Abstract

The work involved the analysis and presentation of a proposal for the adequacy of State Ecology Curriculum content Biology SP. Elaborated a supplementary teaching materials for biology courses, entitled "Learning Ecology with the Santos" with a more regionalized and playful approach to ecology. This was tested and evaluated for their educational and pedagogical efficiency, in the year 2012 in 104 students of the 1st year of high school from a public school in the city of Guarujá / SP, Brazil. The application involved a control group (TC): 38 students (who have not used the new proposal); and other two groups that participated with the use of the new material, in addition to the materials provided by SEE-SP: (T1) with 37 students and (T2) with 34. The analysis involved a qualitative and quantitative study through 4 evaluation tools. The results were statistically analyzed and treated with "t-test"; "ANOVA" and "Tukey pairwise comparisons," which indicated significant differences between the treatment groups compared to the control group; the qualitative analysis was given by observing the attitudinal aspects of students of three groups involved throughout the application process, which confirmed the effectiveness of these materials.

Keywords: Education; Ecology; Regionalization, Playful Aspects.

1.0 Introduction

In biology education there is great concern with the development of attitudes and values of human beings who face different issues related to the environment and other species occupying the planet. Education usually involves social and moral values and, in this sense, the teaching of biology can help in the formation of citizens aware of the world they belong to, and are able to develop practical actions to make judgments and decisions when so required (Gardner, 1999; Fonseca, 2007).

Changes in the formal education education has been the focus of studies by experts in different fields of knowledge (Mello, 2000; Cachapuz, 2004; Gadotti, 2000). The revaluation of the teaching of natural sciences can provide suitable conditions for the improvement of teaching and learning processes (Zuco et al., 1999).

In the National Curriculum Guidelines for Secondary Education (PCNEM) (Brazil, 2007), as well as in the National Curricular Parameters (NCP) Natural Sciences and their Technologies (Brazil, 2002) identifies the importance given to the approach of the contents of Natural sciences faced with the reality experienced by the students, emphasizing that such an approach should not result in the suggestion of the creation of new disciplines or even complicate the work of existing disciplines, but promote fitness for all that is already defined in these documents.

Then comes the need for a teacher looking for a new professional role in research and practice as points Schön (1992), which reaffirms the nature of reflective teacher. Inserting new knowledge more contextualized for students through the regionalization of content and themes, as well as the use of games and playful experiences may represent a vehicle for improving the absorption of scientific knowledge (Gobara & Piubelli, 2004). The languages used may be different and the suitability of teaching strategies provide subsidies for the development of skills and different skills (Perrenoud, 2000) and are related to each of the content identified by the curriculum.

According to Bruner (2001) when it comes to teaching, the structure and mode of representation of the content is a key part in the process learned ticeship. Gambarini and Bastos (2006) suggest a design based on experiences and preconceptions, and an education that is more contextualized. As well as Adams et al. (2004) points out that the lack of more contextualized teaching materials hinders the educational approach to ecological issues, and factors that can influence the formation of the citizen. Sought in this study, indicate the need to expand the significant content, in addition to the interests of the researcher, as Creswell argues (2010).

Thus, this research aimed to analyze the use of teaching materials adapted to support the ecology of education through a more regionalized and playful approach, and assess their applicability through the case study in a public school in the Baixada Santista, São Paulo Brazil.

2.0 Staff Development

The methodology used in the initial stage was a literature review, (CAREGNATO and Mutti, 2006). The contents were
grouped according to their cognitive connections and rearranged, to draw up a suggestion of new sequence of didactic application that favor student learning more contextualized. The following documents were analyzed: 1) Curriculum São Paulo Biology (São Paulo, 2008); 2) Student Biology Book (São Paulo, 2011); 3) Teacher of Biology Book (São Paulo, 2011); 4) National Curriculum Guidelines for Secondary Education (Brazil, 2000); which have been identified, the issues related to ecology and the distribution of content in each of the two-month periods, seeking possible connections between these contents.

Further, these data were used for the preparation of a pedagogical teaching materials to support teaching Ecology. In this material are addressed the themes selected in the initial research, encouraging reading and interpretation, by region and the production of recreational activities and educational games (Borges, 2000), as well as concept maps to facilitate attachment of the exploited content.

The didactic-pedagogic material produced was called "Learning Ecology with Santos," such priority material in your text, aspects of the Baixada Santista (RMBS) in order to contextualize the selected content. This material began to be drawn up six months before the start of your application. The first three chapters were drawn up before the start of the school year where they would be applied, and the others were being prepared simultaneously with the application of the first chapters.

For the preparation of the material followed by the following steps for each of the created chapters:

**Step 1:** After the definition of the content that would be worked out every two months, we defined the objectives that should be achieved;

**Step 2:** research references on each of the content in order to identify regionalized characteristics to present aspects related to the Baixada Santista.

**Step 3:** the chapters were written, seeking to encourage reading, understanding and interpretation of texts, in order to enable a more autonomous learning by the students, and suggest short texts for reflection, titled "An invitation to think" which allowed the inclusion of contextualized content with the living reality of students

**Step 4:** for each content were defined and created playful and interactive activities and educational games, "concept maps" and "hobbies like crossword" "game letters "to mobilize for learning more autonomous. They were also defined objectives and rules so that students clearly understand such activities.

The test of applicability and didactic efficiency of the proposed material (according to the suggested adjustments) was carried out during the school year 2012, with a sample universe consists of a total of 104 students of the 1st year of high school the "State School President Tancredo Neves", created by Law 5393/86 | Law No. 5,393, of October 30, 1986 São Paulo (public school located in the city of Guarujá / SP, belonging to the Board of Education Santos). We selected three groups and after a draw at random, were defined two groups would use the material and a control group where the proposed material would not be used.

The application involved the control group (TC), of a total of 38 students (who used only the available conventional materials SEE / SP: the Notebook Biology Student and Schoolbook) and two groups who participated in the implementation of the new material, called: (T1) with a total of 37 students and (T2) with a total of 34 students (who used besides the new developed support material, conventional materials provided by SEE / SP, as the student notebook and textbook) during the four quarters of the academic year 2012.

Before the participation of students, the research to be conducted and applied Terms of Informed Consent Form (ICF), to all students and in the case of underage students, these were signed by responsible was presented (as directed by Ethics Committee).

N sequence diagnostic assessments were applied to all groups involved (TC, T1 and T2), through closed questionnaires with relevant data to Ecology, in order to draw a profile of the students ' prior knowledge.

This review was prepared with closed questions through a categorization, which is to create categories emerged from the description of the records (Bardin, 1977). In this case, we opted for a thematic categorization for the answers made to ensure possibilities of quantitative and qualitative analysis of the students' level of knowledge. Table 1.

**Table 1:** Categorization of questions of diagnostic evaluation

<table>
<thead>
<tr>
<th>SCREENING OF CONCEPTS PRELIMINARY ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1)</strong> You could tell what we will study in Ecology, within the discipline of Biology?</td>
</tr>
<tr>
<td>a) Yes. We will study various issues on the human body. CE</td>
</tr>
<tr>
<td>b) Yes. We will study the environment that living beings inhabit. (CPC)</td>
</tr>
<tr>
<td>c) Yes. We will study the relationships of living beings among themselves and with the environment in which they live. Copy:</td>
</tr>
<tr>
<td>d) I have no idea what it is Ecology. (SC).</td>
</tr>
<tr>
<td><strong>2)</strong> In your opinion, what is the energy source that sustains life on earth:</td>
</tr>
<tr>
<td>a) water. CE</td>
</tr>
<tr>
<td>b) the food. (CPC)</td>
</tr>
<tr>
<td>c) I have no idea. (SC)</td>
</tr>
<tr>
<td>d) The source of energy that keeps life on Earth is the sun.</td>
</tr>
</tbody>
</table>
3. Do you know what are the biological processes of photosynthesis and respiration, and which beings live performing such processes?

| a) Yes. I know what those processes and all living beings realize the two processes. (CPC) |
| b) Yes. I know what these processes and know that photosynthesis only plants perform and breathing all living things on Earth. C |
| c) are processes for cleaning the air of Earth. No living performs such a process. CE |
| d) I never learned what those processes and not those who perform them. (SC) |

4. You could tell what are ecosystems.

| a) Yes. There are parts of the earth’s surface. (CPC) |
| b) Yes. Designates, set of biotic and abiotic factors, which simultaneously act on a region, defining characteristics. Copy: |
| c) Yes. They are names given to different seas of the Earth. CE |
| d) No. I never studied anything about ecosystems. (SC). |

5. Do you think the human species is the most important on the planet?

| a) Yes, because we are the only species that thinks and so dominate the other species. CE |
| b) No, because there are other species that are also important. (CPC) |
| c) I do not know the meaning of the word species. (SC) |
| d) No. For me all living species are important in sustaining life on Earth. C |

SCREENING:

- CC = CORRECT CONCEPT
- CPC = PARTLY CORRECT CONCEPT.
- EC = WRONG CONCEPT
- SC = NO CONCEPT ON THE THEME.

The methodology for establishing the diagnostic evaluation of the results was the “simultaneous triangulation”, analyzing both qualitative and quantitative data collected. The data relating to the applicability and material efficiency were collected through the application of four evaluation instruments with closed and open questions, each applied them every two months and containing the information needed to identify the level of student learning for each group of contents worked during each semesters.

It then carried out a qualitative analysis of the skills and abilities defined for each set of content. These data were then quantified by allocating 0 notes 10 to students for all tests applied, taking into account the number of correct answers for each question posed. The results of these evaluations were measured and tabulated, the collected quantitative and qualitative data were compared and processed by statistical studies, analyzing the frequency of occurrence, as well as applying the tests “NEW” and “Tuckey pairwise comparisons” to check the degree of differences between the control groups and treatments.

This study was submitted to the analysis of Ethics in research with human beings, which was favorable to their development (Opinion Embodied under No. 1472 of 24/04/2012).

3.0 Results

3.1 Analysis, Adequacy and Produce Didactic-pedagogical

Through the literature review, we performed a comparison of how the contents were willing bimonthly in the Official Curriculum and how they could be arranged in a new suggestion, with a view of how to present them in a more integrated, with more connection between them, without intent to complicate, or add new content, but yes, facilitating the presentation of such content by teachers.

The goal of this small capital adequacy in the presentation of the content was to provide students with a better understanding and assimilation of content, so that they could relate them more directly with their own realities.

It was identified for example, that the content of the 1st and 2nd Quarter of the Official Curriculum there is a separation of issues related to the same concepts. For example, the biogeochemical cycles are presented in the 1st quarter while the environmental problems related to these cycles are developed in the 2nd quarter, which requires a resumption of the subject presented earlier. These concepts could be gathered into a single presentation in the 2nd quarter on the topic “Human intervention and the environmental imbalances”, as suggested in the proposal for suitability of content (Table 2); this would bring the contents on biogeochemical cycles with the environmental problems linked to them, including highlighting the anthropic interference in such processes, its causes and consequences.

In the analysis of content offered by PCNEM (National Curriculum Parameters for Middle School) it is possible to identify that the same, has bases referred also to the analysis performed by the evaluation instruments and the PISA and the ENEM. It is worth noting also that the transversal issues can and should be dealt with in a cross-disciplinary and interdisciplinary, not just the responsibility of the discipline of biology.

The proposed new capital adequacy suggested in this research was based on experience and perception of the author, so this is a case study of specific, they may not submit the same results when applied in different scale of the displayed. Other studies may be developed to identify the impacts of such suggestions in a range of coverage. For each set of content selected, set the type of teaching strategy that would be adopted in the preparation of the material.
produced, this practice has led to the adaptation and creation of games and playful experiences and interactive, specific to each of the contents.

Among the playful activities and interactive compiled for each chapter in order to facilitate the processes of teaching and learning, we used the educational games, conceptual maps and pastimes didactic, so as to provide students with activities of fixation of the contents. (Figure 1 and Figure 2.)

All games used in classrooms were applied over a period of 2 hours classes, long enough so that the students could become aware of the rules, handling including cutting and pasting when needed and play effectively.

**BOARD GAME "ENVIRONMENTAL CONSERVATION**

**OBJECTIVE**
The player with the best luck and better knowledge of Environmental Conservation strategies should first reach the final stage of the game, showing that he knows very well how to play his role in Conservation, Preservation and reduction of impacts to the Environment.

**GAME RULES**

Number of Players: 4

Components of the game:

1. TRAVEL COORDINATOR OF START TO END
   - TWENTY (20) LETTERS FROM SURPRISE QUESTIONS (?), NUMBERED FROM 1 TO 20, ON ENVIRONMENTAL CONSERVATION ISSUES
   - ONE (1) DICE
   - FOUR (4) COLORED PINS

**PREPARATION**

1. Shuffle the SURPRISE cards, which should remain on the board during the game, with their numerical faces facing upwards.
2. Each game will then choose a pin to play and everyone should put their pins in the marked beginning on the board.

**STARTING THE GAME**

Each player must then play the dice, and whoever scores the highest score in the dice, must start the game. In sequence they will play between the participants from the left of the 1st and so on.

The 1st player must play the dice, and walk with his pin on the respective houses on the board, if the house that falls is the symbol (?), He should remove one of the numbered cards, read the information contained in the card and Following guidelines.

The other players must do the same in their turn to play.

The winner is the one who first reaches the END of the GAME, marked on the board.

---

**Figure 1:** Example of Board Game on Environmental Conservation

---


3.2 Results Material and Application Test / Appraisal of Applicability and Efficiency

As for the results of diagnostic evaluation, they were analyzed qualitatively and quantitatively to trace an initial cognitive profile of three groups involved in the research, TC, T1 and T2. The analysis of the skills and abilities defined for the content covered was tested by applying ratings with closed and open questions.

For all evaluation instruments used, 0 to 10 notes have been allocated, with the range from 10 to 5 Notes correspond to concepts obtained by students who were on the average to above average in relation to the acquired knowledge, and the notes below 4 corresponded to concepts attributed to students considered below average knowledge on the issues.

The average of all grades of control and treatment groups 1 and 2 are shown below (Table 2).

### Table 2: Mean Classes Control and Treatment 1 and 2, for Evaluation

<table>
<thead>
<tr>
<th></th>
<th>AVERAGE OF ASSESSMENT FOR CLASSES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DIAGNOSTIC</td>
</tr>
<tr>
<td>Control Panel</td>
<td>6.4</td>
</tr>
<tr>
<td>Treatment group 1</td>
<td>6.2</td>
</tr>
<tr>
<td>Treatment group 2</td>
<td>6.6</td>
</tr>
</tbody>
</table>

To confirm the results presented statistical tests were performed "t test student" and "ANOVA" for all tests applied:

**In Evaluation Diagnostic:**

- T test - Class Control (TC) / Class 1 treatment (T1) (p = 0.3939572)
- T test - Class Control (TC) / class 2 treatment (T2) (p = 0.3855499)
- T test - Turma1 treatment (T1) / class 2 treatment (T2) (p = 0.2890358)

At t test, the differences between the TC / T1 classes; TC / T2 and T1 / T2 were not significant (p> 0.05).

The test "ANOVA" performed also showed no significant differences p = 0.86.

**In the evaluation of the 1st Quarter:**

- T test - Class Control (TC) / class 2 treatment (T2) (p = 0.036)
- T test - Turma1 treatment (T1) / class 2 treatment (T2) (p = 0.886)

The differences presented in the "t test" between TC / T1 and TC / T2 were significant (p<0.05), since the differences between T1 / T2 were not significant (p> 0.05), which proves that classes that used the new materials produced had a better performance in relation to class control, which did not use the produced material for this particular block content.

Unlike the notes in the test "ANOVA" for this quarter was significant (p = 0.035), though the "paired comparison Tukey" found no difference between the pairs, which means that the difference between the grades of the classes is not very strong.

**In the evaluation of the 2nd Quarter:**

- T test - Class Control (TC) / Class 1 treatment (T1) (p = 0.024)
- The results of the ANOVA showed a significant difference (p = 0.009) and "Tukey paired comparison" indicates that T1
is the one with different grades. It observed that the average of all groups fell into this second evaluation.

To check the reliability of the results obtained were applied test "t student", which showed the following results:

- t test - Class Control (TC) / Class 1 treatment (T1) (p = 0.005)
- t test - Class Control (TC) / class 2 treatment (T2) (p = 0.111)
- t test - Turma 1 treatment (T1) / class 2 treatment (T2) (p = 0.121)

In the "t test" the differences between the TC / T1 groups were significant and TC / T2 and T1 / T2 were not significant (p > 0.05).

**In the evaluation of the 3rd Quarter:**

The test results "ANOVA" did not show a significant difference (p = 0.08) and Tukey's pairwise comparison indicates that the T1 class is one with different notes. It observed that the average of all groups fell in this assessment, the possible causes of these variations will be presented in the discussion.

To check the reliability of the results obtained were applied test "t student", which showed the following results:

- t test - Class Control (TC) / Class 1 treatment (T1) (p = 2.11E-08)
- t test - Class Control (TC) / class 2 treatment (T2) (p = 0.003035)
- t test - Turma 1 treatment (T1) / class 2 treatment (T2) (p = 0.000155)

At t test, the differences between the TC / T1 classes; TC / T2 and T1 / T2 were significant (p <0.05).

**In assessing the 4th Quarter:**

The test results "ANOVA" showed no significant difference (p = 0.21), the group T1 is still that with different grades.

To check the reliability of the results obtained were applied test "t student", which showed the following results:

- t test - Class Control (TC) / Class 1 treatment (T1) (p = 0.042)
- t test - Class Control (TC) / class 2 treatment (T2) (p = 0.426)
- t test - Turma 1 treatment (T1) / class 2 treatment (T2) (p = 0.08)

In the "t" test the differences between the TC / T1 groups were significant and TC / T2 and T1 / T2 were not significant (p > 0.05).

**4.0 Discussion**

Transforming the pedagogical practice of teaching is one of the great challenges of educators today with this all and any action that reference is made to this issue is of paramount importance to the processes of teaching and learning.

As the application of concepts of regionalization as points Lisbon (2007), care must be taken to ensure that the concept of region is not based on logical positivism, but in a regionalization where the concepts discussed to allow students to extend their learning about different perspectives, leading them to critical reflection on society to which they belong (Stuchi, 2011; Evangelhista, 2007) having as its point of departure the prior knowledge of students.

In relation to insertion of playful practices and educational games for securing the contents, such choice was based on the expansion of the cognitive development of students in order to provide a playful function of pleasure and fun and at the same time presenting the educational function of teaching anything that is necessary for the individual (Perticarrari, 2010), (zanon et al., 2008); (Kishimoto, 2002), (Miyazawa & Ursi, 2010), (Kishimoto, 1994).

In relation to the conceptual maps, enable the representation of the organization of content, which allow the analysis of the relationships that students establish between these concepts. This strategy interactive teaching is based on learning theory or theory of assimilation, of David Ausubel (1968), this strategy was developed by Novak and River Severn (1984) and has proposed a way to exploit the theory of meaningful learning of Ausubel.

Through the results obtained, it was possible to identify that the way to learn from each one of the groups was specific: in the case of TC, its performance was lower in 3 of the 4 two-valued, now at T1 showed a yield higher evaluation in all two-valued, while the T2, was below the income of T1 and higher than the TC, in 3 of the 4 two-valued, even if these differences were not significant in some statistical tests conducted, it was observed that there were differences in the qualitative analysis.

The results showed that the T1 took best the material throughout the school year, demonstrating an appropriation more positive knowledge acquired through the use of materials prepared so regionalized, more playful and interactive; indicating that this type of support material provides new ways of teaching and learning content related to ecology.

In the case of T2, some factors may be considered to explain the interference presented in its overall assessment, it was a class formed in part with students repeat, with problems of circumvention, little motivated the processes of teaching and learning, but that still managed to evolve positively with a small rise in relation to the control group, a fact that must be taken into consideration.

Even though in a few moments the results presented were identified as not significant in statistical tests, in the practice of teaching and learning processes should be considered, because it is important to highlight the involvement protagonist of students in learning, when the contents are more contextualized and more interactive and fun, students become part of learning outcomes.
Other studies should be undertaken to identify the degree of interference issues related with the learning beyond the reported in this study, so as to enable a wide quantification of the real impact of these interferences, as well as the type of presentation or materials used for teaching and learning.

Develop education for citizenship is mainly the formation of values of sustainability which will form individuals who transform into action the real meaning of man’s relationship with the environment in which they live and this same man with all components biotic and abiotic stresses that the surround in its environment.

In practice, the educational material to support produced throughout this research work, serves as an indicator a path to be taken, to make the teaching of Ecology something more enjoyable and meaningful to students.

5.0 Conclusions

The proposed presentation Ecology content, referring to 1st year of high school, developed from State Curriculum Biology, when developed in a more integrated way, even if only with some adjustments in the order of presentation of this content without major changes, can facilitate the teaching and learning processes.

The curriculum is not static and must be used in order to provide the autonomy of the teacher with the teaching processes. The educational courseware presented more contextualized, regionalized and more playful, with a positive impact on overall student learning about ecology, it is suggested that such a perspective is used and expanded as the interdisciplinary and transdisciplinary sphere to other content and curriculum subjects formal through the interdisciplinary and transdisciplinary sphere to other content and curriculum subjects contextualized, regionalized and more playful, with a positive impact on overall student learning about ecology.

References

10. GAMBARINI, C; BASTOS, F. The use of text written by teachers and students in science lessons.
20. PERRENOUD, P. 10 new skills to teach. Porto Alegre (Brazil). Hucitec Publisher. 2000.
23. SÃO PAULO, Brazil. The Student of Biology, Education, 1st series, volume 1, 2, 3 and 4. 2011. 1990. Mary Agnes Fini. - São Paulo-SP. The State Department of Education of SP.
