Teaching tools and the quality of science education: some reflections.

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Abstract

During the years 2014 and 2015 developed a survey in order to collect data and reflect on the relationship between the quality of teaching and learning science and the tools and teaching resources used, with the participation of five students from the Biological Sciences, belonging to a public University of São Paulo, Brazil; five teachers and about 120 students, divided into four different classes of middle school. The methodology involved document analysis, records of teaching episodes, identification and analysis of teaching tools. Activities that aroused most interest were: games, videos and hands-on activities like watching slides in microscopes and magnifying glasses in structures, organization of a garden, strawberry DNA extraction and assembly models of the solar system. The students showed great interest during the explanation of the contents, mainly while the materials were demonstrated. Despite research in science teaching area present analyzes, discussions and productions of different resources and teaching materials, which can diversify, streamline and better prepare the lessons, the results just are applied in real situations in class, seeking to improve the quality of teaching and learning. Hence the importance of making enforcement activities and analysis of different resources, instruments and teaching activities. It is vital to establish partnerships between universities and schools as institutions that produce, test, analyze and evaluate the tools, resources, and activities used in teaching to seek improvements in built learning.

Keywords: teaching tools; science teaching; teaching resources

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Introduction

During the years 2014 and 2015 he developed a research on tools, materials and activities that could contribute to the quality of scientific education in the initial years of schooling. Participated in this investigation five graduates of undergraduate programs in Biological Sciences, belonging to a public University of São Paulo, Brazil; five teachers and about 120 students, divided into four different classes of primary schools and middle school in three public schools.

The research assumed that "doing science at school is using own science procedures to observe, hypothesize, experiment, record, organize, analyse, create ..." (PEACOCK and FREITAS, 2008, p.11), and such procedures can be developed from the use of appropriate and diverse educational resources, highlighting the active construction of knowledge.

Despite the consensus among teachers and researchers on the importance of diversifying the instruments used in class what is observed, customarily in the teaching practice, is a big gap between the importance attached to this type of activity and its implementation, a fact reported by various research (Andrade and Massabni, 2011; Coquide, 2008; and others). The absence of practical activities makes teaching out of date and uninteresting, as well as low understanding of scientific concepts.

For research use are the terms teaching tools and educational resources to refer to the materials used in science and biology classes. Instruments or teaching resources can be classified as human and material resources that the teacher uses to help and facilitate learning, "are also called teaching resources, aids, teaching methods, teaching materials, audio-visual resources, multimedia or institutional material" (Karling, 1991, p. 245).

According to Pais (2000), teaching resources involve a variety of elements used as experimental support in the organization of teaching and learning, ie the resource is a mediator who facilitates student-teacher interaction and knowledge.

Souza (2007) defines teaching resource as any material used to aid in the teaching and learning process of the proposed content for the author:

Use teaching resources in the teaching-learning process is important for the student to assimilate the contents worked, developing their creativity, motor skills and ability to handle different objects that can be used by the teacher in the implementation of their classes (Souza, 2007, p. 112-113).

It is believed that the use of different teaching resources contribute more effectively to the process of teaching and learning and to achieve heterogeneity of students who have different characteristics and learn in different ways. Also teaching resources must be appropriate to the educational goals, an instrument may be adapting to the achievement of a goal but not all of the goals of science education. Thus, the teacher needs to know and work with a variety of proposals to meet the diverse possibilities and limitations of a class of students.

Agreeing with Castoldi (2009):

(...) With the use of didactic and pedagogical resources it is thought to fill the gaps that traditional education often leaves, and this, in addition to exposing the content in a different way, makes the participants of the learning process students (Castoldi 2009, p. 985).

For Fields, et al. (2003), the teaching-learning processes related to science and biology, include content sometimes abstract and difficult to assimilate by students when presented under the education of traditionalist bias in which content is separated from reality. Often the student memorizes a concept, a content, but does not understand it, does not relate it to other facts and concepts, and does not build an understanding about the concept. If we consider that many students cannot see the application of the contents assisted in the classroom on a day-to-day, we can see how much is necessary to carry out new forms of educational work, using different instruments and technology in the teaching process learning to make it more participatory and collaborative work.

From these notes, the survey aimed to collect data and reflect on the relationship between the quality of teaching and learning science and the tools and teaching resources used.

Methodology

This research was carried out in the period from 2014 to 2015. Firstly, there was a survey of sites, repositories and magazines of materials and instruments and / or activities for teaching science, valuing: active participation of students during classes; Favouring activities of discovery and construction of knowledge, avoiding the simple presentation of a concept; Activities that could be carried out in groups or collaboratively.

After selection of the materials, there was the organization of didactic sequences that could be developed with students from public schools.

For the implementation of didactic sequences, weekly visits were made to three state public schools. On these occasions, the faculty were consulted on the development of activities, a schedule for work and development of the sequences was organized.

In all, more than forty interventions were carried out (meetings with teachers, development classes and activities). During these interventions, there were records of activities, and application in field

journals (Lüdke; Andre, 1986), audio records, analysis of activities produced by students, materials that were qualitatively analysed, aiming to reflect on actions before, during and After activities (Schon, 2000).

The data were analysed qualitatively with the aid of theoretical structures and research on didactic tools (Morais and Mancuso, 2004, Borges, 2002, Delizoicov and ANGOTTI, 1994 and others).

Results and Discussion

In order to carry out activities with students, the following instruments, resources and / or activities were selected, prepared or adapted that focused on themes such as: plant diversity, photosynthesis, astronomy, DNA molecule, Brazilian biomes. Videos and simulations were used; Educational games; Models and posters; Observation of structures in microscopes and loupes (stereoscopes).

The preparation of the activity took place, the organization of rooms and materials by the university students and teacher for conduction with the students and teachers of the public schools.

It was observed that the students of classes spanned great heterogeneity regarding the forms of construction of learning and practical activities can contribute to students to learn using different senses mobilized during lectures. According to Lima et al (1999), inter-related testing the learner and the objects of their knowledge, theory and practice, *i.e*, joins the interpretation of the subject to the phenomena and natural processes observed, guided not only by scientific knowledge already established, but the knowledge and hypotheses raised by students, before challenging situations.

The use of videos, such as the videos that exemplified the characteristics of the various Brazilian biomes, or the videos that simulated the germination of the seed, can provide the visualization of processes and structures that were only in the students' imagination, often very constructive distant from reality addition, videos are features that enable the synthesis between image and sound, creating a range of experiences depending on what is transmitted, no longer just sound and image, but also a form of expression that can generate in the spectator elements motivation to new situations as a critical spectator.

It was also clear that educational games contributed to motivate students, using games that included separation of materials for recycling, games about human systems, card games. Games can be considered as an important educational alternative for providing the development of affective, cognitive, social, linguistic, motor and moral, and contribute to fostering creativity, autonomy, responsibility, criticality and cooperation of those involved (CAMPOS; Bortoloto; FELÍCIO , 2003).

By combining the playful aspects to cognitive, understand that the game is an important strategy for the teaching and learning of abstract and complex concepts, fostering internal motivation, reasoning, argumentation, the interaction between students and between teachers and students (Campos, and Bortoloto e Felicio, 2003).

The activities that most aroused interest were: games, videos and practical activities like watching slides in microscopes and structures in magnifiers, organizing a garden, strawberry DNA extraction and assembly models of the solar system.

The students showed great interest during the explanation of the contents, mainly while the materials were demonstrated. In practice lesson on the extraction of DNA from strawberries, for example, students raised questions and inferences performed on subjects such as: “How is the structure of DNA?” To the extent that question, it was possible to bring the students to observe the material, linking theory and practice.

The activities on the solar system the questions also occurred, "as the stars die?"; "If the sun is a star, then it will also delete?" The questions were answered, and also sought to raise other issues in order to engage students in the search for explanations and research on the issues, to reach the answers that satisfy the curiosities and to approach the scientific concepts currently accepted. At such times, some students demonstrated easily, others have demonstrated difficulties with the terms and concepts understandable fact, as they were in the process of knowledge construction. There was emphasis on meaning and not just the concept itself, valuing understanding.

The written activities and assessments noticed a difference between the quality of the responses provided by students. When the question was related to a content working in lecture, some students responded with a very similar concept to the one presented by the textbook or the teacher, some left the question blank and others had divergent response concept accepted for explanation. But when the matter involved a L worked through a play, practical activity, video, or simulation, the student had a further discussion with larger inferences, examples and explanations on the subject.

The students were more participative in practical classes, when compared to the classes that the professor orally exposed the content. In the lectures, for example, students little questioning or participated sometimes showed indiscipline with side conversations, lack of attention and interest, situations hardly observed during a practice activity. It is considered that practical activities, use of games, simulations, making posters, can promote the motivation and involvement of the student in class.

With the development of this work it was also possible to obtain meaningful data regarding the training of undergraduates involved in the development of activities. Thus, important contributions to the training of undergraduates involved with the execution and analysis of real teaching situations because they experienced in

practice as a class can be planned and conducted, and were able to compare differences in student learning resources function and activities.

Many teachers indicated that in the course of the classes they do not have time to learn about analysing materials, and their involvement in the proposed activities gave them new knowledge and reflections on different resources, materials and teaching activities.

The students were able to experience the most dynamic science classes and less expository, with different teaching tools used in order to enrich the process of teaching and learning.

Considerations

Although the research in the area of science education presents analyses, discussions and productions of different resources and didactic materials that can diversify, improve and prepare the lessons better, the results obtained in the investigations are not applied in real situations in the classroom, which could contribute to an improvement in the quality of teaching and learning and reduce the gap between research and teaching. It recognizes the importance of greater integration between university and school, with the possibility of carrying out enforcement activities and analysis of different resources, instruments and teaching activities.

The planning of activities, together with the teachers and from the target audience analysis is of fundamental importance to the success of pedagogical activity, as well as the establishment of partnerships between universities and schools as institutions that produce, test , analyze and evaluate the tools, resources and activities Which are used for teaching science, with the aim of promoting quality education.

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