



## Application of a didactic sequence: the collaborative scientific doing for the teaching of chemistry in basic education

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### ABSTRACT

This article is the result of research that focused on the study of scientific work with collaborative proposals and as a field of study, "Chemistry and Kitchen". In this way, we sought to dynamize the teaching-learning process of Chemistry, establishing the School as an ideal space for stimulating scientific research and building a fair, democratic, and inclusive society, based on everyday practical activities. The research was divided into the following steps: bibliographic review for the formation of a database on the subject under study, followed by the application of a didactic sequence with collaborative proposals for second and third-year high school students of the Technical course in Agroecology of a school of the state education network, in a small town in the interior of Bahia, in the year 2021. After the application of the didactic sequence, in possession of the data, the analysis was carried out, finally presenting the results of the research. It is worth mentioning that, during an asynchronous period, scientific research relied on the help of some digital tools, such as online laboratories and their potential, for the beginning of practical activities in the discipline of Chemistry in High School.

**Key words:** Chemistry, Kitchen, Collaborative Proposals, Inclusion.

### 1 INTRODUCTION

Chemistry is present in all compounds. Thus, there is no product without "chemistry". And, the kitchen is a complete laboratory. Chemical knowledge is there empirically.

In the 18th century, the French Menon inserted the term "culinary art", demonstrating that a relationship is needed between practical experience in cooking and scientific theory to obtain the best dishes. With chemical knowledge, we can gain numerous experiences in our kitchen, and basic concepts of chemistry can help us in the preparation of food and understand its composition to obtain better results.

According to Cury (2012, p. 41),

The information becomes knowledge through actions that encourage students to think about, connect and contextualize them, finding points of approximation and distancing to articulate the diversity of the data. Knowledge is, in this sense, information treated, signified by thought operations. This process should become a systematic and permanent practice because it will sustain the approach to complex problems.



At the time that no one learns alone, the kitchen presents itself as a link between scientific doing and collaborative teaching: the student is the protagonist of the learning process. Thus, Collaborative Teaching appears as an important instrument, as an inclusion strategy, because it enables the sharing of knowledge among professionals and contributes to the learning processes of individuals, the target audience of Special Education.

Therefore, we sought to investigate how collaborative proposals can make chemistry teaching more attractive and meaningful and what is the importance of chemical knowledge in the preparation of a recipe. With the application of a didactic sequence, producing a double exchange relationship between "Scientific Doing" and the "Collaborative Proposals" in the discipline of Chemistry in High School, Chemistry and Cooking are an ideal atmosphere to evaluate the previous knowledge of research participants, using chemical knowledge as a form of social integration and, creating arguments based on data and information gathered, for the formulation, adjustment, and defense of common ideas, points of view and decisions that respect and promote human rights, citizenship, and quality education.

It is noteworthy that the entire methodological approach was based on qualitative research, always trying to investigate behavior changes over time, seeking proof of information through observations and experiments. It should be said that, during the asynchronous period, online simulators were used.

The human being has the right to live and live with other human beings, without discrimination, and without hateful segregation. And the more "different" the human being, the more needs he has, and the more this right is imposed. And this is a natural right, which would not even need to be positive in law. It didn't have to be in the Constitution. At the same time, a collaborative proposal aims at the collaboration of all students, encouraging them to be curious and independent, being able to appreciate the reality lived with other looks, with the eyes of those who accept or refute ready definitions. The search for reflection on the relationship - Teaching chemistry x insignificance x exclusion - as well as other factors, point to the intense need to investigate ways for chemistry teaching not to be restricted to just decorating formulas and concepts for competitions and vestibular.

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## **2 LITERATURE REVIEW**

As the literature points out, chemistry classes are considered the least important by the majority of students, since they claim a certain distance between theory and everyday life. The teaching of Chemistry follows in a traditional and decontextualized way with daily life, generating in students disinterest in the subject even the chemistry is present in our daily life. Learning chemistry should enable students to give students a critical view of the chemical transformations that occur in the physical world, as well as to judge the information acquired in the media, school, and society. From there, the student will make his decision and thus interact with the world as a citizen (SILVA, 2013).



On the other hand, taking into account the thought of Chassot (1995), there is a boundary between the abstraction of chemistry and the reality of the student. In 2004, the same author stated that the contents of Chemistry in high school are inserted in a curriculum that does not lead to the release of students because they were or are written by those who hold power and have no intention of losing it. We need to break this barrier, starting with scientific literacy so that chemical knowledge is the domain of all and not just of a closed group (CHASSOT, 2004).

To reduce this stigma, it is necessary to innovate the pedagogical process so that there is a greater appreciation of the discipline, simultaneously promoting inclusion, since, in the present day there is still the view that, "chemistry is only for the intelligent". In this perspective, the collaborative proposal favors the sharing of decision-making and responsibilities. When we transport this concept to the educational universe, full of characters and languages so different, we attach even more value to the exchange of experiences between teachers and students.

According to Irala (2004), collaborative learning is part of the idea that knowledge is the product of a consensus of a knowledge community, something that people build by talking, working together directly or indirectly, and reaching an agreement. Collaborative proposals are teaching tactics that encourage student participation in the learning process and make learning an active and effective process. It is a set of educational approaches that helps teachers make their pedagogical practice inclusive.

And, the struggle to build a truly inclusive school is great, but putting a child or young person with a special need, within a common classroom, does not mean the effectiveness of the practice of Inclusive Education.

Mantoan (2004) states:

Conceptual problems, disrespect for constitutional precepts, biased interpretations of our educational legislation, and prejudices distort the meaning of school inclusion, reducing it only to the insertion of students with disabilities in regular education and disregarding the benefits that this educational innovation provides to the education of students in general, by provoking basic changes in the pedagogical organization of schools and in the way of conceiving the role of the school institution in the formation of new generations.

(MANTOAN, 2004, p. 2).

According to the Salamanca Declaration and the Brazilian Constitution of 1988, inclusive education in the Regular School is a process that requires respect, dedication, and understanding of others, both educational institutions, and the people who receive



these students, accepting the differences of each one. In the era in which we live, there are no longer educational processes instituted in a manicomial way as they suggest from the 1960s and 1970s (SALAMANCA, 1994; BRAZIL, 1988).

Based on mantoan's ideas (2010), all teaching units should be a space of inclusion for all, so that students build their knowledge according to their peculiarities and times, participating in the teaching and learning process and developing as active subjects in the act of learning. These ideas dialogue with the proposal of the National Common Curriculum Base (BNCC) since it proposes that, as mediators of knowledge, we need to think about how the subject relates to the territory and sees ourselves facing it. It is of fundamental importance that the classroom dialogue with the daily life of the student, and perform educational practices that value the cultural diversities of the municipality, without forgetting the different subjects that constitute it. It is necessary to seek teaching techniques that enable the integral development of the subject, exercising more and more creative actions that value communities, whether rural, quilombolas, indigenous, landless, or Roma among others (BRASIL, 1996).

As the contents of Chemistry are broad and as a false discourse has been created in high school that science teaching serves only for competition and vestibular, the Chemistry present in the kitchen besides demystifying this idea is a way to work the formation of the subject integrally. With the development of new teaching strategies, it is possible to break with practices that prevent access for all to quality education (SANCHES; TEODORO, 2006).

According to a series developed at Unesp, entitled Chemical Series in the kitchen, Emiliano CHEMELLO is based on the application of Principles and Laws of Chemistry to address common topics in our kitchen as "salt" (sodium chloride), and onion, among others. In 2018, the Journal of Science and Mathematics Teaching brings a report addressing the positive effects that the workshop on chemistry in the kitchen brought to the production of scientific knowledge.

According to Piaget (1978), knowledge is in mental procedures and cognitive abilities, where successive discoveries lead to the formation of new constructions. The student gradually forms his intellect, interacting with the environment in which he lives, his world.

Fig1: Conclusion of the SD - Presentation of the students at the Solidarity Economy Fair of the



Municipality

Fig1: Conclusion of the SD - Presentation of the students at the Solidarity Economy Fair of the Municipality. (MEDEIROS, M.S.R, 2022).

Figure 1 shows this relationship of integration with the internal and external world of the individual. For Piaget (1978), doing and understanding do not happen simultaneously.

To understand in action a certain situation, to a degree sufficient to achieve the proposed objectives, and to understand is to achieve in thought to dominate situations, until it can solve the problems raised by it, with why and how of the connections found and, on the other hand, used in the action. (PIAGET, 1978, p.176).

With the arrival of the Renaissance, when culture and values turned to man, there was a change in this phase of ignorance and transformation of routines, beginning to speak of the rights and duties of the disabled. In this sense, it is also the purpose of high school, according to the National Common Curriculum Base (BNCC) (Brazilian Ministry of Education, 2018), the "improvement of the student as a human person [...] to build a fairer, more ethical, democratic, inclusive, sustainable and supportive society" (p. 466). It advocates the need, in high school, to build personal and collective projects based on cooperation, which in a way strengthens the concept of collaborative activities.

For Moran (2000), one learns when he relates, establishes bonds between what was loose, chaotic, dispersed, interacting with it in a new context, giving it meaning, finding a new meaning, learning when one is on the antenna when one asks, questions, learns by interest, need.



According to Oliveira et al (2012), we understand things better when we experience the practice and this makes us understand that the best way to teach the student to learn is when he starts to have direct contact with the object of study. The school plays the role of bringing the student knowledge and understanding of the problems that are around us.

When researching a product and /or processes present in the routine of our kitchen, it is expected the construction of knowledge is a significant way, since the teacher should play the role of advisor in the formation of a citizen who can seek and build collaborative paths, so that there is a production of knowledge in a critical and participatory way, since, in doing pedagogical and great value, it involves the reality of the day-to-day of each one.

### **3 RESEARCH METHODOLOGY**

The methodological assumptions were based on qualitative research (GIL, According to Gil, the research is a "rational and systematic procedure that aims to provide answers to the problems that are proposed".

The work presented here focused on a descriptive developmental approach, in which we sought to investigate behavior changes over a time interval, seeking information about the study variables. Therefore, the didactic sequence (DS) was initiated as the application of an individual preliminary questionnaire, in which the relationship between the laboratory and the kitchen, the scientists and the cooks, and the varieties of chemical solutions found in the kitchen were discussed. The focus was to investigate the students' previous knowledge of the theme. Soon after, through debates on the collected data, the chosen content was introduced (Mixtures and Solutions), where conceptual differences were worked through virtual simulators such as Labvirt.

However, as we advocate the use of collaborative proposals, part of the studies was carried out in groups of five students, considering different and complementary skills of each member for a true implementation of the youth protagonism. Aiming at a greater opportunity for participation and commitment in the learning process, we include discussions, exchanges of experiences, and points of view.

Thus, we request the construction of a string depicting the theme "Chemical Solutions" and associating the same with our daily life in the kitchen.

It is noteworthy that all the work ensured the development of skills and skills defined by bncc. Finally, we seek proof of information through observations and experimentation through the production of a jelly.



#### 4 RESULTS AND DISCUSSION

We live in a society imbued with science and technology. The mastery of certain scientific and technological knowledge can be of great value to understanding and being able to evaluate important issues for society. The teaching of Chemistry can contribute to this process by correlating the contents with technological applications, and their social, environmental, political, and economic implications, to spread a scientific culture that allows people to judge, with foundations, the knowledge disseminated by various sources of information and assume their decisions, as an individual and member of a social group. Thus, an approach to content through themes that enable the social contextualization of scientific and technological knowledge can broaden students' interest in science, favoring scientific literacy at higher levels than just knowledge of facts and processes (SHWARTZ et al., 2005, SILVA; MARCONDES, 2010).

In this context, active methodologies present themselves as a new way of thinking about traditional teaching. This is because one of the principles of bncc is the promotion of the student as the protagonist of their teaching-learning process. Thus, active methodologies emerge as an alternative to provide students with the means for them to be able to guide their educational development, fleeing the teaching model in which the teacher had all the knowledge within the classroom.

Still, within this model, collaborative proposals present themselves as a pedagogical action that seeks to meet new demands presented, both by students and their teachers, in the paradigm of inclusion. Here, the teacher should look for methodologies that prevail principle of equity, because regardless of the area, Education is a right of all.

Fig2: Final product of the Didactic Sequence - Fresh jam with typical fruits of the region.



Fig2: Final product of SD - Fresh jam with fruits typical of the region. (MEDEIROS. M.S.R., 2002)





And, thinking about the integrator axis, "Chemistry in the Kitchen", the use of workshops to work on the proposed concepts and contents, as shown in Fig .2 is an excellent request. In a workshop, with the Production of Jam in nature, we can work the content "Substance, Mixtures and Solutions" through the pectin test.

Fig 3: Pectin 3d structure

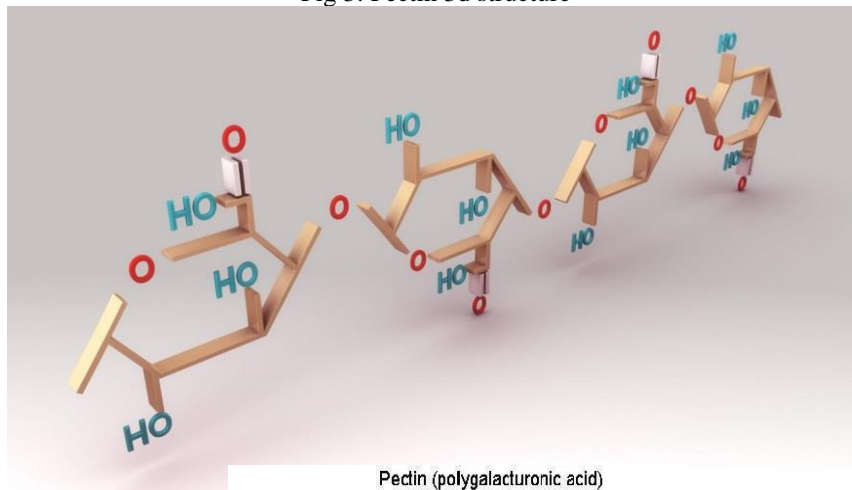


Fig. 3 -Pectin structure 3d. n-structure/1082657. On 10/09/2022Image extracted from [https://www.turbosquid.com/pt\\_br/3d-models/3d-model-pecti](https://www.turbosquid.com/pt_br/3d-models/3d-model-pecti)

As we can see in the above structure, pectin is a polysaccharide, that is, they are carbohydrates that, by hydrolysis, originate a large number of monosaccharides. They're natural polymers. Thus, sugar also helps to form the jelly, contributing to gelatinization because it promotes the dehydration of pectin molecules (highly hydrophilic). It also acts as a preservative, preventing the product from being easily debased. Also, it improves the flavor of the jam and increases its brightness and degree of softness. Other culinary practices can assign values when doing scientific, taking away the abstraction of the Sciences and resignifying them.

According to Chalmers (1993),

Scientific knowledge is proven knowledge. Scientific theories are derived rigorously from obtaining experience data acquired by observation and experiment. Science is based on what we can see, hear, touch, etc. Personal opinions or preferences and speculative assumptions have no place in science. Science is objective. Scientific knowledge is reliable knowledge because it is objectively proven knowledge (CHALMERS, 1993, p. 17).

Regarding the "collaborative proposal", Mendes, Vilaronga, and Zerbato (2014), state that:



However, the proposal of collaborative teaching is not that of work centered on students with disabilities, it is assumed that both teachers work with all students in the classroom, suiting the activities so that all students have access and can participate in the activity planned to reach the curriculum (MENDES, VILARONGA AND ZERBATO, 2014, p.76).

Thus, a teaching proposal is sought focused on equality and equity, because the Education is everyone's right. And, "Chemistry and Cooking" is an integrating axis that, through collaborative proposals, enables the discussion of science putting everyone on the same level.

*In our everyday kitchen  
Chemical solutions are present  
They are homogeneous mixtures  
formed by solutes and solvents.  
(GROUP 2, 2021.)*

## 5 CONCLUSIONS AND IMPLICATIONS

The scores made in this study indicate the need for innovative pedagogical practices, in addition to encouraging scientific research already in some stages of Basic Education, to develop in students the ability to analyze problems and think about the data, instead of simply decorating formulas. For the teaching of the area in question, to promote the development of the capacity for analysis and synthesis, it is essential to seek support in overcoming outdated pedagogical practices subsidized by protocol logic, in which concepts are taught according to formalism.



Fig. 4: Group 2 - Solidarity Fair Exhibition



Fig. 4: Group 2 - Municipal Solidarity Fair Exhibition. (MEDEIROS. M. S.R,2022 )

*Chemistry and cooking  
It is a relevant theme  
Addressing science,  
An inherent object*

*In the kitchen is the first laboratory  
With reagents such as acids, oils, and biological yeast  
Many experiments are possible to make  
Physical reactions and chemical concepts are likely to realize  
(GROUP 1, 2021)*

Thus, taking into account Vygotsky's sociointeractionism, the theme "Chemistry and Cooking" as a collaborative proposal favors social interaction, which enables school inclusion and, consequently, we will have a more effective production of knowledge since collaborative teaching values diversity and the right to schooling for all. It foresees the individualization of teaching, with collaborative teaching, is a strategy that enables the learning of students with specific educational needs in inclusion processes, through care proposals that consider caring not to generate discrimination and segregation, and enable reflection on more effective pedagogical practices for all students.

*When we talk about Solutions  
We highlight some relevant aspects  
Some have a false appearance  
With a scattered part  
And a dispersant  
(GROUP 3, 2021).*

The Best Articles:

*Application of a didactic sequence: the collaborative scientific doing for the teaching of chemistry in basic education*



This is our challenge as mediators of knowledge: to seek valorization and recognition of scientific knowledge, which is not a simple task, taking into account the complexity of human relations and transformation processes.



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As Rubem Alves said, schools that are wings do not love caged birds. What they love is birds in flight. They exist to give birds the courage to fly. Teaching the flight, that they can't do, because the flight is already born inside the birds. Flight cannot be taught. It can only be encouraged. At that point, I am proud of my beloved UESB. Gratitude to the teachers with whom I lived from my graduation to the time of graduate school. Especially, I turn my attention to Professor Dr. Joelia Martins Barros, who has always been guiding me, and encouraging me to walk the path of science! I couldn't forget my school, CEMJA. That, since I got out of the UESB, has been my knowledge barn. Thank you to my colleagues and especially management and my great colleague and friend, Professor Ma. Josleide Cristina D'Oliveira Mattos, who was always my supporters at all times. Thank you very much for the support received during this important stage of my life! I could not forget also IFNMG: Thank you to all the advisors I have had so far, especially my Tutor Crislayne de Souza. May the Lord bless you!



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