

Discover the introductory organic chemistry with PARSEL module “Chemistry and oral hygiene”

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Considerations and goals

The adapted Parsel module was named “Chemistry and oral hygiene” from the original “Brushing up on chemistry”. In this module, applied to ninth-grade classes, students were faced with the fact that chemistry is present in daily hygiene products and that the analysis of product packages will promote a critical attitude and influence their choices as consumers.

In the original Parsel module students were expected to:

1. Relate chemistry with everyday life and increase students’ interest in chemistry.
2. Discover numerous substances that are ingredients of toothpastes and their role.
3. Prepare basic toothpaste in the laboratory and compare it with commercial products.
4. Analyse various kinds of toothpastes.
5. Discuss the importance of dental care.

In the ninth-grade, students must study chemical bonds and introduce organic chemistry. By the end of the year they should be able to:

- Recognize the constitution and the importance of hydrocarbons;
- Distinguish various kinds of hydrocarbons;
- Identify some compounds with functional groups;
- Recognize through structural formulas, more complex carbon compounds such as synthetic polymers.

In the ninth-grade, Portuguese students don’t usually show much enthusiasm in the study of concepts such as organic chemistry or chemical bonding. The Parsel module was an opportunity to make a different approach, so that these concepts would appear in a context of everyday life, showing that chemistry is a powerful tool to increase the knowledge about the natural world we live in.

In this paper we discuss the application of the module to ninth-grade students, and make a critical analysis towards the achievement of the overall objectives.

IBSE and “Chemistry and oral hygiene”: the implementation experience

The suggested teaching-learning approach included four stages:

1. Introducing a more relevant context to the students.
2. Inquiry-based Problem solving.
3. Socio-Scientific decision making;
4. Introducing relevant chemical concepts.

In the first stage, a question was put to the students: “Is chemistry present in everyday products?” and more specifically, “What

are the chemical compounds present in the toothpaste?”. After a general discussion, a task was given to all students (previously organized in groups) to select and bring to class a commercial brand of toothpaste. The teacher suggested that students should also study a commercial brand of toothpaste produced in Portugal since 1932. This stage took about 20 minutes.

The analysis of product packages and consecutive systematization of the ingredients into particular groups was the next phase.

The students were given a support document in digital format, translated from the original Parsel module, and some Internet websites were suggested, so that they could find answers to solve their initial problem.

In the ninth-grade, students are about to make a choice regarding their professional future. It is very important to show them (even for those who are about to stop studying chemistry) that this science is essential to the understanding of the world we live in. In this context, the study and preparation of the toothpaste was motivating.

Nevertheless, the chemical compounds that exist in the toothpaste are very complex for 14-year-old students. They did not have previous knowledge of organic chemistry and so, they were discouraged by the names of the chemical compounds.

After the investigation took place in the classroom, they prepared toothpaste in the laboratory and compared it to the chosen commercial brand. For this last task it was necessary to make coloured eggs. Because this procedure would imply the use of another lesson time, the teacher provided the coloured eggs.

The second stage took one lesson of forty-five minutes and for the laboratory work it was necessary one lesson of ninety minutes.

After the preparation of the toothpaste, students answered a series of questions regarding the interpretation of the laboratory work and finally, at home, prepared an oral presentation, to show their classmates the results of their investigation and the conclusions they had reached. The final presentation took one lesson of ninety minutes.

Finally, it was necessary to introduce some relevant chemical concepts such as chemical bonding and through SLS (Sodium Lauryl Sulphate) formula, more complex carbon compounds were presented.

Students’ reactions, reflection and evaluation

When the project was presented to the students, they showed enthusiasm, especially concerning the laboratory work. The analysis of the labels was not a very motivating experience. Students found very complex chemical names that they didn’t understand. A question often emerged: “Why do we need to know what these names mean?”.

It was not difficult for them to group the majority of the ingredients and identify their role/function. Nevertheless, some ingredients with complicated names, such as *PEG-6* or *cocamidopropyl betaine* were simply ignored by the students. The laboratory work was exciting, and most of them participated with enthusiasm. It was an opportunity to remember and apply the concepts of acidity and alkalinity of solutions.

Most of the students were able to answer the questions about the laboratory work.

This module was also interesting in terms of the interdisciplinary work that can be developed with other members of the school community. The students developed a project in Art Education that consisted in drawing the package of the toothpaste and

one of the parents that is a dentist, offered himself to go to school and talk about oral hygiene.

Students were evaluated taking into account the pre-experimental work, the practical work and the final presentation. The majority of the groups showed difficulties in terms of autonomy, especially in the laboratory. They did not read the instructions carefully and because of that they didn't execute all the required laboratory procedures. During final presentation students also showed some difficulties in the interpretation of the laboratory work.

The initial goals were partially achieved. After analysing the various commercial brands of toothpaste the students were not able to choose the best one for their needs.

Conclusion and outlook

Globally it is indisputable that the application of this module contributed to the development of scientific literacy. Despite the difficulties, the analysis of a product of daily use led the pupils to inquiry, promoting the development of a critical reasoning and creative thought. Students' questions stimulated their curiosity, thus encouraging their learning. This experiment arouses curiosity for further projects. What if we select other products we see around us, for instance, natural gas, from that example we can study organic chemistry, chemical bonds, distillation, and so on. Let's take the students to chemistry and not the chemistry to the students.

Literature

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