the scenario previously exposed, this work presents the results reached in the first stage of the assessment of the Science and Technology with Creativity Program, as a pilot-project developed in 11 public schools of the city of Belo Horizonte, in the state of Minas Gerais. Currently in progress, this assessment has been applied in two different moments: post-initial and final moment, both within the same academic year. We hope to identify, characterize and analyze, by confronting the data and information gathered in the two stages, the pertinence and efficiency of the different strategies, of the procedures and instruments through which we try to meet the targets and reach the goals of CTC.

The assessment process takes place based on a comprehensive approach, aiming at responding, within the limits, to the different dimensions of the place where the Program is inserted, in order to determine its merit, utility or effectiveness, its relevance and its quality, thus creating subsidies and recommendations for its extension, correction or improvement.

Despite the fact that the CTC implementation process is happening at the same time in different locations, it is essential to consider as a starting point that, in each state or city where the Program is implemented, it has specific features. However, this fact does not mean that the results verified are strictly limited to the regional sphere, which demonstrates that the solution of specific problems regarding the most general recommendations for processes in progress can many times be obtained in the same place. These indicatives can form the basis for the creation of new initiatives, which will generate other and deeper subsidies for future projects, in a continuous movement, which result is the improvement of the actions, through the production of increasingly more elaborated knowledge.

Therefore, the evaluation and disclosure of experiences such as this one are essential, as they demonstrate, if executed where educational actions are more concentrated – that is, the public educational system – to be potentially capable of inspiring and subsidizing other initiatives committed to the ideal of pedagogy, as its foundations are solidly based on the socialization of scientific knowledge, a factor indispensable for breaking the vicious cycle uniting the pair exclusion and delay that has been striking Brazilian society for decades.



JORGE WERTHEIN
CEO of RITLA

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To all students, parents of students, teachers, pedagogical coordinators, school principals, regional management, technicians and administrators of the Education and Culture Department of the City of Belo Horizonte, who kindly received the assessors and gave their honest testimonies committed to the improvement of the quality of education, sharing their experiences, opinions and hopes.

To the Secretary of Education of Belo Horizonte, for opening the Department and the schools for the execution of the assessment process.

To the team of Sangari Brasil, represented by Ana Rosa Abreu, for the valuable contribution in the formulation of this assessment.

I see the pleasure of my students, they want to have Science classes. "Don't we have Science class today?". They even make things up. When we don't have class, they say we do: "Teacher, we do have class today". I can see that they did better even in the formal evaluation.

TESTEMONY FROM A TEACHER

Executive Summary

This document is an assessment carried out by RITLA – Latin American Technological Information Network, of the impacts of implementing the CTC Program in institutions of the Municipal Department of Education (SME) of Belo Horizonte in the second semester of 2006.

CTC – Science and Technology with Creativity is a Program intended for scientific education at Junior High School level, which puts together initial and continued teacher training, support material for the teacher and student and different inquiry materials.

In Belo Horizonte, the Project covered the implementation of 12 (twelve) Units in 11 (eleven) schools of the Network, which is equivalent to 6% of the total, and about 160 permanent teachers; 40 trainers (teachers, school coordinators and technicians of the Department of Education) and 7,700 students from 1st and 2nd cycles of Junior High School.

The assessment methodology used focal groups and individual interviews with 102 actors of the Program: pedagogical coordinators and school principals, SME technicians, trainers, teachers, students and their families.

The greatest impacts of CTC in Belo Horizonte were the enthusiasm and the appreciation for Science noticed in students, teachers and family members. CTC stimulated an investigative attitude toward Science education, which allowed the integration of this knowledge with other areas such as the extension of its view of the education process. The enchantment of students for Science was perceived in the acquisition of the knowledge produced in the school and in its repercussion outside the classroom. In this sense, the work carried out by educators increased students' capacity of taking innovative initiatives. They started to dialogue about problems related to the environment, particularly the need to make changes in the production and consumption ways, from the ecological, cultural and social point of view.

A significant part of those directly involved in the Program notices that the access to a good quality work – with good materials and investigative pedagogical proposals – has been generating a positive appreciation feeling, which resounds in everyone's self-esteem.

Among the challenges mentioned by educators, there is the construction of new interdisciplinary strategies, which use Science as an important ally to enhance the quality of teaching and learning, as well as the need for higher investments in actions that link Science teaching to reading and writing processes. Investing in reading and writing using the potential of Sciences, through CTC, may point out new ways to face this which is, without a doubt, one of the greatest educational challenges today.

In the first assessment of this initiative, the relevance of CTC in the education context of Belo Horizonte is clear, not only due to the impacts analyzed, but also due to the explicit request of those involved for the continuity of the actions of this Program.

1. Information obtained in the website of the Belo Horizonte City Hall: www.pbh.gov.br/educacao/escolas.htm.

1. Introduction

Teaching should be such that what is offered is perceived
as a valuable gift and not as a hard duty.

ALBERT EINSTEIN

1.1 The importance of establishing scientific knowledge

Although in the past few years Brazil has been trying to enhance its scientific and technological capital, the initiatives of approximation with the scientific knowledge are still inaccessible to the majority of the Brazilian population, specially the new generations. The speech of the Ministry of Science and Technology, Sérgio Machado, translates this perception:

We do know that scientific development is increasingly fast. In the past 50 years, having this agency as witness, the scientific discoveries surpassed all knowledge accumulated by Humanity in its History. Our Country took part with a certain delay. (REZENDE, 2006)

Indeed, in the 21st century, it is still necessary to draw the attention of the general public, especially governors, in order to understand the real importance of Science education to improve life conditions, social, political and economic development of a country and the construction of a better world.

Undoubtly, public domain of science and technology concepts can significantly contribute to increase the possibilities of the exercise of citizenship and solidify democratic processes, as states Tedesco (2006):

The main argument to justify the priority of Junior High School Education has a social-political nature. Mastering basic scientific knowledge is an indispensable component in the formation of a citizen of the information society. This is the reason why scientific formation must be incorporated to the content of universal and obligatory education. (TEDESCO, 2006)

The precarious access to scientific knowledge and even smaller access to the possibility of producing science and technology is the reflex of the huge “naturalized” social inequalities, which are reified in an incisive manner by the Brazilian educational system. Although Brazil has achieved the universalization of Junior High School Education in this decade, what Charlot (2004) said should be noticed – the care for an allegedly equality in the beginning and a deep inequality in the end: “today, the safe of the possible was opened but in fact, the opportunities

are very narrow, they require more than the mere increase in the offer of places in a classroom or school – many times without any quality in the public network.” So, for many, overcoming inequalities has, today, in public schools, “the last republican space left for us” (HENRIQUES, 2004), the institution being a cozy place to democratize the access to knowledge and scientific and technological production, stimulating the interest for Science and the relations between scientific concepts and life.

The quest for expanding a quality education in Brazilian public schools goes through a real and symbolic investment in the socialization of Science teaching. In the words of the Ministry of Education, Fernando Haddad, to young scientists, the appreciation of scientific production appears with strength: “You can help MEC with the same creativity and dedication you used in your projects and studies. We want to find out more appropriate ways to reach young people and discover talents.” (HADDAD, 2007).

To Pavão (2005), clear determinants for the scientific and technological development of the country are: a quality scientific education in schools, training of qualified teachers, the existence of consolidated universities and research institutions, the integration of scientific and technological production with industrial production in an attempt to solve serious social problems and to overcome the inequalities that affect the country.

The acknowledgement of the importance of Science education is not yet defined in the Brazilian educational field, as Chaves points out (2005)::

In addition to carrying out a strong Science education program, it is necessary to review the way Science is taught in Brazil. We have a rooted tradition of an education based on books, excessively formal, in which people end up believing that knowing the name of things is the same as knowing them. Scientific education must begin with the contact of the children with natural phenomena, in simple situations in which they can change the environment or the initial conditions of a natural system and observe how it behaves. (CHAVES, 2005, p. 58)

Some authors raise the issue that, due to the precarious situation related to literacy in the first grades of Junior High School, the educational system focused on this segment, investing heavily in the *lato sensu* literacy and in instrumental mathematics, which ended up putting scientific literacy in second place and, in a general way, result in the training of generations of teachers who do not feel secure enough to work on this educational field, strengthening a systematic vicious circle.

Starting to do sciences is, in fact, teaching students to question themselves. However, this task is not as simple as it seems:

For students, there is a high degree of detachment between the scientific activity and everyday life. In general, they are not aware of how much the scientific-technological activity participates and affects our daily reality. The school science is uneventful, dull, not very useful and very difficult. We know that students’ interests are focused on action, dialogue, idea confrontation, teamwork, experimentation, group reflection, in the search for

new questionings. However, Science classes are not able to transmit the idea of being vital, human, fascinating, inquirer, opened, tolerant, useful and creative, which are features of the scientific activity. (Pavão, 2005)

In this area, because it is still unveiled, the linking possibilities among the contents, subjects and curriculum need to be understood, drawing the attention to the essential role of teachers and mediators of the educational process. As pointed out by Santomé (1998), it is the educator’s role to show students the relationship between the different kinds of knowledge, in addition to generating interests, as they are not innate.

Finally, Science education from the earliest years of Junior High School can be discussed based on the importance of stimulating other kinds of knowledge, such as the development of the Portuguese language; with the possibility of allowing the appearance of talents among children of poorer classes for scientific careers; and, also, due to the fact that the scientific knowledge and the new technologies are essential for the population to know how to behave when dealing with processes and innovations about which it needs to have a critical opinion. (WERTHEIN, 2004)

1.2 Science and Technology with Creativity Program

*I insist on being a man of my time,
not a man exiled from it.*

PAULO FREIRE

The Science and Technology with Creativity Program - CTC was idealized by Sangari Brasil, a plurinational British institution, with over forty years in the market, present in Brazil for about ten years, with the purpose of conceiving, developing, supplying and implementing solutions and projects for all levels of learning and scientific research. Its central proposal is to support teachers, creating a formative context capable of allowing transformations in educational practices so as to contribute for schools to promote and guarantee scientific inclusion of the new generations. The mission of Sangari Brasil is to promote quality education and social inclusion by developing existing national structures.

Within this context, the Science and Technology with Creativity Program proposes to give a new meaning to scientific knowledge in a creative way, allowing the rescue of its students’ authorship, raising their self-esteem and valuing the learning process of which they are part. To do this, it develops a pedagogical proposal based on an inquiry methodology, using different didactic materials, such as books, games, videos, experimentation material, among others, aiming at understanding the natural science phenomena studied, based on official documents (LDB,

CNE, DCN e PCNs). It is also based on a formative work developed with teachers, expanding and qualifying the pedagogical options in the area. CTC is organized in modules for all Junior High School grades, with a curricular proposal that covers abilities, concepts and attitudes necessary for this phase. Its organization allows implementation flexibility, by linking the contents, according to the needs of each education system and the curricular proposal adopted.

In general, it can be stated that the main focus of the program is on the inclusion of scientific knowledge as a knowledge amplification generator, both for the student and for the teacher, considering that the most important capital of a country is knowledge. Knowledge must be shared through an education that takes place with the active involvement of the learner in its construction, as well as previous ideas from students, who play an important role in the learning process. However, such knowledge depends on the training of people capable of producing it. Therefore, the inclusion of Sciences since Junior High School must be necessarily associated to a teacher training policy. In this perspective, training educators for the development of the task is an essential requirement for the development of CTC.

The result should be a significant impact of Science teaching on the quality of education, considering the fact that it involves an extremely important exercise of thought and problem-solving skills, which contributes to awaken in children their creative spirit, their interest, improving learning of the group of subjects, as learning must take place guaranteeing the conjugation between experimentation and enhancement of oral and written expression.

1.3 The implementation space for the CTC Program pilot-project in Belo Horizonte

It should be highlighted that the Municipal Education Network of Belo Horizonte has been promoting a number of changes since 1995, both in its system and in the political-pedagogical sphere. The renovation movement, called “Escola Plural”, started the possibility of investing in the new, in other ways of making education. This information is necessary in order to understand on what grounds CTC is developing and what repercussions this can have in its implementation, considering the coexistence with a number of significant and innovative experiences, specially because the network of the capital of the State of Minas Gerais is one of the first ones in Brazil to adopt “cycles” as an order strategy of the pedagogical times.

The pilot-project for the development of the Science and Technology with Creativity Program in schools of the Municipal Education Network of Belo Horizonte began upon the signing of a protocol of intentions, on August 09, 2006, between the Municipal Department of Education, Sangari do Brasil Ltda. and Instituto Sangari. The purpose of this protocol was to make joint actions for the development and strengthening of scientific education in Junior High Schools of the Network. However, it should be highlighted that the implementation of CTC in Belo Horizonte is the result of a courtesy by Sangari Brasil, aiming at presenting the Program and, most importantly, give visibility to the significant possibilities of a better quality education by bring-

ing together science, reading and writing.

In the agreement signed, it was also established that the Latin American Technological Information Network – RITLA – would coordinate the assessment of the actions resulting from the implementation of CTC in schools. The program was actually implemented in the first semester of 2007.

According to information presented by the “Report on the CTC Program Implementation in the Municipal Education Network of Belo Horizonte” (SANGARI BRASIL, 2007), in the year 2007, the Project includes the participation of 11 (eleven) schools, among the 179 schools that integrate the Network¹, which is equivalent to about 6% of the total, and about 160 permanent teachers; 40 trainers (teachers, school coordinators and technicians of the Education Department) and 7,700 students of the 1st and 2nd cycles of Junior High School, and *CTC actions were thought so that educators of the Municipal Network can acquire its conceptions, enrich and incorporate the practices divulged by the Program, adapting to its reality, so that CTC becomes part of the local pedagogical culture.*

Chart 1 – List of CTC participating schools

Name of School	Regional Education Administration Offices (GRE)
Escola Municipal de Vila Pinho	Barreiro
Escola Municipal Mestre Paranhos	Centro Sul
Escola Municipal Ulisses Guimarães	Centro Sul
Escola Municipal Fernando Dias Costa	Leste
Escola Municipal Emídio Berutto	Leste
Escola Municipal Oswaldo Pierucetti	Noroeste
Escola Municipal Francisco Campos	Norte
Escola Municipal Governador Ozanan Coelho	Nordeste
Escola Municipal Milton Sales	Oeste
Escola Municipal Alice Nacif	Pampulha
Escola Municipal Antonia Ferreira	Venda Nova

Regional Education Administration Offices (GRE)

The team of the Municipal Department of Education of Belo Horizonte was in charge of selecting the education professionals who would work as trainers of the teachers who participate in the Project. It was defined that these professionals selected would receive systematic training, under the coordination of the team of Educational Consultants of Sangari.

The criteria defined for selecting the trainers were:

- Be a permanent professional of the local education network;
- Have a degree in Sciences;

1. Information obtained from the website of Belo Horizonte City Hall: www.pbh.gov.br/educacao/escolas.htm.

- Have classroom experience;
- Have leadership skills;
- Preferably, have worked in the coordination of teacher groups.

For the initial preparation of the works in schools, Sangari team organized an initial 32-hour training for teacher-trainers selected by SME. This first stage included continued training actions for teachers and systematic actions for follow-up and support for the development of the Program in schools through meetings (monthly meetings of 8 hours) and distance follow-up. Teacher training is developed by trainers in schools and supervised by the coordination agency appointed by the Education Department, advised by Sangari.

Regarding principals and coordinators, initial meetings were promoted with the Sangari team, as well as systematic actions with the technical team of the Department of Education. *The idea was that these professionals could understand the Program and commit to it, as well as visualize the possible impacts related to the pedagogical, administrative and organizational aspects of school administration.* (SANGARI BRASIL, 2007)

The CTC units adopted in 2007 by the schools of Belo Horizonte are listed below, organized pedagogically as follows: 01 (one) CTC unit per semester, in each year of the 1st and 2nd cycles of Junior High School.

Chart 2 – CTC units adopted in the Belo Horizonte pilot-project

Cycle	Year	CTC Units	
		1 st Semester	2 nd Semester
1 st	1 st	Water	Living Beings
	2 nd	Life of Plants	Solids and Liquids
	3 rd	Life Cycles	Transformations
2 nd	1 st	Weather and Climate	Rocks and Minerals
	2 nd	Human Body	Electricity
	3 rd	Ecosystems	Diversity of Plants

Source: Sangari Brasil Report.

Teacher training occurred based on the most general issues involving scientific education, investigative methodology and, more specifically, the contents and activities of these units. For their development, the schools received didactic material for all activities (kit for scientific inquiry, games, videos), teacher's book and student's book. The training was carried out involving groups of trainers who are mostly teachers or pedagogical coordinators of the schools. This work also had the presence of local assistants connected to the educational administration offices of the SME department. Initial training was intended for classroom practice, studies, exchange of experiences and discussion of issues that emerge throughout the development of the work. General conceptions of Science teaching, inquiry methodology and the specificities of the units were covered. Each of the Units adopted was the object of a specific training moment.

Chart 3 – Teacher Training Proposal

Actions	Objectives	Themes
Initial Training	• CTC Program presentation and preparation for its beginning	• Methodology and general approach of the CTC teaching and learning proposal • Pedagogical proposals, didactics and Science teaching • Specific training for the development of the first Units in the classroom
Continued training	• Systematic training meetings • Support for the development of CTC activities in the classroom	• CTC development • Classroom management • Reflection on the practice • Science teaching methodology through inquiry • Other themes related to the development of CTC in the classroom
Procedural assessment	• Procedural assessment	• Reflexive reports on aspects related to students' learning, their own professional development and other themes of the program

Source: Sangari Brasil Report.

Also according to information of the “Report on the CTC Program Implementation in the Municipal Education Network of Belo Horizonte” (SANGARI BRASIL, 2007), the Municipal Department of Education, together with Sangari, established a co-responsibility relationship for the development of the CTC Program, each institution being in charge of the following:

Instituto Sangari:

- Systematic and specialized pedagogic advising, being directly responsible for teacher training;
- Supervision of the teacher-trainers' work;
- Advising for the administration of pedagogical actions;
- Delivery of materials within the period determined;
- Technical and organizational support during the development of the Program;
- Participation in monthly meetings in the Department of Education and whenever necessary.

Municipal Department of Education:

- Indication of a local professional for the general coordination of the Program;
- Indication of professionals for the pedagogical coordination, supervision and follow-up of teacher works;
- Organization of local events: appointment, selection of trainers, offering of infrastructure for events etc.;
- Definition of time and space for systematic training activities for teachers and trainers;
- Orientation of schools principals to receive CTC in their daily activities with possible routine alterations;
- Timetable execution.

With these principles, plans and articulations, CTC began at SME and schools participating in the pilot-project. However, it should be highlighted that, in the world of proposals and ideas for classroom practice, there is a long path to be trodden and it is in this path that a lot of possibilities and limits of educational programs are defined.

We have included ahead the first results of the CTC assessment, in the opinion of the main actors of this process: students, teachers, pedagogical coordinators, principals, assistants of regional administration offices, technicians and administrators of SME.

2. Methodology

A few assessment studies in the field of educational programs would be complete without a qualitative look. Descriptive, monitoring and estimate studies are both accurate and rich in qualitative information. In the case of the CTC assessment, which development agglutinates a number of variables that escape from the analysis based on quantitative approaches, the resorting to this view is of undeniable importance.

Therefore, taking the assessment act as an understanding process of this action, based on defined criteria, aiming at determining its relevance, effectiveness and quality and, thus, produce subsidies for its expansion, correction or improvement, a combination of methods capable of allowing a multiple and comprehensive analysis of the Program development in Belo Horizonte was used, sheltering the view of the whole.

Focal groups (with students, parents of students, teachers, pedagogical coordinators and regional coordinators), structured individual interviews (with school principals, technicians and supervisors of SME) and the direct observation of the schools where the Program is implemented were the basic procedures of this process, complemented by instruments intended for obtaining quantitative information (questionnaires, characterization cards), mainly regarding the profile of the schools and the actors.

The “focal group” technique, through which components of a certain group narrate and discuss perceptions on the theme, stands out from the others mentioned herein because it provides the attainment of consistent qualitative information on behaviors, practices and perceptions from a number of people which would hardly be produced in a short period of time using other resources.

The selection of the actors researched considered the need to understand the structuring, the operation and the repercussions of CTC. Thus, because this is a diagnostic assessment, portraying the first step of implementation of the Program, the actors of this process were interviewed in order to find out their results with the students, the schools and the communities where the pilot-project was carried out.

In the chart below, a summary of the field work developed is presented:

Chart 4 – Field work – Participating actors

Actors	No. of People Interviewed	Research Strategy*
Students	49	GF (4)
Parents or tutors	17	GF (2)
Teachers	17	GF (2)
Principals	11	EI (11)
Regional Coordinators**	6	GF (1)
SME Team***	2	EI (2)
TOTAL	102	

* GF – Focal Group; EI – Individual Interview. ** The group includes regional coordinators and the like.
*** Technicians and supervisors of the pedagogical area, Secretary of Education and Culture.

About the students researched

Out of the total number of students assessed, 63% are female and 37% are male, as shown in table 1. From the point of view of self-identification by color, table 2 shows that those who define themselves as black and brown-skinned respond, jointly, for the vast majority, comprising 80%; 18%.

Table 1 – Distribution of students by sex

Sex	Quantity	%
Female	31	63
Male	18	37

Fonte: Avaliação do Programa CTC em Belo Horizonte, 2007.

Table 2 – Distribution of students by color

Color	Quantity	%
Black	10	21
Brown	29	59
White	9	18
Not declared	1	2

Source: Assessment of the CTC Program in Belo Horizonte, 2007.

Regarding age, participating students range from 7 to 13 years old, with a predominance of the 8 to 10 age group, totalizing about 70%. The 11 to 13 age group corresponds to 22%, whereas students aged 7 totalize 8%.

Table 3 – Distribution of students by age

Age	7	8	9	10	11	12	13
Students	4	12	9	13	8	1	2
%	8	25	18	27	16	2	4

Source: Assessment of the CTC Program in Belo Horizonte, 2007.

Aiming at reaching these students – Junior High school children and teenagers –, a specific procedure for the realization of focal groups was developed. Although they use a previous guide, the focal groups are based on the proposition, to students, of playful activities, highlighting the use of drawing as a way to register their opinions and their knowledge.

The option for the drawing as an object of study is based on the premise that this is an important expression form in the learning development of children (cognitive, psychomotor, social, cultural and affective), assuming a relevant role in the educative process. Add to this the fact that it is a resource accessible to all, as it is a frequent practice in schools and, in part, in everyday experiences. As Vigotsky says, children do not draw what they see, but what they know:

Very frequently, children's drawings not only have nothing to do with the real perception of the object but also, many times, contradict this perception... when children release their repertoire of memories in a drawing, they do so the same way they do when they speak, telling a story. The main feature of this behavior is that it contains a certain degree of abstraction, which is necessarily imposed by any verbal representation. Then we see that drawing is a graphic language that appears having as its base the verbal language... these facts provide the elements for us to start interpreting children's drawings as a preliminary stage in the development of written language. (VIGOTSKY: 1991, p.127 e 128)

Through drawing, it was possible to observe several perceptions in relation to scientific knowledge and the way this knowledge is being worked with, as well as its influence as a reading and writing stimulator, an important element of the CTC proposal.

The basic guide used to conduct the focal groups (Exhibit 1) was adapted based on the features of the work in progress in the schools/classes involved.

On August 22, 2007, students from the Escola Municipal Fernando Dias Costa were interviewed. We had intended to work with students from the 2nd cycle, but the school administration had involved students from the 1st and 2nd cycles. Therefore, we organized two focal groups, one with students from the 1st cycle and the other one with students from the 2nd cycle.

Sitting on a circle, which facilitates group communication, the students talked about the importance of preserving the environment, about the life cycle of the worms, the experiments they made, the relationship that parents have with the Project and drew what they most liked learning.

In the morning of August 23, 2007, a focal group was made with students from the 2nd cycle of Escola Municipal Francisco Campos. The students interviewed talked about issues covered in class, such as: water preservation, the importance of each organ in the human body and registered, on a sheet of paper, what most caught their attention in Science classes. In the afternoon, the focal group was carried out with students from the 1st cycle of Escola Municipal Deputado Milton Salles. Children reported orally and through drawings how important it is to take care of animals endangered of extinction and plants, which are essential to life in the Planet.

3. The path of the CTC Program at SME Belo Horizonte

3.1 The experience of SME in the area of Sciences and the adoption of CTC

When it was experimentally adopted in the municipal public network of Belo Horizonte, the Program Science and Technology with Creativity found a fertile soil for its development. This is the strongest impression that offers the analysis of its path in the city, during the first semester of 2007.

We are in a society which has centuries of scientific paradigm construction. We read the world based on science. However, this notion is not very consolidated to us. We consume technology, which is the result of scientific inquiry of the world, but we do not see reality based on this paradigm that guides our life. And I think Science education should present this. And from an early age. So, the kid has to think with hypotheses, has to know how to investigate reality, has to have access to this scientific knowledge, because this is the knowledge of our time. And the space for this is the school, for this systematized knowledge. (GF Assistants)

This impression is based not only on the roles assumed by the Municipal Department of Education – which includes “proposing, developing, adopting and adapting methods and techniques capable of turning Education into an attractive and accessible process to all layers of the population” and “proposing innovations and updates in the Education area, turning it into a tool for awareness and citizenship formation” (BELO HORIZONTE CITY HALL, 2007) -, but, mostly, on the experience accumulated and under permanent construction since the adoption of “Escola Plural”, in 1995.

Acknowledged as a proposal with deeply innovative features, Escola Plural is committed to the principles of right to education and inclusion. Among its guidelines, the appreciation for the student as the center of the educative process has an essential role, aiming at a “thorough education in all dimensions, that is to say, attitudes, values, procedures and concepts of the several areas of knowledge, creating, in this process, new alternatives for the relationship with knowledge at school.” (BELO HORIZONTE CITY HALL, 2007).

In this context, the testimonies obtained from representatives of the “pedagogical training and political-pedagogic coordination management” and “Regional Education Agencies” of the Municipal Department of Education show the existence of a general conception of science education in tune with the aforementioned referentials, but not totally materialized in practice.

There was nothing guided. This was a curricular issue of the school. So, each school developed things as they wished in the curriculum. There are schools that progressed. Other

schools just had their forty minute class. Other schools didn't even use it, it depended on the school. (GF Assistants)

The Department has been working hard toward the construction of the cycles, which is what guides us, and the cycles are cycles of age. And, in this sense, we have been discussing how students learn. How long does this learning take? And then the areas of knowledge appear as important areas in the education of these students. In this sense, I think we have been making a lot of investments in the past ten years. Not specifically in the area of Sciences, but in the consolidation of the cycles. (GF Assistants)

According to those interviewed, CTC meets the needs of revitalizing Science education in the network and brings it to a new level of recognition and appreciation, specially among teachers who work in the two initial cycles of Junior High School, leaders without specific training in the area. As a technician points out, "the CTC Program arrived at the right time, in a moment when we are open to it".

With an experimental nature, after the SME agreement with Sangari Brasil, the implementation process of the Program in schools was preceded by the assessment of its proposal and its material by specialized technicians of the Department and is noticed by the people interviewed:

I think Sangari introduced itself, brought the proposal and was assessed by the coordination. I think the Department is at a moment of using everything that contributes to our curricular discussion. We are at a phase of growth, of thinking about the fragmentation issue, not only Sciences. CTC caught us at that moment. There was an analysis of what they were proposing and it was assessed as something that deserved to go through this experience. (GF Assistants)

Sangari arrived, I think, through the vision that the Belo Horizonte network has an innovative Project, that it is trying to change the educational structure. So, I think this stimulates our partners to participate. (GF Assistants)

Regarding the selection of participating schools

The schools that integrate the pilot were selected, according to the Department of Education, based on some general criteria and counting on the most accurate views of the regional administrations, in charge of the direct follow up of the schools.

An SME technician points out the fact that regional administrations chose the schools in which the investment in a Project such as CTC could help overcome a few problems, such as the difficulty to develop collective work, highlighting other situations, like a school whose main reason to choose would be more connected to the context of extreme social vulnerability of the work developed: "It is the opposite there, the school has a very high collective investment. It chose it because it is on the verge of very serious conflicts".

The interviews made with other actors show that they are aware of these criteria and procedures, in addition to exemplifying the diversity of focuses present in the selection process:

We were at a moment of assessing the performance of the school in the "Prova Brasil". Not by chance, this school has the lowest "NSE", which is the socio-economic level. It meets an extremely needy and vulnerable population, and it was in a moment of reflection on its entire process with these students. It is a school that accepts challenges. So, our criterion was to choose a school that had a poor performance, in an area of social vulnerability, but with a team that would accept the challenge of implementing a proposal. And we did it! (GF Assistants)

Our school is also a school with vulnerable children, with very low performance. The socio-economic level of those kids is the lowest of the region. It is a cluster in the richest part of the city, with a very traditional school. The teachers, each in their classroom, cannot perform collective work. (GF Assistants)

In our regional office, the school already developed, about fourteen years ago, a project in the environmental area, in the recycling area, in the computer science area, in the music area. So, due to this, offering CTC was like giving them a present. (GF Assistants)

Regarding the selection of trainers

Regarding the selection of trainers for the Program, their indication was the responsibility of the schools selected, together with the respective regional administration offices, as observed by an SME technician:

Teachers are from two different groups: first cycle and second cycle. We asked the schools to choose, among those that worked with the first cycle, one that could be a reference, a "teacher trainer". So, the school itself, together with the pedagogical coordination and the administration, appointed someone. Then, two people from each school came – one in the morning and one in the afternoon. Some schools chose the pedagogical coordination, so the pedagogical coordinator comes. Actually, he is not in the action of development, Project execution in the classroom. Some are teachers; so, they come, they are a reference, they are trainers and there they also develop the Project. (SME Team)

SME's concern in promoting a careful and democratic process to select the trainers is noticed in the speech of a regional assistant, when referring to the choice, in one school, of an experienced and acknowledged teacher:

We had a teacher who was already the coordinator of another project here, and her choice was very wise, because there was a very good acceptance in the school! It was like giving continuity to the work they were already developing. (GF Assistants)

Other people interviewed also exemplified the several situations in which the selection process of the trainers took place:

In the 2nd cycle, an organization was made and two teachers were going to be in charge of developing CTC. In the 1st cycle, on the other hand, all teachers were to develop a project. As we only had one position, we called a teacher trainer, who back then was a coordinator and then left, but continued as our trainer. (GF Assistants)

In my school, we checked who would like it, who was willing to learn about the Project. And then two teachers came up. (GF Assistants)

We left it up to the school to talk with those who had interest, availability. Then, in the 2nd cycle, the coordinators stayed. In the 1st cycle, we had teachers who demonstrated interest and are fantastic! We can see in the work they develop that they have the profile, that they were very well selected. (GF Assistants)

In certain cases, there was a replacement of the trainers initially selected, for different reasons, without jeopardizing the activities developed. In a general way, the selection process was appropriate and brought legitimacy to the professionals who started working as trainers.

3.2 The opinions of the SME management team on CTC

3.2.1 CTC Proposal – pedagogical and methodological aspects

The CTC proposal, according to the people interviewed, is in tune with the line of work adopted by SME and has an innovative perspective for Science education, specially when we consider that the pedagogical practice in the area is still, generally speaking, not very dynamic, mostly when it comes to the development of an investigative attitude, which is the focus of the Program. As stated by a representative of the SME's pedagogical area, "in the pedagogical field, in the training field, in the methodology field, the Project is excellent!". Other statements are equally illustrative:

This is what we are looking for, it is what we are trying to say. This change of attitude, of behavior, as educators. I think CTC shows us that this is possible. You say: you have to form a critical person, a reflexive citizen. And this work methodology shows that it is possible. (GF Assistants)

When Sangari proposes a methodology that leads kids to be critical, to be observers, to want to search knowledge too, this is very close to what we also believe. (GF Assistants)

The proposal implies changing attitudes, procedures, values. There are different kinds of learning. (SME Team)

There is a bunch of stuff which I am sure in regular Science classes would never happen. (GF Assistants)

The methodological approach is certainly one of the highlights of the Program, which allowed the central participation of the student in the scientific knowledge construction process:

This is a feature of the Project that motivates us all. I don't just get here and say: "I am going to study rocks, soil...". Then I do a field work with soil and that's it, "done, leave it behind, let's do something else". No, if I am going to study soil, I plant on this soil, I investigate the living beings on this ground, I integrate and try to analyze the features and the composition of this soil, isn't that right? That's the idea, if I can have a globalized view to study soil and build some continuity, a routine to return to that, then my appropriation is different from the names, the words. (SME Team)

When we were students, our Science classes were theoretical... Every now and then, we would go to the lab. And we couldn't touch anything! Now the lab is in the classroom. (GF Assistants)

The counterpoint presented by the speech of a member of the regional management of assistants is very elucidative of the different focuses and procedures that CTC establishes:

With CTC, I went back to the days I was in school, I saw how important Science was to me, because it put me ahead. But we had teachers who worked with the textbook and we did not go through this experimentation phase. Even so, what was on the book was very instigating to me! I always searched for more. I think this action is very cool in schools! Working like we have been working is essential in the development of these kids... The laws are all there, around us. And we don't think about this! (GF Assistants)

The material resources that integrate the Program constitute one of the most highlighted issues by the people interviewed, who mention their quality and presentation. It should be said that traditionally the area of Sciences lacks resources for the development of experiments, having a more theoretical than practical treatment in most schools, even in a network like the one in Belo Horizonte.

The didactic material of the Project responds to a very high demand from schools. (SME Team)

Those who are using it only praise it. The quality, the diversity, because the student gains when the activity is individual and the group gains when it is a group activity. They are all praises! (GF Assistants)

The material is assessed as excellent by teachers who work with it and by the administration. There are no buts. It is the highlight of the Sangari Project. (GF Assistants)

It is important to highlight that a few opinions refer to the "novelty" that, for some teachers, represents working with a material that implies an appropriation process not as usual as conven-

tional textbooks, since the proposal, as a whole, also requires – and mainly – from educators an investigative attitude, which they often don't have.

According to the people interviewed, the general assessment in schools, after one semester using CTC, is very positive, regarding both the pedagogical proposal and the material resources that support it when changing the view of the education process it contributes to consolidate:

What we hear teachers say, after practically six months of Project, is that the material, the book, the kit, the proposal, everything contributes for the school work, helps teachers, guides their work in the area of sciences. The proposal helps the school get organized, helps teachers work. (SME Team)

There is a conception that students have to be passive. And this methodology takes students from this place. Because they are going to have to walk around the classroom, gather in groups, handle things, change the order in the classroom, the desks. And we have colleagues, quite a few, who assess students as “good” or “bad” based on their ability of being quiet, sit in a row, or not. And that is not discipline. Discipline is knowing how to get organized, is knowing how to produce respecting rules, agreements. And I think this is what the methodology causes. (GF Assistants)

3.2.2 Training process and the role of the pedagogical team of Sangari Brasil

The training and follow-up work developed around CTC is acknowledged by those interviewed, who highlight its quality and competence and dedication of the Sangari Brasil team and the Municipal Department of Education, which, in an initiative by the Belo Horizonte City Hall, allowed the teachers involved to visit the premises and the Sangari team in São Paulo. SME offered air tickets and accommodation for the group, and Sangari provided an intense program, as highlighted by a representative of the pedagogical area: “In addition to the training here, we also went to São Paulo. We took all teachers there, we visited the Darwin exhibition and we had a 3-day training at Sangari.”

When it comes to Sangari support, I think we have nothing to complain. They are always present. The [Sangari technician] is a very participative, involving, enthusiastic person! Even the Department, represented by [members of the SME pedagogical team], who are always calling the schools, wanting to know, questioning. This Sangari/Department organization has been meeting our needs. (GF Assistants)

However, many testimonies mention the fact that those responsible for the training in the schools sometimes are not teachers, but coordinators and regional management assistants, which multiple activities may prevent a more accurate guidance work with teachers who did not have access to Sangari's direct training:

We have been discussing this training issue. One trains the other in the school. For the 1st cycle, those who were coordinators but then left the position came. They came to do the training and then transmit it to teachers. And I think the 2nd cycle experience was better, with a teacher. Teachers get involved and are more committed. They come to take the training here, they are directly trained. There, now, I am going to have problems, because this person who used to be coordinator started, but will be replaced by someone else. And we had problems to find the time for the training, time to talk. (GF Assistants)

It is much more interesting to have the person who develops the Project in the school do the training here. We do the training here, don't we? I don't know about you, but I don't have time to transmit the training to teachers! What we do there is follow-up. And the person who did the training here is there, solving his doubts, looking at the material. (GF Assistants)

For those who did not take the training course here, it is more difficult. I see this because in my school I have these two examples. Those who took it here, I can guarantee a good discussion. It is nice. Now, the teachers who did not take the training course here, I know how to stimulate them, but it is complicated. (GF Assistants)

In these testimonies, the choice for teachers working at schools to perform the role of trainers seems to be acknowledged as more appropriate than the choice for pedagogical coordinators and regional assistants, professionals whose multiple activities would be a hindering factor for a more direct and day to day work with the school professionals.

In some cases, strategies and alternatives are being adopted aiming at solving the problems arisen in the area of continued training of teachers, taking advantage of the opportunities the Program planning offers:

The school I assist managed to organize itself so that all teachers could attend the training courses, even though the schedule put together by CTC and the Department provided this. It is three days, part time. This goes to the schools a little ahead of time. The school manages to organize itself in a way that the other group replaces the teachers who are leaving. So, things are working there. (GF Assistants)

We had a Saturday at school, which is when there are no students for the CTC training. This was agreed there. The school trainers themselves said: “Don't do this, we want to do it, because we will be in equal conditions.” And I was in the support. I made a power-point presentation, gave all the support when I thought I had to interfere. Each person that came here wanted to teach a little bit of what they learned and what they were already doing in the classroom. Teachers who were not trainers assimilated and worked in the classroom in a much more interesting form than those who remained officially as trainers. Official trainers were more insecure than they were. So, this led me to think: “Guys, it would be perfect if everyone had this access”. I am talking about the school, because the entire school is taking the Project. (GF Assistants)

3.2.3 Initial impacts of CTC

The perception of the people interviewed on the initial impacts of CTC in the universe of the school, considering its main actors, is based mostly on the indirect follow-up – which is the case of technicians and supervisors of SME – and visits to schools by assistants from regional administration offices. Despite the short implementation time of the Program, people recurrently say that they can identify changes, especially in students and teachers.

Regarding students and their families

The most noticeable impacts noticed in students refer to the increasing motivation toward Science classes.

The teachers say that the student's receptivity is very good, that kids start to ask: Do we have Science class today? Are the other students having Science class? They want it to continue, you know? (SME Team)

I think, as they are having the opportunity to handle something as nice, beautiful – because the material is beautiful! – they are feeling great! Because some materials are to be used individually, students can have them, handle them, test them! They have been replacing PE classes for Science classes: “No, I don't want PE, I want Science!”. (GF Assistants)

Some people interviewed also highlight changes in the way students are assimilating what they learned in classes, as shown in some testimonies, which mention the enthusiasm of students:

I was at the school and between classes, they had homework to do. The all had the “Human Body” book and came to ask me, kind of joking – only later I related to Sangari –, “how long could I hold my breath”. Then we played with this for a while and I said, thinking I was saying something new, “so let's see the diaphragm!”. And everyone knew what it was! They took the book, showed me, reproduced the experiment. Then I began to ask more. They were in love with the material, they said they like the classes! And I have to say that in this school, in the beginning of the year, one assessment by the coordinators reported that “maybe the kids cannot handle the content, because this area is very vulnerable”. But they love it! They are learning everything! (GF Assistants)

Maybe it is easier to realize this when you see that a student elaborated something different from the usual, like a teacher said: “the student is using such word”, you know? A science word he never used before... Students are acquiring the routine of redoing and keep doing things. (SME Team)

In the school, we had a general meeting with a group of coordinators, and then we went outside, where the kids were about to make a presentation, and then they presented the Program. They made a “rap” of the CTC Program, “rap” about the themes... They made yellow folders, like the ones Sangari usually sends. It was something else! (SME Team)

Regarding the students' families, there is also evidence of the CTC repercussion, mainly in the interest they demonstrate in learning about the activities these students are involved with, and maybe even participate in them:

In some activities, the parents wanted to go to the school to see what their children were doing. Somebody jokingly asked if after the Science class, it was possible to have a turn for the parents... (GF Assistants)

Mothers wanted to see the flowers they planted because at home they described the flower and the mothers were curious: “What flower is this?”. These are small things, but they certainly awaken parents' curiosity: “What are they doing? Why are they saying this at home? What is going on? What are they learning with this at school? Is this really important? What class is this?”. (GF Assistants)

I had a report from a student who asked the teacher if he could keep the material used once they finished the book: “Can I keep this material so that my mom can do the experiments at home?”. The teacher said: “Of course you can”. (GF Assistants)

Regarding teachers

The main impact of the Program on teachers, according to the people interviewed, lies in the positive shock represented by its proposal and by the gradual process of learning its innovations which takes place in the several people involved:

I think our teachers don't feel secure and then they stick to a more traditional class – questionnaires, questions and answers –, because they also don't know exactly how that phenomenon occurs, and Sangari is showing this, making them research. And we can see, in the school, those who are handling the methodology well and those who are having difficulties. With Sangari, there are no two ways about it, they have to handle it. If teachers don't have a good education, they have to research, inquire. And if they do, they recover this a little bit. (GF Assistants)

In some cases, fear of the “unknown” was registered, as well as some level of resistance due to the lack of specific knowledge from the teacher in the area of sciences::

You have several degrees of reaction with something that comes from outside. It is something different from what we have every day and changes the routine, the work, it interferes in teachers' actions in the classroom, it changes their work. So, teachers who had this profile [Science-oriented], when the material arrived, they attended the training, really embraced it. And those who had difficulty, as they are not specialists, they are school teachers, not majored in Sciences, they were actually scared: “No, how am I going to work with this? I don't master this knowledge.” Therefore, if we can convince teachers that they are also going to inquire, it is easier. (SME Team)

However, as the work results begin to appear, this work “takes over”, as one of the interviewed people reported:

At first there was a lot of resistance from the old administration. It was hard to get two people to do the training course. They started to see how the Project was going, questioned a little – “Why were the people chosen?” – and we had to go there and explain. Now this is our assessment: it was great for the school! The most resistant teacher is the one who embraces the Project gladly today! (GF Assistants)

I’ve been to the school recently and the coordinator, who is a reference in the 1st cycle, was very proud of the lily she got, and was all excited to talk about the Project, which is great! And the work of the 1st cycle, I saw it in the classroom, is in general very good! (GF Assistants)

Regarding other curricular areas

In a network where the investment in literacy has a considerable accumulation, an impact already noticeable of CTC is its articulation with this area, as can be seen in the testimonies of the people interviewed. There are many situations of teachers who are working with Sciences and articulate text reading and written activities with literacy activities. Likewise, mathematical education takes place within an interdisciplinary perspective, also integrating science contents.

In the schools I assist, there is a reference teacher, with major in Humanities, if I am not mistaken, who is trying to work, together with the students’ literacy process, with a few scientific information texts. (GF Assistants)

The Project contributed for the curricular discussion, since the training course. We can notice, even in an incipient manner, that this articulation begins. Due to the fact that they are reference teachers in all areas. Of course it is a discussion that has just begun, but Science texts are being used in some literacy processes and also in other areas, such as Mathematics. (GF Assistants)

It is also possible to verify some impact of the Program in the planning routine of teachers, as shown in the testimony below, which mentions a teacher who plans her classes linking them with other subjects, using CTC:

She is a trainer, participates in all these training courses, went to São Paulo with us and works in the classroom. She develops the project in the classroom. She coordinates, is a trainer but works in the classroom. And what does she bring us? The same journal the student makes, she makes one for herself. Hers is not only a registration notebook, very common among our Junior High School teachers. There she includes her notes, plus what she proposed to the student, plus what is in the book she said she is going to use, plus what she attaches. So, if that theme

brings more things that she can try to get outside, she puts it there too. Then that class is all registered there. It really is like a journal, to follow that class etc. And then, what does she do? She is not a Science teacher, she is a regent teacher. So, if she worked with things in Sciences that had words with ch, with x, etc., she produces in that text and asks the kids to work Portuguese, with words with x, ch, ss, etc., you know? It is a rough example, but it gives an idea of the articulation she makes. She seeks unity in her work. She even makes evaluations. She gives tests, exercises and projects involving the Science work she was developing. So, in Sangari’s notebook, which is her work journal with CTC, she is actually showing a link with other areas of knowledge. (SME Team)

The issue of the use of time in the development of the classes gets a new meaning as the interdisciplinary process gains room, as pointed out by a member of the SME’S pedagogical team:

Something we discuss is the class planning issue. Can it last longer? It can, but it cannot last longer than necessary. Everything lasts the time necessary, there is no need to extend something because it is very good, I extend when it is necessary for a pedagogical action. So, if I am discussing the time of Science classes: “Can I use this somewhere else?” It is what some schools did. I am working with a student a problem that involves a text; then I use this text to teach written language, resume the text, extend Science work to other areas. Then the report we have is a little bit of what teachers say. (SME Team)

Other interdisciplinary examples appear in the reports:

The girls came up to me with this doubt: a Geography teacher asked them, in one of the classes: “What is this project? Sciences, Geography or History? Because we see so many things...”. That is when the girls realized the possibility of articulating with other subjects. (GF Assistants)

I have a teacher who used a lot of Art work inside CTC with the kids. She called me in the classroom and showed me. (GF Assistants)

Regarding the more general space of the school

CTC appropriation by the schools takes place slowly, as the work surpasses the classroom limits and becomes known:

I started paying attention to small things to show the school what was going on, such as the pinwheel making. The entire school wanted to know why there were kids in the classroom making a toy. But that toy was the result of something. The lily, which was planted in the cube until it bloomed. I spread lilies in the Department, in the teachers’ room [laughs]. (GF Assistants)

We should also highlight the fact that CTC, in some cases, surpasses the limits of classes and segments in which it was originally implemented, as exemplified in the testimonies below:

The “night shift” students asked: “When are we going to do these experiments the little ones are doing?” Because the classroom is always full of flowers or bean plants! (GF Assistants)

EJA took the training course. In the school where I work, there is EJA at night, and the teachers claimed they wanted it. The material is adapted for the Youth and Adults course. They are not participating, only the morning shift. (GF Assistants)

4. CTC Program in schools

4.1 Learning Science contents

The first issue that appears in the field work in Belo Horizonte is regarding students’ learning of Science contents. It is clear, when parents, teachers and principals speak, how students resumed their interest and pleasure in Science classes and improved their learning ability in Sciences after the implementation of CTC.

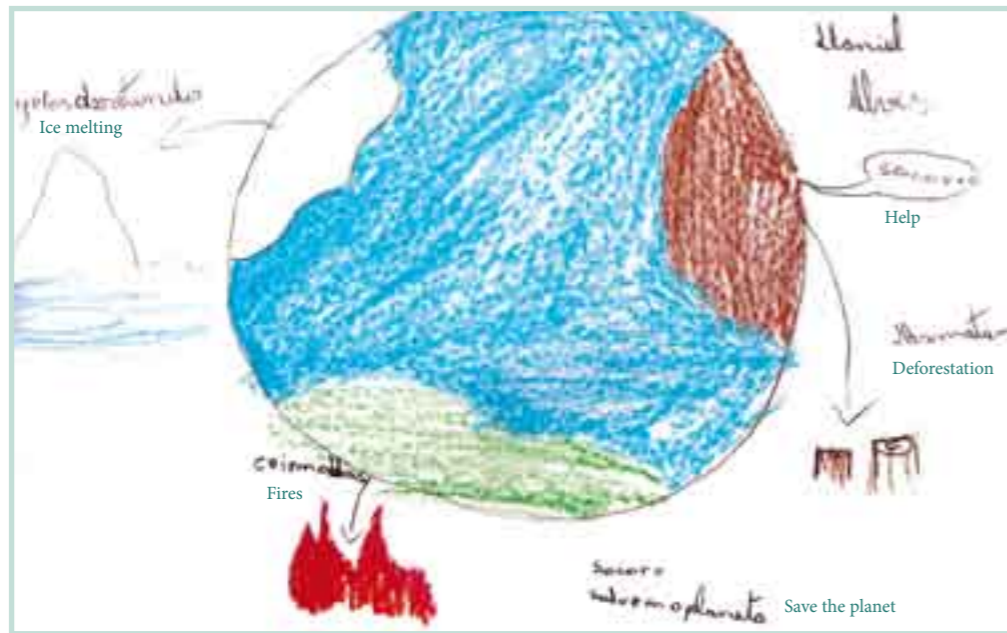
To me, this Project was very interesting, because my son is in the 4th grade and never took interest in anything and then this Science Program started, now he is all excited, memorizing the names of things. (GF’s students’ parents)

The day we have science class is the day she comes to school happier. (GF’s students’ parents)

Kids like CTC. How are you going to tell someone that you don’t want CTC, that it is not interesting, if the kids are crazy about it? There is no way. (Principal)

At Taquaril, there are lots of fires and today the students get desperate when they look at the mountain and see fire, you know? They go: “Teacher, look at the nature, teacher!”, and this started with CTC. (GF Teachers)





I see how my students enjoy it, they want it. “Aren’t we going to have Science classes today? Don’t we have Science class today?”. Some days they even make it up. When there is no class, they say the opposite: “Yes, we do have class today”. I see that even in the test, the formal evaluation, they did better. (GF Teachers)

The students also insist in always telling what they learned from the experiments and the Science classes. Like other actors heard, in their testimonies it is very evident the progressive grasping of knowledge, as well as the developed and sharp capacity of relating this knowledge to other practical issues experienced in their everyday lives, which awakens in them the sense of inquiry, curiosity, discovery.

The bean plant was a success! They were always telling me what was happening with the bean plant! (Principal)

I didn’t know that worms were so important to help plants grow. The teacher also said that Italy is one of the countries that most produces wine and that they were using chemical fertilizers. This spoiled the beverage. Then they started using the worm humus as natural fertilizer, and the beverage got very good... (GF Students – 1st cycle)

I also didn’t know that worms were so good for us... when they poo on plants, it helps them grow faster and the food tastes better. (GF Students – 1st cycle)

I used to think that there were male and female worms. Then I learned there is only female... it reproduces by itself, without the male, because it is hermaphrodite. The worm divides itself in two parts, then it mates, right? (GF Students – 1st cycle)



What I liked the most was planting the beans.



Belo Horizonte, August 22, 2007
The worms;
Worms mating.

In Science classes with CTC, I had many “super dooper cool” classes, with very interesting experiments and texts. There was one class that I loved. It was about the breathing systems and we talked about lungs and airways. (GF Students – 2nd cycle)

This grasping of contents is expressed mainly by a kind of awareness for the ecological and environmental issue, among other ways. Students, with CTC classes, seem to have created a more sensitive look toward the environment issue. They feel integrated to the environment and start to see the place where they live differently, observing things that used to go unnoticed, such as fires, wellsprings, mountains, plants and animals. Notice that many times the contents discussed also seem to potentialize the critical ability of pupils, making them break with certain views pre-established by common sense.

I learned that with a simple wrong action in nature, in the environment, we harm ourselves very much. (GF Students – 2nd cycle)

Where I live, from my balcony, we have a beautiful view from the nature. There are mountains way in the back and a bunch of stuff. When the air is too dry, then people burn the land and instead of having that clear view, there is the view of pollution with smoke. (GF Students – 2nd cycle)

Down there, there is a water fountain, and a bridge, then it gets sad. You see paper, plastic, tire... then we stop and think that nature is asking for help, but all we do is destroy it. It gives the fruit and instead of harvesting, we throw it away. (GF Students – 2nd cycle)

This awareness ends up translating into some changes in their behavior, to the extent that students, in some cases, work as real nature protectors. Besides, they assume the task of bring-

ing awareness to other people, and, in this work, they are creative and have a lot of ideas and projects, as exemplified in the following testimonies:

When we get to the end of the year, there will be a Science fair, and we wanted to open it not only for people at Taquaril, but others too, and start showing not only here, but in other places as well. Because the Science fair will show what we learned to the rest of the population. (GF Students – 2nd cycle)

If CTC were more united, it could be broadcast in radios and television programs. Because there is television everywhere. People who watched it could contribute with us... (GF Students – 2nd cycle)

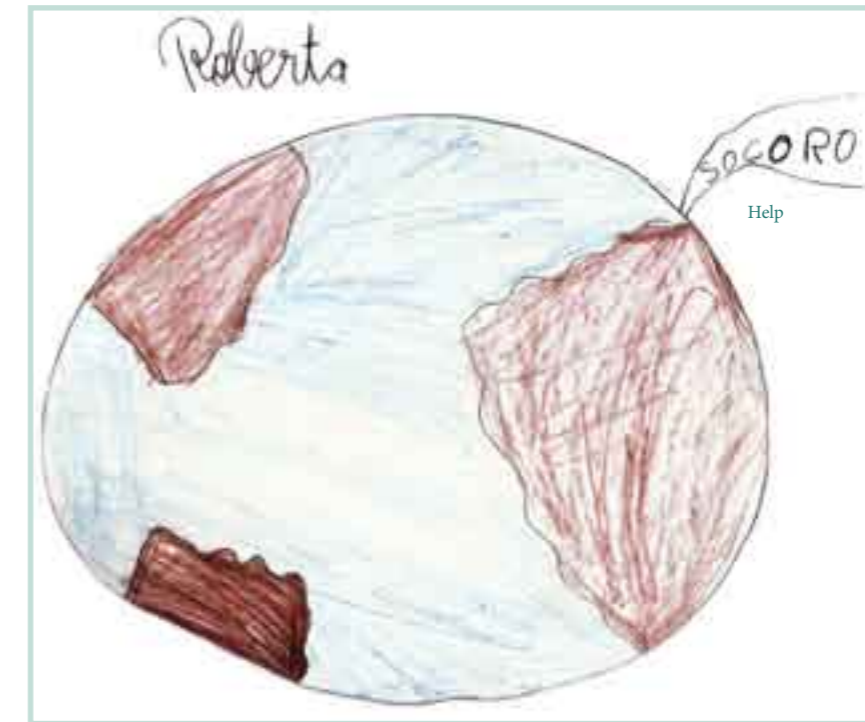
And it would also be even better if we did something similar to what I did with the album... A way to show other people. So that people can hear what it is like where we live. Then they would find out what they are doing. (GF Students – 2nd cycle)

To me, the advantage of the Science classes, specially the part about plants, is the awareness about the environment. When students grow up, they won't have this problem we are having. They will have more awareness too, because they learn to respect the plants, they know it has life, it is a living being and deserves respect too. My daughter, if I step on a plant, she says: "Don't step on it, it feels pain, it dies.." (GF's students' parents)

Mine got home saying: "We have to save water, can't be in the shower too long, otherwise we run out of water and die of thirst". I thought that was cute (GF's students' parents)



In the past, there used to be a waterfall here. Now, with the pollution, it turned into a dumpster.



4.2 Students' preferences

According to testimonies, Science classes, after the adoption of the CTC Program, became undeniably more interesting for students. They say that, among other things, what they liked the most about these classes were the experiments and, consequently the materials used.

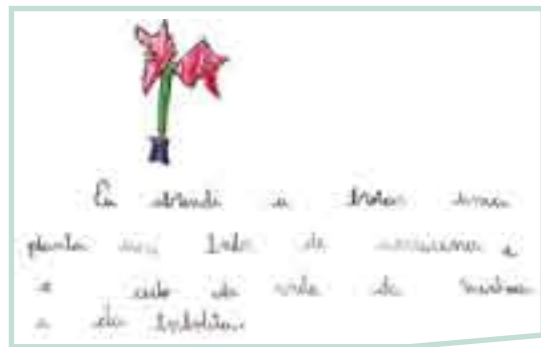
I also thought the materials were very cool, because in addition to learning more, we saw things up close, the egg, the worm, the bulb, these things... (GF Students – 1st cycle)

I think it is cool because of its structure. They can make the material very similar to what it actually is. (GF Students – 2nd cycle)

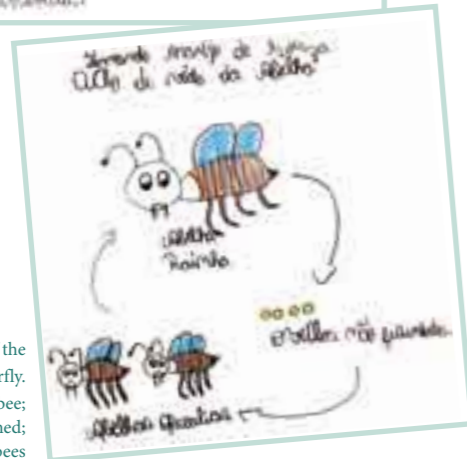
The group work also appears in the students' testimonies as a gain in the CTC classes, as they recognize that this has been helping form a more unite class. Teachers agree with this fact, and also highlight the improvement of self-esteem and understanding ability of their students.

I like when we do the activities, because then the entire class is united, just like my class used to be. (GF Students – 2nd cycle)

I liked everything we had in the CTC program, but what I liked the most was the part we had to sit together, form groups to present what we had found out about a certain theme. I liked this part because we could discuss our ideas with more knowledge. (GF Students – 2nd cycle)



I learned how to plant a lily bulb and the life cycle of the worm and the butterfly.



Life cycle of the butterfly.
Queen bee;
Eggs not hatched;
Worker bees



A very agitated class, you know? A class that fought a lot. There was dispute among students. To me this was the best benefit. They learned to work in groups and listening to each other. Until then, one would speak, the other one called him names and the other one attacked them. So, it was very complicated. But now it is not. (GF Teachers)

The kids' pleasure increases, certainly. What I am saying is that inside the Project what they most like doing is touching and handling things, because it is part of their age. They do it and their writing skills improved, their self-esteem improved, their mental organization improved. They start believing they are capable and think with coherence. I think it really improved. The relationships with the kids, because it is a group work, so there is involvement, the discussion about a certain discovery. (Principal)

Following the same train of thought, students also point out aspects they disapprove of, regarding those that disturb the science class or even their absence. The "mess" made by some colleagues stands out in the different groups who participate in the field work. For these students, this "mess" gets in the way of experiments, hence their distaste and disapproval.

The only thing I don't like is when I am looking at that Science thing and the other kids are making a mess... (GF Students – 2nd cycle)

Students also comment they dislike when the Science class is postponed:

What I didn't like about CTC was when classes were postponed because of lack of organization. (GF Students – 2nd cycle)

Besides, the bond created with what they produce leads students to be more aware of situations that can risk the experiments that require follow-up and observation, which is the case of the beam plant, the bulb, the lily and the worm terrarium.

When we make experiments, we put them on the counter. Then we have classes in the same classroom the entire afternoon and evening. This is bad, because sometimes other students touch it, some break it. It is very bad! (GF Students – 2nd cycle)

Once I made experiments, left them on the counter and next thing I knew, there was nothing there. (GF Students – 2nd cycle)

4.3 Material resources

The material resources are the greatest attractions of the Program. Students talk about the materials with a certain enchantment in their eyes. To them, the access to these materials means a fantastic opportunity of contact with what they are learning, things they had not experienced before CTC was implemented.

There were things there we didn't even know what they were. Like the pipette the teacher used to make an experiment. We didn't even know what that was. (GF Students – 2nd cycle)

It is good because we can have contact with the things we see... With the earth, in a classroom, studying... (GF Students – 2nd cycle)

We can learn how it works, like a thermometer, we make it and see how it works... (GF Students – 2nd cycle)

Also for teachers, the materials meant a great gain for education. When they talk about them, they demonstrate in several occasions a great deal of enthusiasm with the endless work possibilities these resources provide.

It was a beautiful thing to open that box in the classroom! I felt like I was back in my school days, when we learned to motivate students. I've never seen so much motivation! And, during the experiments too, because they had their material: "it is mine teacher! It is ours teacher!" They were so careful when they put them away in the cabinet. (GF Teachers)

This project is very rich. It makes me want to bring my son to study here... the book is very well organized, there is a sequence, but not the same old sequence, it makes the students think. It is everything we believe in. I want to do it, but I don't have time to organize things. It comes ready. But not ready in a limiting way. It is in a way that helps you... You have to have nerve to work in these schools, because it is a lot of work!

(GF Teachers)

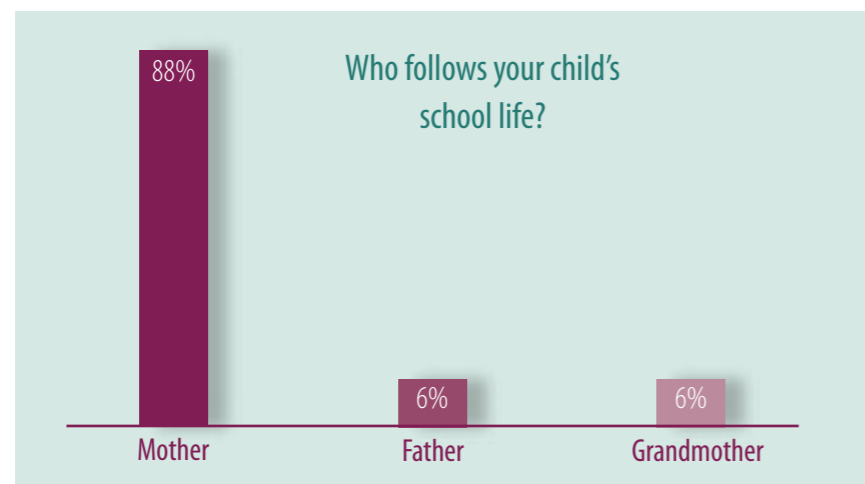
What I thought was interesting is that they think about the smallest details, because we, as educators, sometimes have difficulties... Simple, short, cohesive texts, and also the upper-case letters, which is easier for the child to start reading... All texts are like this. So, it allows a good integration because they worry about this detail. (GF Teachers)

It is impossible not to get carried away, specially when things begin to happen. When the lilies blossomed, it was an event. Some wanted to take them home. Teachers wanted it, employees wanted it, students wanted it, they wanted to take pictures, they loved it. I mean, it is impossible not to live it. It was pretty, cheered up the school. So, when it really happens, no matter how resistant the person is, it is impossible not to get involved. (GF Teachers)

4.4 CTC and students' families

In the statements of parents and even students, the influence CTC has on the families is noticeable, specially mothers, who play an important role in their kids' school life, as shown in graph 1:

Graph 1 – Follow-up of students' school life



Source: Assessment of the CTC Program in Belo Horizonte, 2007.

According to the family members interviewed, kids talk about the classes at home and also want to teach their parents, brothers and neighbors everything they learned at school.

My daughter is studying female human reproduction. She is a girl and is delighted with the female body: "mom, women are wonderful...". My mother passed away, but when she was alive, I didn't talk about these things with her. I was embarrassed. Today, thank God, we can talk about this more openly. (GF's students' parents)

When there was a project about the worm terrarium, you should have seen it! We have one at home, because she made one! And she talks to the worms. I didn't even know worms had



CTC Project
I learned that we must not pollute the rivers or pollute the world.

mouths. She gave me a Science class: "Mom, of course worms have mouths, or else how would they live?". (GF's students' parents)

Sometimes we speak, she seems to be learning from us, we are learning from her... [How do you think your mother learns something from you?] So, when she sees a worm, I say: "Don't kill it mom, let it live..." Then she says: "All right." (GF Students – 1st cycle)

I used to get home all excited, even whistling with joy. Because there are a lot of people back home. Then I would get my book and explain what the teacher had taught. My mother got really interested in the book. She read it. Any person who did this CTC work, I am sure this person got home and told his or her mother, because the CTC Program is very good! (GF Students – 2nd cycle)

This is what I was saying, we start learning again with them. Because sometimes you are doing things, put your hands here, there... "Did you wash your hands?". Then I say: "Listen to this!". (GF's students' parents)

4.5 Teachers and CTC

In addition to the change in students' interest for Science, it was also possible to observe the influence of the Program both in the pedagogical practice of teachers and in their relation with this area of knowledge.

All my life was very urban. Although I was born in the country and lived there for a while, I like big and busy cities. I go to my farm and my hands get callus from digging holes, planting, handling earth... I turn into a country girl, nobody believes it when they see me. I went that far.

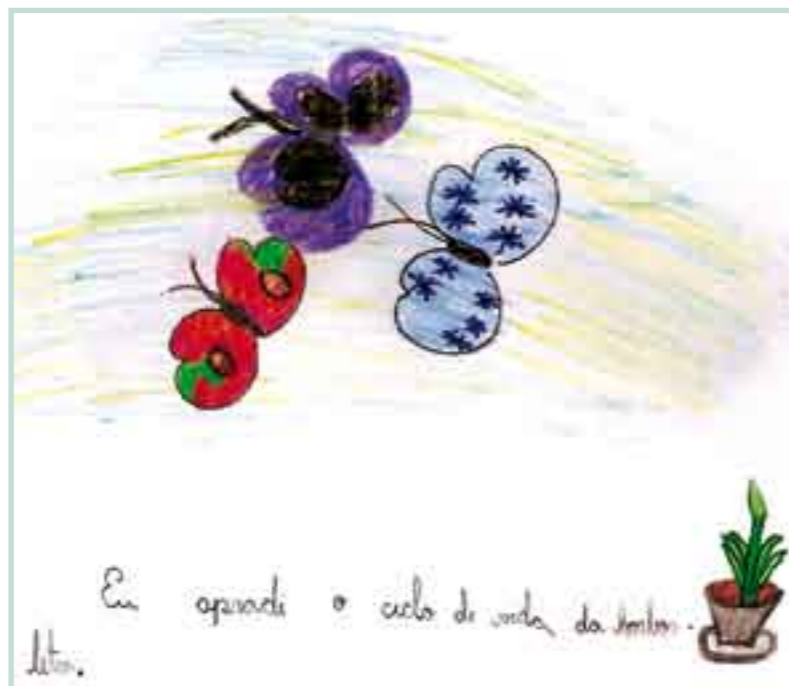
If I weren't so old, I'd go back to college to work with Sciences, because I am in love with it, and, because of that, so are the boys. (GF Teachers)

This school science has never been my favorite subject, definitely. I always liked Geography, History, Portuguese, other things, and if I could escape Sciences, I did. If I could not teach Sciences, I wouldn't. And this year, as a coincidence, due to some changes in the school, I ended up having to teach Sciences both in the morning and in the afternoon. I consider myself privileged, because I was lucky enough to get Sciences in a year in which CTC is being implemented in my school. (GF Teachers)

We had a very theoretical education. Books based on reading and sometimes memorizing. This practice is sometimes very difficult for us, due to the way we were educated. And now we have the material and the guidance, so even we get surprised with these practices: "Wow, if I had learned this!" Or things I learned in college, that children will have the opportunity to experience much earlier. I think this is very good. (GF Teachers)

When we saw the material, we realized that the Project really enhanced science education. Children do get involved with this Project. The school here, and I believe most schools, in general – not only public, also private, do not realize the dimension of science in the everyday lives of these students. There is a lot of copying, a lot of "bla bla bla", and the children are really not inserted in this process, they go through it and that does not stay, they don't grow with scientific thinking in them. Because whether it is in botany, biology, whatever, if they learn to think scientifically, they learn to act scientifically, and they can apply this to their lives, in any circumstance. (Principal)

Field work points out that the motivation of students also contaminates teachers, who start getting more involved with the group. The classes gain a more involving sense, not strictly mechanical.



I learned the life cycle of the butterfly.

Like I said: the kids are making teachers rethink... with Sangari, what is a problem for the teacher is what the students are enjoying. There were teachers – and I've been told this – who said: "Look, I am ashamed of my classes after Sangari". Because I had never taught a class that got students so involved. And this coming from a teacher, an old teacher, out of the blue, not because I asked or somebody asked. She was planning her class and I said: "My Goodness, sometimes this is tiring, isn't it?". The she said: "Cida, I am disappointed on myself... I have never taught such a good class as now. My class plans all stunk. Now the kids go crazy, the class is good, things happen. And there were days when I was kind of lost with them". (Principal)

Regarding work with Sciences, Reading and Writing

CTC is organized with diversified proposals for activities, in which reading different kinds of text and writing in the Science Journal are present systematically. They provide significant contexts of use for learning the Portuguese language.

Some teachers and a Principal see in the Program an opportunity to intensify the literacy process of their students, as they are motivated by the classes.

My class had very serious reading problems. Now, as I like Sciences, and when I saw that material, I felt that it would be a new beginning, a new kind of work. (GF Teachers)

I work with kids that have difficulty to learn and they could barely read, wrote very poorly and with CTC, even their Portuguese, which used to be very difficult for them, became easier, because they have the pleasure of registering in the Science Journal, they take very good care of their Journal. (GF Teachers)

It is interesting to mention the difficulty to work with CTC due to the lack of writing and reading skills, I think this is interesting. So, if the issue is reading and writing, the problem goes to the other subjects. If this is what gets in the way of CTC, imagine the other things! So let's think about the literacy issue, the training. Then the problem is in the base. I am saying that the reading and writing difficulty will not be about CTC, is not about a text from a CTC book, this is not the problem. It will be a total problem. The person will have problems in life. It is not a specific problem. (GF Teachers)

In other statements, teachers report how they have been working with, for example, the Science Journal, to support the reading and writing development of students. The production of the Journals has been adapted according to the level of each group. In many occasions, teachers started with collective texts so that students could acquire more independence in their written production.

My first activity was to make the Science Journal. I started from there, because they were completely disorganized, they had a lot of difficulties. So we started with the Journal. Every class, they already had this habit. When they finish, they open it and register. But this register is done their way. It is something I read. When there is something unclear, I work with the Portuguese. In the beginning, they really couldn't handle it. We started to work in groups, then each one wanted to work individually: "We are in 5th grade already, everybody copies

the same!”. If you get their notebooks, you will see. Their Journals too, there are many things you can't make out, due to their difficulty in writing. But this is something I managed, with a parallel work. (GF Teachers)

I used a lot the oral part, because they do speak a lot, but write very little. They don't know how to express their thoughts on paper. This way we worked a lot with collective text. I would say: “What have you got there? Tell me the words you got!”. I would write them on the board and then write a collective text. After the 6th, 7th class, when they already knew how to organize the text, then they started making individual texts. But we worked collectively, including for the text production... (GF Teachers)

So, I still don't know the perfect way to register with the kids. There is a lot of collective production, they speak and I write. I can't change this much. I have this limitation in the afternoon. It is difficult. I would like to have a more specific material, for them to register with more independence. (GF Teachers)

In addition to the successful experiences that many teachers report in their testimonies, there are also issues not yet clear regarding the articulation between the area of Sciences and Portuguese. Many people interviewed relate the difficulty they found when working with the contents of the Program due to the literacy level of their students, even those who were in the 2nd cycle already.

We also have a lot of difficulty to get children to read their texts. We have many kids who are at the end of the cycle, in the middle of the cycle, who have difficulties to read. My school has problems with the vocabulary, with the language that was used. (GF Teachers)

Regarding operational aspects of the CTC implementation

Teachers point out a few operational problems related to the initial implementation process of CTC. For them, the Program should start in the beginning of the academic year in order to allow a better use of the activities. It should be highlighted that the managerial implementation aspects, such as the adjustment of the number of students per class or the resistance of some teachers, were responsible for delays in the beginning of the activities.

Teachers also mention the precarious structure of some schools to shelter the work they develop, as well as the difficulty to store the materials and the experiments.

We cannot leave anything in the classroom, everything is ruined, the cabinet is ruined... I lost a lot of my material, which I had stored in the teachers' room. (GF Teachers)

They even tear up posters. But there is also the issue of the physical space, the rooms are small, there are too many desks and the classroom is too dark. So, this part of the physical space, of working in the classroom, is very complicated, because only a few rooms are spacious. In some others, we have to put the desks very close to the walls so that we can have some room to walk in the central part. (GF Teachers)



Some teachers, in their testimonies, refer the need for more participation in the Program of other professionals, reinforcing the importance of co-responsibility in educational actions.

I resent not participating in the administration. The coordinator only informed us about the Project. Now, the administration has no contact. I saw all the excitement, the enthusiasm during the workshops, the worms. It was a commotion in the school. The administration doesn't even come close. Doesn't even ask... I think there was a lack of interest from them. I don't think I am the one who has to call them. The administration is there to work with teachers and students. (GF Teachers)

The issue of the demand to train a larger number of teachers was raised by several teachers, who had difficulties regarding time for an appropriate training in the school.

I think everyone should be participating in the training course, not one training the other. Because it is not the same view when a coordinator trains a teacher. (GF Teachers)

I think all teachers have to take it. I remember in São Paulo, the [technician from Sangari] even said: “you are going to be spokespeople for Sangari”, but it is impossible. There is no time for this. We can't sit down with our colleague and say: “Oh, this and that happened...”. Up until today, what I saw there I did not transfer to anyone. What I did do was help my closest colleague, but only when he requested help. Because it depends on the teacher's desire. And this thing about embracing the Project or not, that's because the teacher was not seduced by the material. If he had taken the training course, done the experiments, he would have been seduced by the material. We don't have authority, because from a colleague to another, it doesn't work. (GF Teachers)

4.6 Impacts of CTC on students

As we have seen so far, many impacts were verified after the implementation of the CTC Program among students, who acknowledge the change in the dynamics of Science classes after the Program was implemented. According to their testimonies, the classes used to be only expository, based on boring exercises and text reading. After the Program, they found dynamism and applicability previously unknown in Science education.

She [the teacher] also said that the CTC Program, in addition to being interesting, was very important, as we don't learn only sitting on a chair, listening, we learn with new knowledge. (GF Students – 2nd cycle)

When we didn't have CTC, Science classes were dull... As he said: "Nobody was interested in anything". The teacher was constantly telling us to be quiet, nobody was interested. Now it is more interesting, we are making experiments and many other things. (GF Students – 2nd cycle)

Before, the teacher would speak and we would write... she would talk about planets a lot, she had questionnaires with 20 questions. I didn't like it... The teacher gave us too much to do. She would give us almost two pages to copy. Now, we make the experiment, then we read it and then we summarize the first class, the second class... Until the class we stopped at. (GF Students – 2nd cycle)

You would get a book, work with that book, with those activities. It was more centralized. So, before, if the teacher liked the subject, he would do a good job. (GF Teachers)

It is also in the expectation for the "next Science class", renewed each day among students, that CTC shows its more immediate impact:

There is nothing in the Science classes that I don't like. I like everything, but also, like Davi said, when we ask: "Teacher, do we have Science class today?" "No, Thursday." Then Thursday comes: "Teacher, is it today?" "No, next Thursday." Then next Thursday comes: "Teacher, is it today?"... You know what I mean? (GF Students – 2nd cycle)

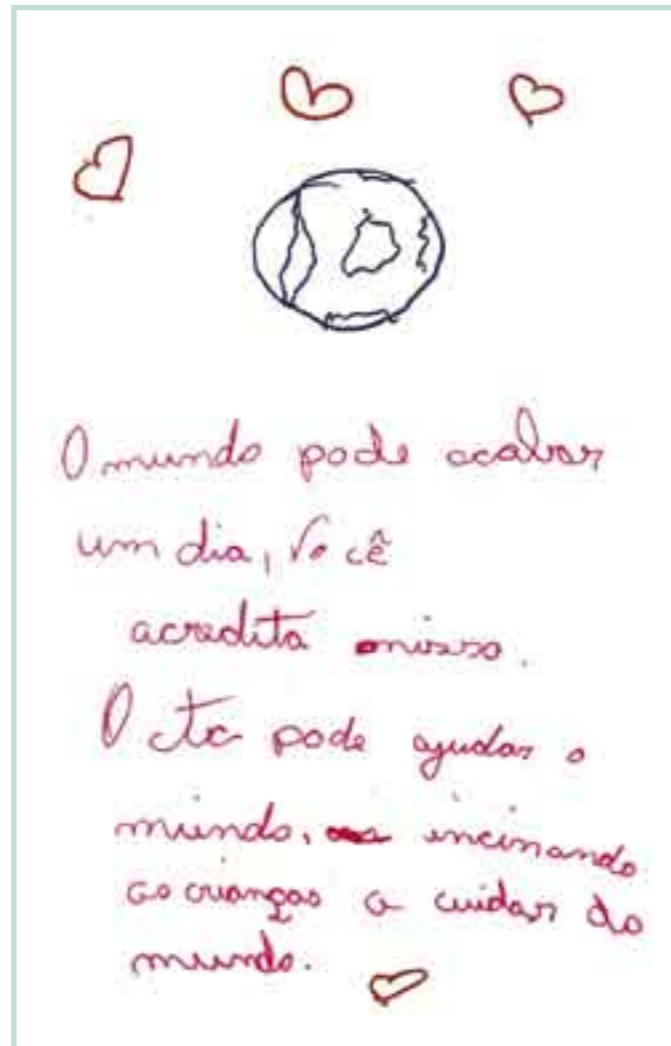
However, we should highlight that the most important aspect of the impacts of the Program on students is the fact that they are acting both in the present, with the awareness regarding the seriousness of the environmental problems faced today and the quest for solutions for them, and in the future, when choosing a career, for example, as demonstrated in the testimonies of two teachers:

With this inquiry idea, there is the case of my student [student's name], who is concerned with the headsprings, full of trash. And she researched, others researched, even their families did. One student of mine even said she is going to take her grandmother to the school to tell students what Taquari used to be like. So, the fact that we are very close to nature and drew their



attention to nature caused a greater impact. This can be noticed in the school as a whole. From the little ones to the older ones. Teachers mention how children realize what they are doing. Their curiosity is much stronger, so is their joy for doing the activity. (GF Teachers)

Even the career choice! There were professions we only heard about when we got older, teenagers. And they would say: "I am going to work for IBAMA", "I am going to be a botanist", "I am going to be a biologist", I am going to be this or that... So, you kind of get scared, because they come with this speech... "What do you do? What do the people at IBAMA do?" And they structure this. I am amazed at seeing them thinking about the future, about a career. (GF Teachers)



The world might end one day, you believe this. CTC can help the world, by teaching children to take care of the world.

5. Ideas, suggestions and perspectives of the people interviewed for the improvement of the CTC Program in Belo Horizonte

As exposed in previous chapters, the CTC experience in Belo Horizonte is very well assessed by those who build it, in the pedagogical team and the Regional Administration Offices of Education and mostly in the schools that develop the Program, including in its universe students, their relatives, teachers and principals. The demand for the incorporation of CTC and for the continuity of processes and activities it sets off is often mentioned and the intention to contribute to this is expressed, directly or indirectly, by the several actors who participate in this study.

Therefore, we have included below a comprehensive table with ideas, suggestions and perspectives regarding the Program, offering important clues in order to maintain and improve the paths that have been taken so far based on the reality of the place where CTC is developed.

It should be highlighted that many ideas systematized here have been mentioned in previous items; others will be listed here according to the most recurrent categories. However, all of them contain the authorship, and the original formulation, so as to allow the identification of where it came from the specific context.

5.1 Regarding planning and organization of the Program in Belo Horizonte

Theme	Testimony
<ul style="list-style-type: none"> The Program management must try to start the implementation process in due time, so that the activities planned can take place with plenty of time. 	<p>Some schools started with some delay, and maybe they could not finish the first volume in the first semester. Some schools finished in June, others didn't, they finished in August. (SME Team)</p> <p>Two teachers did not get involved, one from the morning and one from the afternoon. They are very resistant! And when the person participates, it is different! You feel appreciated, you feel like you are participating in the implementation of that policy, you feel more responsible. (GF Assistants)</p>
<ul style="list-style-type: none"> The several actors of the decision-making process and implementation of the Program should be more involved 	<p>There was a school that started the Project practically two months late. Then, we tried to read the "Why did this school start the Project so late?". Our initial opinion was that the school was reluctant. It is an outside thing, so we pushed it a little, talked to the school coordination. Then the coordination talked about its limitations, but promised: "No, on such day we are going to start it!". Actually, some teachers had already started, but not the school as a whole. There was this resistance too, some difficulty to interpret it, a little fear... all this together. (SME Team)</p> <p>It is hard for teachers to understand this, "I will stop working with that book...". They book they've known forever. They are going to have to stop working with that kind of material, which is something that has been in progress for years, to start working with something new. And this new one has to be explained to them, because Sangari has this vision of Sciences, of putting four units a year... A book that develops a number of inquiries, countless information, a series of experiments with one theme. (GF Assistants)</p>

Theme	Testimony
<ul style="list-style-type: none"> • More spaces to exchange experiences and for the socialization of the results reached must be created. 	<p>I think there should be a space for the schools that adopted the Program to exchange their experiences. When we went to São Paulo, we talked to the multipliers about how each school was working, and the result was so rich. So, there should be a webpage, a "blog". Here, there are only a few groups working, but if I divulged what I did: with pictures, like the day when we built the pinwheel, it was so cool! If I had a way to divulge this, a lot of people who are a little discouraged would get very excited. (GF Teachers)</p>

5.2 Regarding the training process and the follow-up of the Program at schools

Theme	Testimony
<ul style="list-style-type: none"> • Value and improve the teacher training spaces. 	<p>Even with the implementation of the new compensation by cycle, I think we are still limited. The issue of Sciences seemed to gain room at the end of the 2nd cycle, which used to be the 5th grade, when you had a Science teacher! The person who withholds the knowledge on that subject. And I can see that this thing is still rooted in the development of the Project. Because people say that literacy for those children is much more important! There are only two or three teachers who managed to work with literacy using the Project, using the books and all the activities... Transporting it, using it with other subjects... So, it is still something compartmentalized! (GF Assistants)</p>
<ul style="list-style-type: none"> • Training must support the articulation between CTC activities and the reading and writing learning process. 	<p>The difficulties we have: the issue of writing, reading, interpreting... (GF Teachers)</p>

5.3 Sobre a infra-estrutura, os recursos materiais e as atividades pedagógicas

Theme	Testimony
<ul style="list-style-type: none"> • The schools must potentialize the use of their spaces, improving the infrastructure for the actions they develop 	<p>I used to think that there had to be a special place to put things, like a cabinet, to put what students made. Because then there is the afternoon class and the night class and the students touch everything. There had to be one cabinet for each class, to leave the materials and the experiments we make. (GF Students)</p> <p>The only problem that I found was the structure. It is a lot of material. And this thing about material storage. (GF Teachers)</p>
<ul style="list-style-type: none"> • There should be investments in training and follow-up of teachers, in the association between planning the activities and students' learning process – considering its several "stages", reopening the discussion on the volume of content or material in its real dimension. 	<p>When teachers see the material, they say: "It is a lot of stuff!", thinking that it is two units. Then we reply that the time could be redimensioned. We know that a Science class usually lasts one hour and that, within a week, there are two, maybe three Science classes, given the priority our teachers give to the specific content covered in the first cycle and the second cycle. So we believe they are going to start working with it in mid February, March... (SME Team)</p> <p>We need more time. The time is very short. (GF Teachers)</p> <p>It is all too rich to be done so quickly, you know? For example, when the mangrove topic came up, I was surprised because the kids here don't know anything about it. So you have to prepare them and this takes time. (GF Teachers)</p>

5.4 Regarding the pilot-project conclusion, the administration and the perspectives of the Program

Theme	Testimony
<ul style="list-style-type: none"> • The continuity of the process started in essential, in order to keep the credibility of the governmental action and guarantee and increase the gains with the good results reached. 	<p>The problem is starting a Project and not having continuity. Specially this one, which is probably very costly. Students touch everything, handle, it is concrete, it is experiencing their production. They are making the Journal, dictating the experiment to the teacher, raising hypothesis, is very interesting. Because we usually start and don't finish. Even here, in the state of Minas, we've had this our entire lives, we've had wonderful projects that were not concluded. (Vice-Principal)</p> <p>I wouldn't like for it to be interrupted at all. Because it is allowing a commotion in the school. We cannot continue approving of some teachers' mistakes. Things start and never finish. This happens a lot. Many times, even due to lack of involvement from the teachers themselves. (GF Assistants)</p>
<ul style="list-style-type: none"> • The extension of CTC must take place consistently and gradually, so that the good results reached are not jeopardized, and future gains can be reached. 	<p>It is a school that fears that the Project will not continue next year. So, I think that this school needs the Project to continue. It felt some connection to the Program, so I believe, as everyone else there, that this would be unfair to the school. Because they have created something innovative, different, a cool thing. I think the extension would be something important in this network, based on this experience... I guess it is a successful experience. It has been very interesting! (GF Assistants)</p> <p>I think we have to extend it. I think we should extend it to some schools, not all. And keep it. And, if it is not possible to extend it to more schools right now, we have to at least keep it in the ones that have it now so that we can have time to be able to say if there is any qualitative result. (GF Assistants)</p> <p>It is a fantastic project for the network! I think this is all we expect from educational policies, from innovation for education. But I still don't see the Project in the network as a whole. If the Department said: "In 2008, our partnership with Sangari is for two hundred schools of the network!", I think we can't handle it. Then the Project will lose. Because we won't be able to follow more, to focus. We have always hated saying that this is a pilot-implementation. You only work with a certain group. But I guess, right now, if we have to extend it for next year, we shouldn't extend it 100%. We have to be careful to make it happen and show that it can work. Because things will get lost if you don't have a good coordination. Then soon the material will be left aside in the school. (GF Assistants)</p>
<ul style="list-style-type: none"> • The maintenance and extension of the Program are strongly linked to the involvement of the professionals that work in it, that is why strengthening this link must be one of the main targets of the action. 	<p>I think that when we analyze what is happening at the school, when we listen to this teacher, the one who trains the others, who comes here and says what is happening there, then we see his participation effort... So, based on these aspects, I think the continuity can happen. By the participation of the professional. When the principal sends a professional here, for the training, with the semester already in progress in the school, this is a portrait of the relationship the school established with the Program and the importance the school gave to it, because if the school does not give importance, it does not release the teacher. (SME Team)</p>

5.5 Suggestions of themes for training in the continuity of CTC in Belo Horizonte

- The relations between class time, learning process and volume of contents and activities of the Program.
- The specific work of CTC with students at literacy level.
- Meeting students' expectations regarding class regularity and its organization.
- The organization of individual and collective activities in the classroom and students' participation.
- The organization and storage of materials and projects of teachers and students in the classroom

5.6 Strengths, delicate issues and potentialities of CTC in Belo Horizonte

Concluding the list of ideas, suggestions and perspectives pointed out in this chapter, we have included below a systematization of strengths, delicate issues and potentialities of CTC in Belo Horizonte.

Strengths

- The tuning between the CTC proposal and the referentials of the work of SME of Belo Horizonte, associated to the fact that the Program contributes for the improvement of Science education in the network as a whole and the teachers without specific major in the area.
- The acknowledgement of the innovative nature of CTC for Science education, mostly regarding its methodological approach, which allows the central participation of the student in the scientific knowledge construction process; the quality in the training process developed by Sangari and the competence and dedication of the technical teams of Sangari and SME; the quality and presentation of the didactic and paradidactic material and the fact that it represents the possibility of change in the work in the area of Sciences, which usually lack resources for the development of experiments and investigation.
- The positive impact of CTC in students, regarding the satisfaction with the dynamics and the materials of the Science classes; the noticeable awareness of students regarding the ecological and environmental issue, noticed in the way they start looking at the place where they live, in the critical ability with which they observe the environment and the concern they demonstrate with the problems that reach them; the interest in talking about their classes and teaching what they learned to parents and neighbors; their availability for collaborative work, resulting in better relationships and school environment.
- The impact of the Program's routine in the planning of some teachers, who articulate CTC

with other activities they develop and other areas, specially regarding literacy work, which accumulation in the public network of Belo Horizonte is very solid.

- The fact that some schools adopt strategies and alternatives to deal with the problems that appear in the area of continuous training of teachers and the informal "expansion" of the Program to other segments, such as EJA.

Delicate issues

- The need for adjustment in the initial schedule for the development of the work so that there are no delays and the activities of the Program do not coincide with the school calendar and planning.
- The fact that some of the people in charge of training in schools are not teachers, but pedagogical coordinators and technicians of the regional administrations of SME, whose multiple activities usually prevent a more accurate guidance work with teachers who had no access to Sangari's direct training.
- The demand for participation of a higher number of teachers in initial training carried out by Sangari.
- The little familiarity of some teachers with the Program and the consequent resistance to its proposal.
- The importance of continuity of the process started, in order of keeping the credibility of the governmental action and guaranteeing and increasing the results reached so far.

Potentialities for the development of the Program

- The acknowledgement and awareness of the actors involved, both in the SME and in the schools, regarding the importance of investing in Science education.
- The issues involving the environment, area of strong mobilization of students' interest in Science classes.
- Support of teachers and enthusiasm of students.
- The concern displayed by most actors who participated in the assessment with the possibility that the Program might be discontinued and their desire to keep it.

6. Final considerations

The mind that opens up to a new idea
never returns to its original size.

ALBERT EINSTEIN

We have included a number of considerations that summarize the main aspects verified by the different actors who produce CTC in Belo Horizonte. In this first stage of the assessment, two aspects are highlighted, based mainly on the observation of the impacts of the CTC pilot-experience on the 11 SME schools of Belo Horizonte which have been participating directly in the Program since the second semester of 2006.

The first aspect is related to the awareness retake of the teaching and learning value in the area of Sciences to broaden up and qualify the cultural and social universe of students and teachers in a plural and humanitarian perspective. The retake of this sphere by the Department, by the schools involved, by teachers and students is, perhaps, the most significant impact noticed so far in the educative process, bringing it closer to several areas, such as reading and writing. In the testimonies of the different actors, we constantly notice the understanding of the important role that science has in the learning processes and, additionally, in the processes to increase the interest for what is new. In this sense, there is a retake of Sciences as a qualified mobilizer of the educational process and, notably, as an essential element in the minimum learning needs of a contemporary individual, for the exercise of a complete citizenship.

The second aspect observed that can be highlighted in the area of impacts has to do with the strong potentialization of a work already emphasized by that SME, throughout the experience built with Escola Plural, regarding the awareness and the ability of promoting issues related to the environment, health, population, nutrition and food safety, aspects deeply linked to the concern with sustainable development. The work carried out by the educators supported by CTC resounded in the enlargement of students' ability to take innovative initiatives with their friends and relatives, allowing them to learn and dialogue about problems related to the environment, specially the need to change the production and consumption means, from the ecological, cultural and social point of view.

Based on the data analyzed, we can conclude that these two aspects concentrate the largest potentialities for Science education to take root with the success in that education system. Therefore, more investments are required in actions that articulate the processes and literacy with CTC and the construction of new interdisciplinary strategies, which have in the area of Sciences an important ally to improve the quality of teaching and learning, aiming at educating for a more planetary construction of unity and social justice.

For a significant part of students, parents, teachers and administrators, the possibility of access to a good quality work, with good materials and advanced pedagogical proposal, has been nurturing a positive appreciation feeling, which resounds in everyone's self-esteem. Through science, students and teachers highlight that they were able to experience knowledge situations until then considered very far from their reality and the possibilities they would have, with the cultural and social capital that they had, of analyzing, understanding and rebuilding. In this sense, the Program invested in the idea that students gather all necessary conditions for learning and that, to do so, it is necessary to build opportunities, based on the quality and acknowledgment of the rights of others.

The challenges that were most mentioned by those interviewed expose the precarity that the Science area still experiences in the Brazilian educational system, together with other aspects of the problem which are more structural. The first one would be the poor qualification of teachers for the area, which requires a more direct and systematic training, although the SME of Belo Horizonte has a significant history of training. Administrators and teachers point out a number of issues related to training, which would prevent a better development of the actions proposed. They also highlight the difficulty to promote an integration of subjects, supporting the construction of a more systemic knowledge, in which sciences could be better incorporated.

There are relevant testimonies that mention students' difficulties in complying with the requirements of the Program when they are focused on reading and writing. Maybe CTC needs to extend the existing investment to the articulation with reading and writing so that educators and pupils can potentialize the essential aspect related to basic learning needs. Investing in reading and writing based on the mobilizing potential of Science education, through CTC, can show new ways to face this challenge, which is one of the greatest education challenges today. Considering the accumulation of SME of Belo Horizonte in the development of the rich experience of Escola Plural, maybe it has all ideal conditions for the production of substantial actions/innovations, in terms of experimentation, that seek qualified approximation between the development of reading and writing and the area of sciences.

Finally, the concern regarding the non-continuity of the Program should be highlighted, which, now, must be thought sensibly, considering that such fact may generate loss of credibility and motivation in all actors involved in the school: principals, teachers, students and their parents.

Here at the school, the Program came to stay. It is even here at EJA. We want it to continue!
(Testimony of a Principal)

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