COMICS: A TOOL FOR TEACHERS AND STUDENTS IN TEACHING AND LEARNING SCIENCE

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Abstract

Scientific knowledge is a social construction gained over time; however it is possible that students do not have that understanding. According to Carvalho (2001) is possible that scientific concepts in many cases are not articulated to the daily lives of students and issues of social context. Based on an action research this work tries to detach the importance of making proposals of activities that bring together the scientific concepts with daily life issues of students.

For this purpose we used the information and communication technologies, focused on the production of comics supported by computers. The problem presented to students was about the processes of soil sealing and the consequences for cities such as floods and droughts. The result allowed students to reflect in pairs and with teachers about these problems for their lives.

Students were encouraged by the use of computers in a social context to articulated scientific concepts to communicate science.

While the comics produced by students supported teachers to understand the process of student learning allowing the mediation's inferences in Natural Science Education.
Key words: *comics, cultural tool, environmental issues, ICT.*

Introduction

Science education plays a very important role in broadening students' world outlook. The science classes always discuss real, concrete things and phenomena, which are a part of students' reality and even everyday life (Lamanauskas, 2003).

An important task of science education is making science more relevant to students, more easily learned and remembered, and more reflective of the actual practice of science.

It is expected that students will need to develop and/or improve skills for dealing with controversial issues as they prepare to participate in a democratic society. On this way, science educators seem to agree that relevant, real-life, contexts are important when teaching for scientific literacy (Mork and Jorde, 2004).

In contemporary democratic societies, lay citizens need to understand the nature of scientific knowledge and practice, in order to participate effectively in policy decisions, and to interpret the meaning of new scientific claims which affect their lives (Sandoval, 2005).

Scientific knowledge also contributes to new technologies to be produced. This constant flow of knowledge occurs so quickly that we barely realize that times have changed (Kupstas, 1998). Science and technologies are present in our daily lives even influencing our perception of reality. They made the world smaller and therefore, we are

far from living in the confined space of our city, region or country, isolated from what goes on around the world. (Härnqvist & Burgen, 1997).

It should say that is inherent in the human species the ability to transmit the knowledge produced, because this is important also for the survival of generations, so the school has a fundamental role as a place where human settlements are materialized in this sense, the Information and Communication Technologies (ICT), are technological resources that modified the traditional forms of text and images giving new conceptions about the use of the time and space, so created new challenges.

The media fascination is increasingly embedded in people, this resources move in different languages and information, so on this way the educational plan needs to understand these new challenges.

Another objective is to work on social issues related to scientific concepts, as we understand that natural science education also contributes to the education of the individual because as argued above, faced with new challenges it is necessary for people to be prepared to allow a meaningful action. According to Lemke (1990), if we recognize that scientific knowledge is part of educating students, we must reflect strategies that would assist in better teaching process.

Arroio (2006) indicates that the problem of educational innovations in science education might be properly treated by analyzing the complexity on the basis of methodology of teaching.

We therefore propose an activity that encourages reflection on the part of students, teachers and the community around the school on environmental issues. Proposing a set of actions to be developed by the teachers staff and the students body, elaborating a bulletin in a comic about: land impermeability, droughts, floods and ecologic pavement.

A very important theme that is present in the media and the live of citizens, concerns the problem of floods and droughts in larger quantities at certain times of the year as a taking, from many causes, excessive soil sealing.

According to Philippi and Pelicioni (2005), the degradation is caused often by complete sealing of the land surface

Besides the reflection proposed construction of informative material also wanted students to realize the dichotomy portrayed in newspapers and different media, reading in the news the first months of the year the excess water causing overflow and the middle of the year showing water scarcity and its consequences, such as drought in São Paulo city, Brazil. So it was also possible to develop reading and writing among students in an autonomous and critical, since such a concern is this constant and between teachers and curriculum organizers.

Another point discussed in this work was to show the importance of mediation of learning promoted by the teacher during the natural science classes. The mediation allows to negotiating meanings respecting individuality. This aspect is valuable, because it not homogenizes, but considering the potential difficulties of each student.

Action-research was the approach used in this study because on this approach it is possible to develop such a joint collaborative research among students, school and society (Thiollent, 1985). This methodology allows us to analyze the meaning of "to do" by the students during the production of comics on the computer.

Education and Comics

We find in the studies elaborated by Vygotsky (1978), certain concern with the aspects related to the use of instruments and its relation with the language. A characteristic

typically human being is to use these instruments and to attribute meanings, these are constructed through the culture and of the historical moment of each generation.

Perhaps the writing is a formidable example of as the communication process loads diverse elements constructed for the culture, it is enough to remember the pictorial representations among others using drawings symbols left in caves until the forms contemporaries as the production of texts that incorporate words and images. Comics, identified as representation speeches, allow them that find a set of representative signs of values, norms, beliefs and revealed common sense of a society in the linguistic and visual plan.

According to Vergueiro (2007) the use of comics is important because there is strong identification of students with the icons found in the comics that are part of mass culture, in this sense the comic favor the teaching process

Before of the displayed one we understand that comics are valuable instruments for the communication human being, therefore it in itself contains diverse representations of understanding using signs that had been established by the society in accordance with its culture, as for example, the types of balloons, the drawings that represent meanings of fury, affectivity or mood. Thus through the union between images that gain movement through a sequence and dialogues can contribute in the educational environment, therefore the students can participate of active form using its imagination to complete the spaces between the images (MacCloud, 1993).

The use of comics, beyond sending to situations of the student's daily and the social life, makes possible the reflection on the considered subject, the confrontation of ideas and the brainstorming and alternatives for a presented problem. The use of the computer favors the autonomy in the learning (Route, G.; Izquierdo, 2003).

With the construction of the comics in the education of sciences, using the computer as cultural tool, is possible to promote the inclusion digital and to motivate them to use it the different resources of computer in a perspective in the natural science classes (Arroio e Serra, 2008; Santana, Arroio e Serra, 2008).

Guimarães (2001) made important consideration that treats on the potentiality of comics in the learning process, in the same work the author argues the proper language of the comics and the question of the necessity to teach or not same it to the students during a learning situation. The PCNs – National Curricular Parameters in 1997 established by the MEC - Ministry of the Education recommends to use the comics in the schools more oriented to the discipline Portuguese.

The Curricular Parameters of the Portuguese Language recognizes the necessity to work in the school with different kind of representative texts of the heterogeneity of our culture.

Ramos (2006) also highlights the comics in education, specifically with elements of orality, comics can help to teach elements of orality, since they have similar characteristics to the comics and in accordance with a orientation of PCNs where there are references to that work orality. Ramos (2006) therefore uses the repertory of comic books to show that such an approach is possible.

Technological Resources and Education of Sciences

Frequently we find in some works and even though in the quarrels of the daily one between teachers of natural sciences, that are necessary new methodologies, new approach, cares with the language, incorporation of other subjects as the history and the philosophy of science. Beyond these, a resource very argued by Arroio (2007) in its works, the use of the audiovisual, fact that must be understood with much attention, therefore is

well-known that in the current days television, cinema and internet are very leading in the life mainly of the young ones as form of leisure and communication

Thus it fits to detach that great technological investments are not enough only, spotless laboratories or still a good collection of videos, such resources are important, however it is essential knowing to use, or still, to give significant direction to the learning of the scientific concepts, whichever the resource.

Such concern is possible to find in the work developed for Kamel and La Rocque (2006) where the authors investigate comics in didactic books of Natural Sciences and Portuguese Language using as reference the idea of described significant learning by Ausubel. One of the conclusions of its work is accurately too little and weak joint with the contents, although the excellent joined election of the comics, however with such problematic described one.

In this way it increases the responsibility in the formation of the teacher in all the towards until knowing to select materials for use with the students. Such formation if does not have to restrict the initial college student, but during all the life of the teacher.

Methodology

This work describes the experience of producing comic strips by students (13-14 years old) of the fourth year of the second cycle in the elementary school of the EMEF Jardim das Laranjeiras in São Paulo city, Brazil (Municipal Elementary School). The themes approached were land impermeability, droughts and ecologic sidewalk.

The project was organized in three stages:

1st stage: Previous survey of the students' knowledge about land impermeability – and its problems, floods, lack of water, springs degradation and disordered cities growing. The methodological procedures to approach those subjects were: expositive classes, debates, movies, newspapers, magazines and internet research.

2nd stage: Practical demonstration of the land's makeup using sample materials as sand, mud, sponge and a piece of glass.

3rd stage: Systematization of the subjects developed by the construction of an instructional material in a format of comic strips in the computer. In pairs, the students should organize the information gotten, establishing relations, comparing data to build their knowledge, proposing improvement actions for the inhabitants of around the school about the importance of leaving at least a tiny space without cement.

They started the first sketches of their stories (narrative) in the classroom, to finish it at the computer laboratory as digital comics.

It was used the free software called MKGibi, developed by the Microkids team planning to offer to the student a properly environment to create comic strips, choosing scenarios and characters that belong to "Turma Microkids" (Microkids team), making them more dynamic and interactive (Microkids).

The students were initially oriented about the software utilization, scenarios' choice, characters, balloon's insertion and external images captions to help in their stories (narrative) composition.

They were as well oriented about the comics chart's language, narrative texts made outside of the balloons, characters speech, kind of balloons, charts design.

The data were collected by an audio record of the students' speeches during the activities and it was transcript, with the comics produced by them.

Results and Discussion

Another important concept in Vygotsky's work (2000) concerns the development of higher functions of learning, they are structured in areas of development that each individual has in the learning process, described as real development zone, proximal and potential, the first is understood as what the individual can do alone, the second refers to the path that needs to traverse to reach the next level, in other words the potential which is the level at which the subject is able to mobilize what you know with other concepts, so the process is dynamic, because the student with the help of a peer more experienced, you can reach another level of development.

Such reasoning allows us to say that more experienced peers, along with the materials may mediate the learning process, so the teacher or other students can contribute to it. Importantly, the teacher to investigate the levels of development and their skills in which each student is entered, tailoring activities and groups to interact with these levels.

Reading comics and construction contributes in the development of various skills such as interpreting, analyzing, critique, apply, which occur when the student identifies and explains an issue and when they recognize the author's intention, when you locate information, when comparing and establishing relationships, when reading, when you find possible solutions to a problem situation. It further contributes to plan, create, imagine, run, draw, design etc., when faced with challenging situations related to daily life situations and problems for possible solutions.

We emphasize the following five constructs produced by students showing steps in which to mediation and intervention.

It is observed in Figure 1 attempts to transmit information (as constructing an ecologic sidewalk, present the solution to the problem (to reserve space for planting), raising the hypothesis of no sidewalk ecological (planet suffering indicated by the image of the earth with the thermometer mouth), concluding with the request to change *"This can't go on!"*. These aspects are positive, however, argue that this example the learning process must continue, in other words, the students who constructed this sequence need interventions by the mediator, because in the (figure 1) comic explanation is very simple and direct.

There is a cut in the sealing issue and beginning of another related to the environment, but not a sequence with the above, then the mediation needs to orient the differences between greenhouse and soil sealing.

Figure 1: Comics produced by students.

Since figure 2 is more complete there is greater cause and effect relationship, establishing a clear connection between scientific concepts and critical position. It is observed in its production, use of images captured from the Internet to the composition of the story (beyond those offered by the software). Students tried to insert actual images of droughts and floods to become a fictional story on a true story, to give more credit to what they were. They said the draw is made by someone and the picture is the reality register, they think that the draw can be manipulated and the picture not, they don´t consider the intentions of someone that take the pictures.

Similar to the previous figure, but to a lesser extent, there is a small error, especially in the second figure "*which causes dry, because water in the rain got nowhere to go"*. The work in this case the mediator needs to work some aspects of the construction of language to explain the difference of droughts and floods.

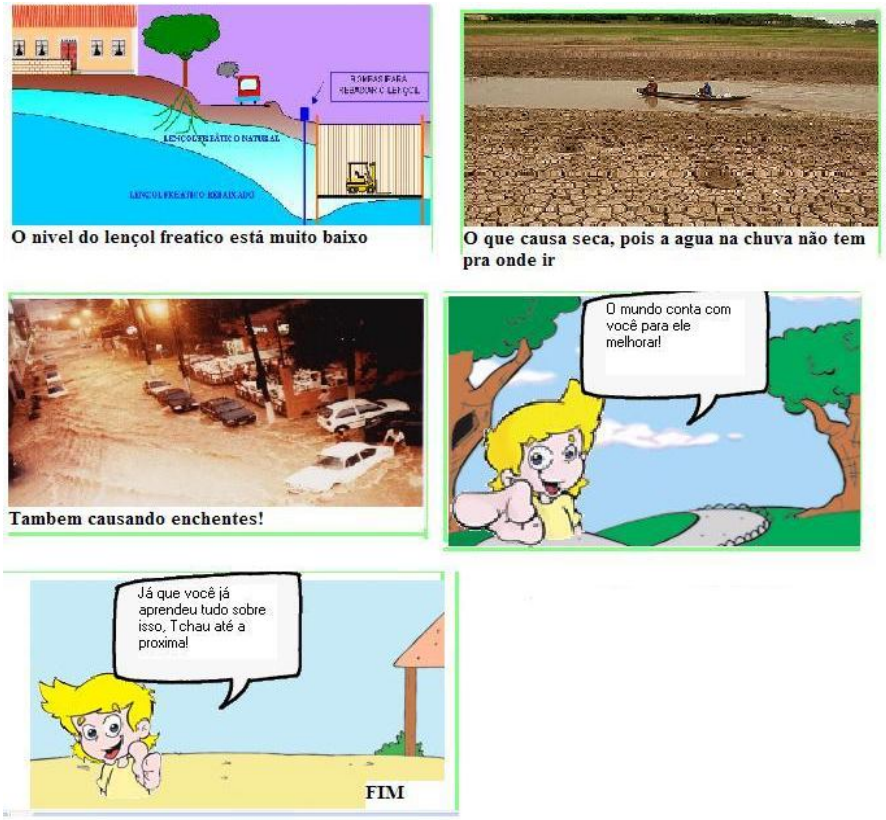

Figure 2: Comics produced by students.

Figure 3 does not list the issue of soil sealing, yet carries an environmental theme, showing that the previous steps have been incorporated, but the intervention of a mediator need to develop further due to lack of theme, and lack of articulation of the theme with a position, because what we see is just a statement "*This world is getting more and more thirsty*". It is necessary to mediate this effect on learning for students to transform observation into action, mobilize action on the finding, in addition to more references to scientific concepts related to the environment.

Figure 3: Comics produced by students.

Also considering Figure 3, we highlight a probable sensorial conception due to an expression used by the students ("The world is getting more and more thirsty"). Mortimer (2006) highlights in his studies, the notion of conceptual profile, showing the specific zones of it. One of them is the zone which relates itself to a continuous conception of matter and it is intimately related to the sensorial and external perceptions of the observed object.

Despite being attached to the atom comprehension, the study is also useful to the reflection made in this paperwork. Still according to Mortimer (2006), it is common to find this characteristic of object perception, especially with students from 6° to 8° grades. The group that produced these comics is 8° grade's students.

Mortimer (2006) with the idea of conceptual profile – by the way, idea that came from the Bachelard studies in which he describes the epistemology profile – makes his argument in the importance of understanding the aspects of perception and comprehension of scientific concepts.

The Mortimer contributions are utilized to understand that the students, while building meanings, can present difficulties called ontology nature impediment. In this manner, the teacher can analyze and plan actions that can overcome this impediment. At the same time, the teacher can show to the students that their comprehension should not be discarding or considered wrong by the scientific concepts, they just have limitations in some context of scientific explanation.

In the example below, figure 4 - the construction is simple but well defines the problem using resources as a way to give a quick message with content that enables the understanding of the topic. The student uses colloquial language to explain the water cycle "*Just let the rain work*". He does not use scientific language, but it is noted that there was understanding of the subject is addressed in previous classes. In this case, that mediation should act with objective for the student realizes the need to expand the story so that others understand the issue, thus demonstrating the ability to write for others to understand.

Figure 4: Comics produced by students.

About the Figure 5, there is a curious situation; there is the insertion of a character with mobility disabilities. The guiding theme of the story refers to the eco-construction of sidewalk and soil sealing. However, the pair of students put it into context a character with a special need asking to the other about the question on the subject under discussion.

When the student can understand the world and realize how attached are all the things, it is possible to establish a relation between the presented activity and the correlated different ideas. This refers, by the Feuerstein's theory (theory of the changeable knowing), to the pupil's capacity in transcend the discussed theme (Meier, 2008).

It is observed that the students interaction to the theme was beyond the direct and immediate necessity (environment and ecologic pavement), amplifying, diversifying the theme and obtaining other situations (disabled, as an example), besides the situation initially presented.

In this construction the mediation should work with the best conceptualization between sidewalk and ecological soil sealing, since the relationship between each other is satisfactory and what need is the best conceptualization of the two items.

Figure 5: Comics produced by student.

The insertion of the disabled person happened after the internet research about the ecologic sidewalk on the internet. With the research many information were presented. The student was responsible to filter the information already utilized in previous classes.

By interviewing the teacher in charge for the informatics lab, it was related to the researchers that while the internet's search about the ecologic sidewalk, other themes related to the disabled people were presented.

Implications

The development of comics in a proposal to allow students to engage with the object of knowledge through interaction with the computer, looking for information on the Internet and asking questions during the activity, in this sense to gains in both directions, ie, teacher and students, while allowing for understanding and intervention for teachers, allows students motivation, integration of skills and thoughts during activity.

According to Arroio (2007) for science education to be successful you must give the student a rich repertoire of experiences in which the concept to be learned is built.

Such experiences form the path for the construction of knowledge, which in turn supports learning. This alto helps to create or recreate an entertaining sense of doubt, which becomes a real incentive for learning.

We believe that even with playful feature, the proposed activity is a concern entering a challenging prospect, which materialized a teaching plan with the purposes and objectives. Emphasize that the action does not end with the construction of the students, but especially and with the possibility of intervention by the teacher with no sense of control or check their power, but with a focus on expanding meanings improving student learning.

This argument allows the assessment according to Hadji (2005), has a formative character, where the teacher at the same time evaluates the student with clear and explicit, while occasional difficulties involved in the students.

Science educators have argued that science classrooms ought to be active learning environments in which students construct personal meanings within the classroom community.

Some constructivist approaches have emphasized the personal construction of knowledge in the individual experiences within the learning environment are paramount, whereas others have underlined the importance of social processes in mediating cognition (Arroio, 2007b).

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