Teaching experience from a subject of social relevance: environmental sanitation - urban drainage

Experiencia de enseñanza a partir de un tema de relevancia social: saneamiento ambiental - drenaje urbano

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Abstract

This paper presents an educational experience which is based on a theme of social relevance. The project titled Sciences Today - a new meaning was developed in a public school in the city of Goiânia - Goiás (Brazil), for teachers and students and had as the main theme 'environmental sanitation' specifically urban drainage. Four groups composed of multidisciplinary faculty from diverse backgrounds were created with the intention of developing subprojects with educational practices aimed at exploring environmental sanitation with the students involved. Each group involved three high schools, a total of twelve classes. Of the four groups, only one has achieved the subproject proposed by members of the group effectively. The others had problems in the implementation of the subproject especially regarding its difficulty in fitting into the present school reality. However, despite the problems encountered, the school students involved in the project show increased interest in conserving the environment - which is verified in recorded videos and audios that are not objects of analysis in this article - demonstrating that environmental education can act as an agent of change in attitude especially when the students realize the integration between the content explored in the classroom and its socio-environmental relevance.

Key words: *environmental education, formal education, environmental sanitation, urban drainage.*

Resumen

Este artículo presenta una experiencia educativa que se basa en un tema de relevancia social. El proyecto titulado ciencias de la actualidad - un nuevo significado se desarrolló en una escuela pública de la ciudad de Goiânia, Goiás, entre profesores y estudiantes, tuvo como tema principal el saneamiento ambiental, específicamente el "drenaje urbano". Fueron formados cuatro núcleos multidisciplinares con la intención de desarrollar subproyectos con prácticas educativas orientadas a temas de saneamiento ambiental con los alumnos implicados. De cada núcleo participaron tres grupos de un total de doce clases. De los cuatro núcleos, sólo uno logró desarrollar el subproyecto propuesto de manera eficaz. Los otros grupos tuvieron problemas en la ejecución del subproyecto, especialmente en la adecuación a la realidad escolar. Sin embargo, a pesar de los problemas encontrados, todos los estudiantes se involucraron con interés en la conservación del medio ambiente, lo que demuestra que la educación ambiental puede actuar como un agente de cambio en la postura, especialmente cuando los estudiantes hacen la integración entre los contenidos estudiados en el aula y su relevancia socio-ambiental.

Palabras clave: *educación ambiental, educación formal, saneamiento ambiental, drenaje urbano.*

INTRODUCTION

Because they affect the destiny of humanity, environmental issues are growing global concerns. In recent decades, many social practices concerned with the environment have been instituted with legislations, government's programs and different NGO initiatives. There is a consensus, within education on the need to address this issue at all teaching levels (Carvalho, 2006) and now Brazilian Law 9795 has instituted the National Policy for Environmental Education (EE), which was regulated by Decree 4281, in June 25, 2002.

The purpose of this law was to fulfill the need of implementing an Environmental Education in all teaching levels, according to the Brazilian Federal Constitution (Brazil, 1988). Education is required to promote reflections, to build concepts, development, and application of methods and experiences to build new knowledge bases and essential environmental values for current and future generations. Thus, Environmental Education has become an important mediator between the educational sphere and the environmental field (Carvalho, 2006).

Today and especially in Brazilian public schools, school environments are often discouraging, with precarious infrastructure and pedagogical and educational projects, which do not motivate students, as they do not take into account the reality of student's lives or their actual interests. Besides, education has few resources available, lack of career planning for its professionals, short time for teacher's qualification, and flat salary policies (National Council of Education – GO, 2009).

Thus this work intends to point out a methodological proposal focused on the proper insertion of EE within the formal education, using the multidisciplinary development centers that act by promoting ways to unite the knowledge of basic science to knowledge gained by students through their social, cultural, political and economic everyday experiences.

This research consideres work with elementary and secondary education, since this community features, among others, two positive aspects for the implementation of a significant EE: the age of intellectual, cultural and social formation and the influence they wield in their nuclear family in perspective of cultural transformation and management changes through Environmental Education (EE). We understand EE, from this perspective, as a process with the challenge of creating conditions to include the different segments of society, striving to qualify people toward citizenship so that their critical stance enables them to participate in the environmental management process.

THE ENVIRONMENT AND THE TEACHING EXPERIENCE

This study is based on the positive resources obtained from a project developed on a small scale in 2009 at Jornalista Luiz Gonzaga Contart school, in the city of Goiânia - state of Goiás.

Most of the students from this school live in neighborhoods located at Pedreira water stream shores, which are already developed or under development stages, along with serious urban draining problems and a risk of sudden floods. This has already happened in 2008 (AMMA, 2008). Thus, in the search for developing a teaching proposal to reach students' life experience, the Environmental Sanitation - Urban Drainage topic was of great importance and it was chosen as the main topic for this project.

Jornalista Luiz Gonzaga Contart (CJLGC) School is located at Jardim Guanabara II neighborhood – Goiânia, GO, and it enrolls students from Elementary, High School, and EJA (Education to Young People). The group participating in the project was composed of a school community involved with problems that resulted from a consolidated urbanization scenario downstream at Pedreiras water stream, Jardim Guanabara I, II and III, Asa Branca, and condominium Aldeia do Vale, and upstream of the watercourse with an urbanization scenario including Vale dos Sonhos neighborhood, which suffers from erosions and floods.

The execution of the work counted on the collaboration of all morning class teachers (20 teachers), who received proposals for activities including 12 classes from High School with the total of 487 students in the age group from 14 to 18 years old. The students' activities were held in the same school period, with teachers' follow-up and extended to the afternoon and evening periods, with follow up from the 'stimulator advisor' from the Laboratory for Nature Sciences.

Characterizing the project

In 2009, the project used only one multidisciplinary nucleus (Figure 1) and worked on the development of a multidisciplinary nucleus of teachers. These teachers would guide students on the formulation of experimental projects on a laboratory scale, which could help to reduce environmental impacts caused by the urban drainage issue of neighborhoods located the Hydrographic Basin of Pedreiras stream, where largest part of this school community lives.

The pilot study collaborated on the preparation of the 2010 study. The pilot study made it possible to demonstrate to teachers that when working with EE, it is desirable to use relevant social topics such as urban drainage.

Furthermore, it was noted that working with multidisciplinary groups of teachers is important since it allows the expansion of knowledge on the subject. It also stimulates the applicability of basic sciences and indicates the importance of creating a link between social and academic institutions with basic education.

In 2010 the project created four nuclei (Figure 2) to improve and expand the original idea. The project, which at first covered only the afternoon and night periods, was extended to the morning school period, with the collaboration of afternoon and night coordination. The project was implemented at the beginning of the school year (February), which made it possible for teachers and students to organize and plan the development of the project along with the activities proposed by the education office or by the teacher (activities in the classroom).

TODAY SCIENCE PROJECT - A New Meaning

Following the school year and the Political and Pedagogic Plan of the School, the project was divided in two modules (Module I and Module II), which were developed in the first and second semesters of 2010 school year. (Figure 3).

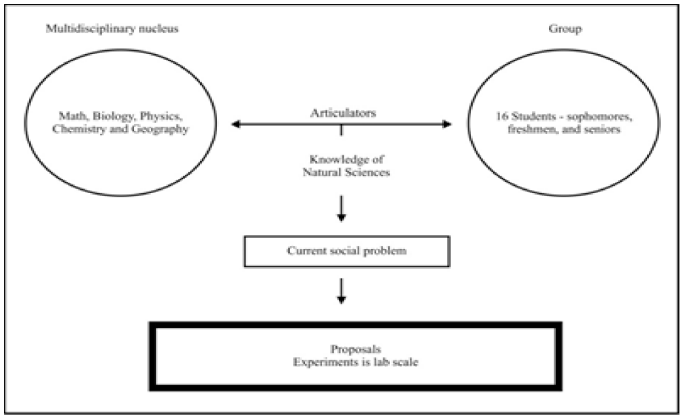

Figure 1: Project`s Structure in 2009

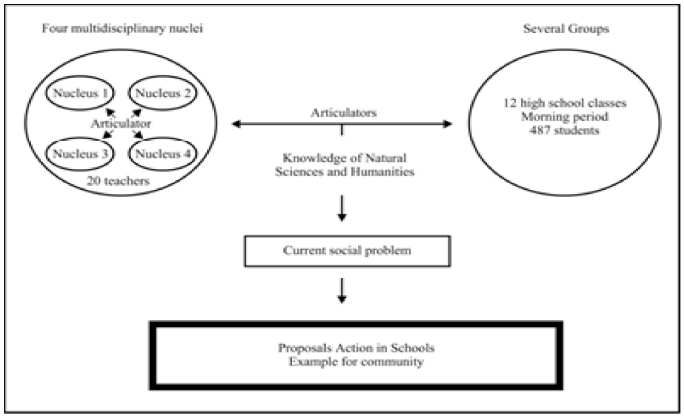

Figure 2: Project's Structure in 2010

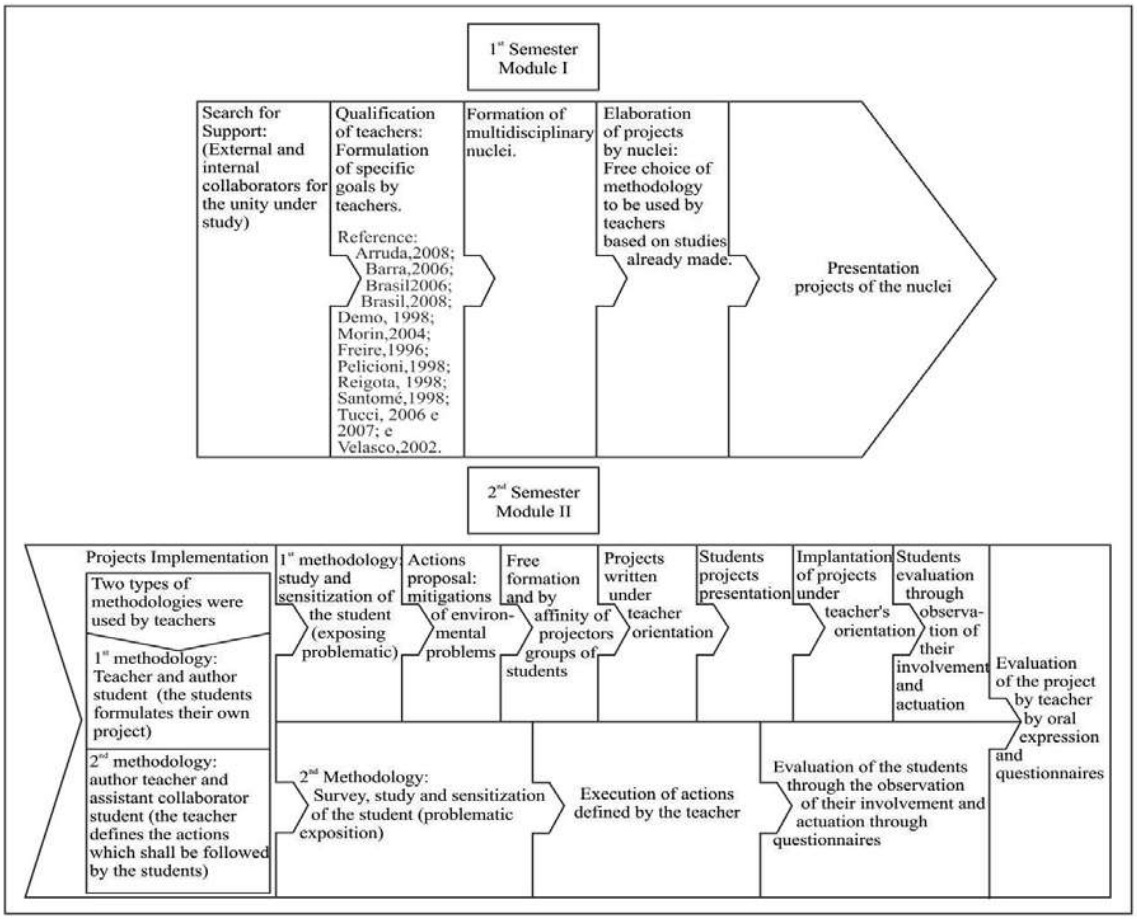

Figure 3: Summary of the methodology applied at Sciences Today Project - A New Meaning 2010.

RESULTS

We understand that EE practices and the application of the participation principle are one of the fundamental premises of water resources-integrated management. Thus, the purpose of this paper was to implement the development of a real and effective methodology, searching for a new meaning for the education through a teaching alternative from a theme of social relevance. It was important to consider the knowledge of students, who live in the neighborhood and coexist with urban drainage problems, to the development of this project.

Thus, this project worked with qualification and implementation stages of plans tuned to make students more aware of environmental issues related Urban Drainage of their surroundings, caused by disordered urbanization, collaborating then for the beginning of an ecologic individual development. Ecologic individuals are people that cultivate ecologic values in their life options and projects and that search to experience, in their daily lives, these ecologically oriented attitudes and behaviors (Rocha, 2001).

Starting from observations performed during activities, the following discussions and results were established:

1) The relations or link between Higher Education with the High School institutions, building connection bridges between different types of knowledge are desirable, but quite not present in our society. This relation makes feasible the teaching-learning process, and awakens in the student the desire to participate sooner in undergraduate activities. It also encourages knowledge about their future professional intentions, a fact confirmed by the interest of some students, after getting in touch with the subjects and activities approached by the Civil and Environmental Engineering courses during the project, as they were admitted in the respective colleges.
2) It is also very important to have financial resources, whether through agreements or through the educational institutional itself, which in this case is under State responsibility. Any work has costs, even low ones, with materials or professionals dedicated to perform them. School and teachers are asked to work with cross-sectional themes, but the means for the full development of such activities are not provided.
3) The school availability is vital in administrative and curricular aspects of the institution. The school needs to welcome to new ways of learning, making available spaces (labs, auditoriums, and others), students, teachers, and resources to make feasible positive results for learning, as well as to open spaces on their curricular planning for subjects experienced in the daily routine of students and community, performing them so all can understand precisely.

This was a partially surpassed challenge, as although the school as a whole (administration and teachers) was promptly made available to participate in the project, it is difficult to break through the 'content culture' of our teaching.

Thus, observing the construction and execution of the plans, the difficulty for schools to include planning time in-group is clear as they face pressures to meet school calendar days imposed by the education bureau. Also, school faces parents anxious for vacation end and the concept that teaching-learning only happens if there a blackboard full of activities and classrooms full of students sitting down in desks copying or listening the teacher at all times.

4) Teachers are one of the main parts of the project, since without their willingness to act as coordinators and mediators, no action can be applied and after all, they are the education professionals. We contend that the pedagogical work in the school, multi or interdisciplinary, must be a collective work. However, the high school teachers, frequently submitted to exhausting workloads and in several schools, teaching became a lonely work and breaking this routine demand efforts as well.

The group division into nuclei of multidisciplinary planning was the alternative found, because besides minimizing the problems mentioned, it has also helped to widen the view about the methodologies that could be applied to students. So, an opportunity was open, even in interdisciplinary moments. To keep an interaction between nuclei, directing them as part of a single work, it was necessary develop the role of an *articulator*.

The articulator was of great importance for the development of the project, meeting all mentioned nuclei, trying to keep interaction between them and verifying the teaching and material needs of the groups. The evaluation of the articulator's work showed that a team of articulators would improve the quality of the activities. Therefore, the proposal was to train a multidisciplinary team of articulators, which would improve the services to the nuclei, expanding the view of the nuclei's needs and making easier the follow-up of activities and understanding of the projects proposals.

Another extremely important issue was the difficulty found on the execution of the plans. Even after reading and discussions of texts with the aid and orientation of NUPEC[1] and PPGEMA[2], the deadlock of putting it into practice arose. Based on readings and discussions, the group brought up a crucial point, that for the implementation of the plans, it would be necessary to adjust the basic disciplinary content of the subject to social relevance, so one of these, by any chance, would be favored over the other.

At that moment, the need of a qualified articulators' team was clear, for aiding each professor in his/her acting area and in his/her difficulties in analyzing and selecting the actual necessary and indispensable contents. Also, to aid in the adjustment between content and theme used.

5) Four multidisciplinary nuclei were formed where each one would assist three High School classes, twelve classes involved in the project (Table 1). Although the teachers' groups were responsible by the specific objectives formulated for the project, not all could achieve them after the nuclei were formed.

The teachers were free to choose the methodologies, so a nucleus was provided with advice concerning students' activities and research, and encouraging students to design their own actions. The other groups used a method where the teacher proposes the content, the answers and the actions ready for the students, leaving them in a comfort zone. However, the student assumes a role of assistant and not author and actor of their own ideas and actions. This type of methodology where the student is only an assistant was not appropriate for the EE process.

6) In the assistance stage of the projects in practice, there was the essential participation of a teacher called 'constructor teacher'. It is teacher with creative and multiple skills (handicraft, carpentry, lumber, construction) that works in cooperation with teachers' nuclei, connecting the theories created to solve a certain problem, implementing proposals written by students. The students learned techniques to build, in a creative and economic way, what they, through investigation and orientation of the teacher, concluded to be important to the community.

The constructor teacher provided the students with a range of activities necessary to implement their ideas, showing alternatives and possibilities to work on them, besides encouraging the autonomy and self-confidence of a common citizen, enhancing the importance to the society of people who are not only critical, but that also make things happen.

In the 2009 pilot study, the proposals made by students were implemented by the construction of experiments models in labs. In 2010, the students implemented their ideas by building full- scale what was proposed a solution, which could be followed as example by the school community and surroundings.

7) The aspect of the school environment improved in a reasonable and visible way. The students' part of the project demonstrated differentiated behavior regarding the preservation of environment, they showed interest in helping to reduce environmental impacts caused by Urban Draining problems of the Hydrographic Basin of Pedreiras Stream and also changes regarding the participation on school daily activities. There

1 NUPEC/UFG is a nucleus of research in the teaching of sciences that develops research and extension actions along with schools of Elementary Teaching of the State of Goiás. From NUPEC participated teachers formers of licensing courses of Chemistry, Physics and Biology, graduation and master students of these knowledge area and teachers from elementary teaching. In the year of 2006, NUPEC and the School of Civil Engineering of UFG had the Project "TEACHING OF SCIENCES FOR THE CONSERVATION OF THE NATURAL RESOURCES AND THE BUILT ENVIRONMENT" approved with FINEP resources. From the project, five schools of high school teaching from the city of Goiânia participated. The Jornalista Luiz Gonzaga Contart School is one of these schools that were incorporated to the project "TEACHING OF SCIENCES FOR THE CONSERVATION OF NATURAL RESOURCES AND THE BUILT ENVIRONMENT" as the sub-project SCIENCES TODAY- A New Meaning.

2 PPGEMA/UFG is the research Post-Graduation program in Environmental Engineering that has the objective of forming researchers, in master's level, which will contribute for the regional sustainable development, building and applying scientific and technological knowledge which integrate the Engineering and the Environment. It was represented through the participation of their teachers and students getting a master's degree, the School of Civil Engineering, in the sub-project SCIENCES TODAY- A New Meaning.

Table 1: Summary of the activities developed by the nuclei.

NUCLEUS 01	**Professionals' Area of Acting:** Portuguese, Math, Biology and Pedagogy.	
	Planning: Planning as a project, titled "Water is Life Project".	
	Adequacy to the Proposal: It was the only one which fit well the proposal, analyzing the disciplinary contents and the implantation of socially relevant project that, in this case, it its Urban Drainage.	
	Used Methodology: It was used the project methodology, sensitizing and providing theoretical basis to the students, surveying the problem and after, helping the students writing their own projects.	
	Total of Classes Involved: Three classes with an average of 49 students each.	
	Results	**Development:** The students wrote proposals for mitigating the draining problems at Pedreira Stream Basin; the projects were written and presented by students to teachers; from them the following projects arose EE project, one of irrigation and one of the alternative method for non-water proofing of the soil (creation of a orchard in small areas); The students performed their actions in morning and afternoon periods; EE speeches were performed by them and they made a recycling work which resulted on a waste bin for eac class of the school, they build a orchard and a nursery.
		Closure: They are preparing for the closure of the project producing presentation panels for exhibiting to the school community and surroundings.
		Evaluation: It was made in a continuous way by the observation of the participation and involvement of students and periodical meetings for discussing about the development and results of the activities they have proposed.
NUCLEUS 02	**Area of the acting professionals:** Arts, Physical Education, Math and Chemistry.	
	Planning: A planning was written as a project titled "Landscaping at School Jardin'Arte".	
	Adequacy to the proposal: It was demonstrated an enormous difficulty of implanting the plan in the daily routine of the school's current classes, prioritizing the disciplinary contents. It is fact that it is complicated for the educator who was formed under a content's perspective, detach from the old and see the possibility of the new, without damages. Perhaps, this has occurred by the lack of planning time, and bigger aids of the articulator, besides, the nucleus could not harmonize the actuation of all the participants, factor that demonstrated the need of being in synchrony and partnership as the base of these formations (ELLIOT, 1996).	
	Used methodology: The work followed an idea formulated by the teachers' nucleus. The lack of opening for helping the students being the authors of their ideas on the development of the project may have been a limit factor of actuation and participation by the part of the students.	
	Total of classes involved: Three classes with an average of 49 students.	
	Results	**Development:** The plan was applied, in a parallel way to the daily activities of the school, meetings were performed in weekends; the students interested by the project as it was exposed made a demonstration of how using the spaces for gardening instead of waterproofing the soil, taking into account the visual welfare.
		Closure: The preparation of the project's closure was made producing a presentation panel for the exhibition to the school community and surroundings.
		Evaluation: It was made in a continuous way by observation of the participation and involvement of students. The participation and income of students were low, compared to the average of students by worked class. Due to the separation made between the project and the school's activity, the students understood the importance of action and of their participation in the project.

Continues

Continuation

NUCLEUS 03	**Area of acting professionals:** Physics, Spanish, Philosophy, Portuguese and Geography.	
	Planning: It was written a plan as a project, titled "Collection and Reuse of Rainwater".	
	Adequacy to the proposal: It fits well the teaching proposal, but it also demonstrated a slight difficulty of uniting base content and theme.	
	Used Methodology: On its work methodology, it was used the problem survey, but it was chosen to direct the students in programmed actions, in other words, it was not able to students to built their own solutions proposal. This methodology is the most common among educators, perhaps because it is less complicated than opening to guiding several ideas and by adjusting the student to a bigger control of their actions avoiding unforeseen issues. This method is shown as efficient about the sensitization and consequent critics of students, but inefficient in what concerns the development of attitudes which can plan effective actions in their social environment. It is interesting allowing the students to be involved in the problems and visualize their intervention capacity, intervening in fact, being teacher's responsibility the role of being the assistant and advisor.	
	Total of classes involved: Three classes with an average of 49 students each. Such students were from a 3rd year of High School, factor that may have contributed to the low participation of the same. The fact is that the development of extracurricular activities does not have any value to entering a University and the 3rd year students are found in a moment of pressure and expectation of a promising academic future, what does not left any space for thinking in social practices.	
	Results	**Development:** The project resulted in educative messages about water and environment in general, which were written as graffiti in strategic points of the school, replacing the vandalism graffiti by art graffiti and educating the school community; there was the construction of rainwater collection and storage model which was connected to the orchard project, serving for it irrigation; this model has demonstrated a way of avoiding the rainwater impact over the soil, contributing for decreasing the superficial flow and also contributing for the not wasting potable water.
		Closure: They are preparing for the closure of the project producing presentation panels for exhibiting to the school community and surroundings.
		Evaluation: A low participation of students occurred in comparison to the quantity of nucleus' actuation rooms, reasserting the problem of limiting the students' creation, the fact they are about to take their *vestibular* tests (relative to SATs) and not motivated to develop extracurricular activities within this time period of their academic lives. However, the few ones that participated had a good and efficient performance.
NUCLEUS 04	**Area of the acting professionals:** History, Sociology and Geography.	
	Planning: A planning was written as a project titled "Documentary: The Inhabitants Surrounding Pedreiras Stream".	
	Adequacy to the proposal: There was a serious and typical problem from state schools today: due to a large board of sick professionals (problems arising, maybe, from the pressure of long work journey the professionals have to be submitted and if they want to have a more worth salary and due to the scenario they have to be submitted today), or also the lack of effective teachers, the nucleus is undone because it was formed by non-effective teachers (with contracts) or who took licenses due to health issues. Thus, the students that should be served by this nucleus had a partial participation in an indirect way (by the movement of other nucleuses). New teachers were hired but it was not possible to promote their adequacy to this program. It shall be clarified that it was not by lack of teachers planning or students involvement, but due to structural factors of the board of personnel that these nucleuses did not progress. It is a problem that was not foreseen and which shall be taken into account. It would be interesting that the maintenance of the board of educators during the year was prioritized, what would avoid damages like these. It is impossible to foresee certain types of diseases, but hiring more effective educators and maybe work with exclusive dedication model since a good remuneration could be a solution.	
	Used methodology: It was a good initiative, able to develop with students a documentary reporting the urban development and their consequent impacts, of Pedreiras Stream surroundings. With the aid of Municipal Agency of Environment GO and Strictu Sensu Program of Environmental Engineering PPGEMA/GO, they have notions of the basin limitation and its importance and they were also a field where they obtained orientations about the impacted status of Pedreira Stream and as Urban Drainage problems are closely connected to this status. At this moment, there was also the first contact of students with the surrounding population of the Stream who would be interviewed in this documentary.	
	Total of classes involved: Three classes with an average of 49 students.	
	Results	**Development:** No results.
		Closure: No results.
		Evaluation: No results.

was improvement in grades, in interest and participation of students who, before the project, did not show any interest and were even anti-social, confirming the importance of contextualizing the school. As mentioned before, these evidences were recorded in audio and video. They are not presented here because they are not part of this article focus. All the school students that actively participated in the project went in trip field to a Permanent Reserve Area, where they constantly showed their concern and interest for environmental problems as well as awareness on preserving and using natural resources.

The following table presents a detailed description of the entire project development.

CONCLUSIONS

Educators need to realize and assume that their permanent condition as researchers and the purpose of their work should not concentrate their efforts only on passing knowledge on, but on the teaching learning process and on strategies that make easier for students to absorb knowledge. This is a basic assumption of the researchers and the project was planned to use EE as a vehicle to test the implementation of this in schools.

The student comes to the school with knowledge acquired by life experience, influenced by an entire social, cultural, and political context. Thus, it is necessary to take into account that actions and methodologies applied could positively influence when it is possible to aggregate, to common sense, knowledge from several sciences, in a contextualized and updated way. On the other hand, it can make no difference, when the link between types of knowledge does not happen and the formal education becomes an obligation for an uncertain future, offering a knowledge that many times is lost with time because it does not have any application.

Educating in the perspective of Environmental Education in schools is a task that demands institutional, political, and pedagogical efforts, among others, but it is not impossible to be performed. The experience presented herein shows a teaching alternative that although having limitations and challenges, showed that types of knowledge acquired in school could be useful today, disregarding the idea of futuristic education with no use for the present.

High school students are great actors on the preservation of the environment as they are in a stage of theoretical, conceptual, and political development. Besides, they behaved as co-authors of concrete actions on environment preservation, providing them the feeling of being useful and taking collective responsibility, which in turn open doors for new and old types of knowledge. This improved the student's outcome regarding the mandatory contents and improving his or her behavior and relationship with their environment. The experience showed in this study enable us to state that the environmental education is a science of social inclusion.

Environmental education is a great instrument for a sustainable management of Urban Drainage, since studying the environment provides an understanding of interactions between natural and social aspects, relations that include processes of cultural and technological creation, and transformation historical and political processes of nature and society. This is a fact that emphasises the importance of researching methodologies that meet Elementary Teaching formal education.

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