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POETIZING CHEMISTRY: APPROACH TO THE CONTENT OF ATOMIC MODELS THROUGH A POEM

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ABSTRACT

This article aims to present the importance of using poems as a didactic resource for the Chemistry class. To this end, a poem entitled "Bricks of Humanity" was elaborated as a pedagogical resource for the introductory teaching of the content of Atomistics, in the execution of the proposed methodology, the Complementary Pedagogical Activity (APC) was used, given that the classes took place in a remote format for a 1st year class, composed of 30 students, despite having been carried out at a distance, it was noted that the use of poems in chemistry has a lot of potential, in which it facilitates the understanding of the contents worked in the classroom, assisting in interpretation and reading and increasing the critical sense of students. Such reflections were stimulated through the questionnaires presented to the students throughout the APC, which aimed to verify the students' previous knowledge and analyze whether the content was really understood. The results suggest that there was an evolution, in which the use of the poem helped them in this process. Finally, it is concluded that the use of the poem as a didactic resource enhances the processes of acquiring knowledge about the content of Atomistics and increases the student's reading and interpretation power.

Keywords: Chemistry Teaching. Poems. Atomistic.

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INTRODUCTION

Chemistry is a natural science and is present in the students' reality, but the transmission and memorization of concepts that is widely used for the teaching of chemistry ends up excluding the relationship between chemistry and everyday life, so that students are unable to associate the contents covered in the classroom with phenomena present in their reality (AQUINO *et al.,* 2014). As a result, students end up viewing chemistry in a fragmented and disconnected way with reality, causing only the memorization of formulas and contents to occur, triggering a lot of difficulty and misunderstanding of scientific concepts (ZANOTTO; STADLER; CARLETTO, 2012).

However, the high school curriculum reports that the teaching of Chemistry should be directed to the construction of critical citizens (BRASIL, 2002). In this perspective, the development of actions aimed at improving teaching has a relevant role in improving the teaching-learning process, which can transform students into being aware of their role in society (SANTOS; SCHNETZLER, 2010).

Currently, it is very common to hear reports about the difficulty of attracting attention and stimulating the interest of students, as they believe that the class of a certain subject is just a ritual, that is, something that must be completed only to achieve a goal, such as finishing high school, not giving due importance (LIMA; BABY; TERRAZAN, 2004).

Thus, the search for methodologies that stimulate the teaching-learning process and that draw the student's attention is an inquiry of pedagogical actions, given that the learning processes must collaborate for the student's development.

Regarding the Chemistry aspect, it is necessary to take actions that promote reflection and overcoming the difficulties faced by students in the face of the contents covered, in which interdisciplinarity is present. Using learning from other areas to try to meet the needs of students becomes one of the solutions for quality teaching and learning (SILVA, 2019).

This present work will be addressed about the concepts that involve atomic models that are often presented only in a mechanized way, that is, transmission and memorization of concepts, not adapting to the reality of students and increasingly distancing themselves from everyday life. Since it is an unattractive and abstract content, requiring more imagination to visualize the theories, in this sense, an approach based on the reality of what is experienced on a daily basis is of fundamental importance for the teaching and learning process. Thus, the use of poems can be an enriching strategy for students, relating

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scientific knowledge and literature, seeking to break with this teaching of transmission and memorization.

Including art in the configuration of poems for the teaching of Science can be very fruitful. In literature, there are several authors who relate scientific themes in their poems, such as Luís de Camões, António Gedeão, Marco Lucchesi, Manuel Bandeira, Vinícius de Moraes, Augusto dos Anjos, among others (MOREIRA, 2002).

Therefore, relating the poem to Chemistry classes is to provide the connection between science and literature, promoting interdisciplinarity, generating possibilities to work on contextualization within the classroom, given that it is from the literary language that it is possible to approach the situations of the student's daily life and society in a practical way and different from the way it is presented in the classroom, in addition, the poem has a playful characteristic (MARTINS, 2016). However, what would a poem be?

According to Moisés (1977), the word "poem" originates from the same root as 'poetry' – *poieîn* which means 'to do', being used historically and universally to represent a text in which the poetic phenomenon occurs. Poem is not a literary model, but the union between poetry and man (PAZ, 2012). According to Lyra (1986) "the poem is, in a more or less consensual way, characterized as a text written (primarily, but not exclusively) in verse". However, there is "no relationship of affiliation between one poem and another [...] each poem is a unique object, created by a 'technique' that dies at the exact moment of creation" (PAZ, 2012).

Throughout history, the poem has been based on scientific knowledge to associate with its creations, this interaction makes the use of poems have great educational potential, in which it can manifest in simple terms, but with authenticity and great beauty, what one wants to convey in many pages of an essay or prose. With this, it makes it possible to experience the affective states of respect, love, sense of morality, justice, among others, which play a significant role within society (MEDEIROS; ANGRA, 2010).

In addition, the poem has a playful characteristic, that is, the playful can be used as a strategy in which it can promote learning from a story, play, game, experimentation, among others, stimulating in the student a willingness to learn, in addition to favoring imagination, thus facilitating learning (CABREIRA, 2007).

It also allows interdisciplinarity, and can be a stimulator and encourager to the habit of reading on the part of students, because according to Godinho and Sibin (2008), the poetic text can be an important instrument in the teaching of reading, making the reader

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observe aspects related to the form, the content of the text in order to achieve greater efficiency in the construction of meaning.

According to Junior (2010, reading and interpreting are indispensable practices for students' knowledge. Therefore, the integration of reading and writing as a way to stimulate not only learning, but also to develop various skills that are essential for an active life in society. Reading and writing become essential, forming the basis for the understanding and perception of what is being taught in the classroom, also becoming a support for the recognition of student learning.

Therefore, thinking about a contextualization of the content of Atomistics, with the objective of stimulating the interest of students and promoting differentiated learning, a poem entitled "Bricks of Humanity" was prepared for the 1st year of High School. Taking into account the current situation we are facing due to the pandemic caused by Covid-19 and as a result of the school reality inserted, many students do not have access to the internet, the activities are taking place through the Complementary Pedagogical Activities (APC).

The APC were designed and elaborated during the suspension of classes in the state network of Mato Grosso do Sul, with the objective of helping students in their studies and understanding of the content, which is prepared by the teacher and made available in digital and printed format by the school for students, since many do not have access to the internet. Today, in school, APC are the main means for the dissemination of knowledge, but they are not the only ones, since each teacher uses the means consistent with their reality. Even at a distance, we want to promote quality teaching, with different methodologies and tools, the focus is for students to become critical citizens and aware of their duties within society, understanding the importance of science, especially in the face of everything we have been through.

Therefore, the poem elaborated was made available at APC as an introductory tool to work on the content of atomic models, to promote curiosity about the content that will be addressed, even if remotely trying to bring a closer relationship between teacher and student.

THEORETICAL/METHODOLOGICAL CONTRIBUTION

This activity was developed in a public school of the state education network, located in the city of Dourados – MS, with the target audience of 30 students from the 1st year of

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high school, in the morning. To preserve their identity, they were identified in this work as E1, E2, E3, E4, even E30.

The APC was made available in print by the school, since they do not have access to the internet. The poem was prepared with the intention of arousing interest and curiosity, since we cannot have physical contact, but try to bring a little of the interaction between teacher and student. The poem entitled "Bricks of Humanity" was developed by a graduate student in Chemistry to compose the APC prepared for the students. The elaborated poem is described below.

BRICKS OF HUMANITY
The building bricks,
Of life and of the 'world',
They are atoms and it is not easy to see them.
They constitute the planets and the stars,
Explaining the chemical reactions,
From the laboratory to nature
Not just being an explosion,
They are processes even within the heart,
They happen without us realizing it
But we still love it.
They say it doesn't need to be seen,
Just imagine,
So several models were created
For your way to glimpse
If we could hold it in our hand,
Peach would be the solution
The core would be the lump
Full of protons, what a suffocation
The juicy pulp would be the electrons
But what a privilege
It is the nucleus that makes it impossible for atoms to fall apart
Preventing electrons from flying in all directions,
But the beauty of a life
It's not the electrons spinning
But how they are united
For a life to form.

The APC was structured with the poem introducing the content, in the first moment before reading the Poem the students were asked the following questions: "What do you mean by poem?"; "Has any poem ever been used in the classroom to present the content in the Chemistry discipline?". In the second moment after reading the poem, a questionnaire was presented, used as an instrument to understand the students' previous knowledge about the understanding of the poem and in relation to the content that will be addressed, with the following questions: "Were you able to understand something about the poem?"; "Can you imagine what content will be covered now?"; "Have you ever heard the word 'atom' and do you know what it means?"; "From reading the poem, can you imagine what

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the image of an atom would be like?", "Do you know what charge electrons and protons have?"; "Can you make a sketch of the models that were created?", in order to remember the classroom and make students think, representing what dialogue would be in the classroom and bringing them closer together.

In the third moment, after the explanation of the content, some questions were asked again: "What is an atom?"; "What is its structure and its constituents?" "What are the atomic models that existed and what were the main evolutions over time?", in order to verify if the students were able to learn the content covered and if in fact the poem facilitated this learning. In which, the data were categorized based on the students' perceptions of what was questioned.

Throughout the pedagogical activity, the content on Atomistics was contemplated, bringing historical concepts of when the word 'atom' appeared, the existing models, their changes over time, bringing references from the poem to the discussion of the content, with the objective of reminding them of the introduction and demonstrating that chemistry is interdisciplinary and can be worked on in different ways, even if it is in remote format.

In research in Chemistry Teaching, the qualitative methodology is important because it positions education as an interactive process, which takes place in the relationship between teachers, students and the specific scientific concepts of Chemistry (MÓL, 2007). Therefore, this present work presented a qualitative research approach, in which science is understood as an area of knowledge, being constructed by social interactions that surround us. Its objective is to understand the phenomena from those who experience them, considering times and spaces of actions and reflections.

DISCUSSION

Thinking about the teaching of Chemistry requires a restructuring that we should not consider only the blackboard and chalk as methodological tools within the classroom. These methods of transmitting the content develop in the student the idea that Chemistry is a set of formulas that must be memorized, being devoid of usefulness in everyday life. It can be assured that through such paths it will not be possible to insert students in the universe of scientific knowledge (ALMEIDA, 2018).

With the application of the pedagogical activity, it was possible to perceive that the use of the poem contributed to the students' understanding of the content, since it managed to arouse interest and draw attention, making them leave their comfort zone to read and

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interpret what the poem was trying to address in order to continue the content.

From the questionnaire, it was verified through the students' answers that a class using a poem, even if simple, helps in the association of concepts and 'breaks' the monotony imposed by the fact that it is centered only on the transmission of the content. Mainly because the content covered is very abstract, requiring more from the student to be able to understand the theories and visualize how the atom is shaped and how matter is constituted.

In the first moment before the reading of the poem, in relation to the questions, it was noted that no student knew how to explain what a poem is and that they had never used this approach in the classroom to work on the chemistry contents, thus observing that teachers need to insert this approach in the classroom to stimulate reading and interpretation and facilitate the understanding of the content, managing to present them in a more playful way and closer to the students' daily lives.

With this, many students reported that when they read the poem for the first time, they were unable to answer the questions, but after reading it again they began to articulate answers, because it was something new and different for them, there was a strangeness, but the students' answers were satisfactory, many were able to interpret, but it is necessary to stimulate in the students the power of reading and interpretation, since the basis for its development.

Regarding the second moment, about the questioning of the students' understanding of the poem, 15 students were able to answer satisfactorily. When we asked if they had ever heard of the word 'atom' and its meaning, only 3 students knew. Regarding the image of the atom, 22 students were able to visualize the image of the atom from the analogy with the peach. About the charges of electrons and protons, no student could explain. And finally, only 2 students made the sketch, even though it was only Dalton's model, it was very satisfactory, but demonstrating that the students' understanding of the atom is still very superficial.

The initial understanding of the poem was really satisfactory, as shown in the following excerpt.

> E2 - "I can see from the well-quoted words about the creation of everything. Like all human beings, animals, everyone who has life, has atoms."
>
> E5 - "I understood that even without seeing, atoms are present in practically everything that is matter".

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> E16 - "Atoms are constituted in various ways and forms, but they are not easy to be seen".

It was thus noted that the students were able to understand the essence of what was represented between the lines of the poem, which in a few words and with an example from everyday life wanted to explain the complexity of the composition of the matter, which is why it is so important to stimulate the students' interpretation and reading, as it is a fundamental exercise for their development in all areas of knowledge.

Although they obtained a satisfactory result on the interpretation of the poem, even if it was basic, the students still did not know how to explain what an atom is, since they had never studied it, but with the poem making an analogy of the atom to the peach, it was easier for them to be able to visualize what an atom would look like if it were seen with the naked eye. However, they understand that the atom is essential and constitutes matter, according to the account.

> E1 - "Atoms are small particles present in almost everything".
>
> E18 - "Atoms are parts of matter".

In the third moment, it was noted that there was an evolution in the students' answers, in which 25 students were able to explain what an atom is. When we asked about the structure of the atom and its constituents, 23 students were able to explain it. Regarding the existing atomic models and what were the main evolutions, 14 students were able to explain.

The reports show that there was an evolution of scientific concepts after the explanation of the content and that there was really an understanding, according to the excerpt.

> E1 - "We saw from the content that atoms are very important, they are particles that form the materials and as the teacher put it in the poem, they have a nucleus that is the protons and around the electrons, being positive and negative charges".
>
> E18 - "Atom is an elementary particle that has a nucleus with a positive charge, called protons and the electrons are around with negative charges and form all matter".

It is noted that they were able to understand the concept of the atom and explained all this complexity in simple words. The students also reported that the poem facilitated the understanding of the content, in which throughout the APC historical concepts of the

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emergence of the term 'atom' were addressed, which models existed, always making a connection with the poem presented and demonstrating all the scientific advances that existed.

Regarding scientific concepts, it is known that the understanding of atomistics is fundamental for students to understand how these particles form matter, therefore, it is necessary to present them using pedagogical alternatives so that they facilitate student learning, managing to reconcile it with everyday life, since it is a very abstract content.

It can be observed that the use of the poem can become the starting point for the understanding of concepts and their relationship with the ideas discussed with the students, managing to establish relationships with the theory, at the same time creating possibilities for the student to express his doubts, thus allowing the construction of knowledge to occur.

The use of poems, as a didactic resource, serves as motivation for students during classes, making them better understand the chemical contents. This occurs because scientific content is worked on in a more pleasurable way, in which the relationship between science and art can stimulate different aspects, such as cognitive and emotional (RETONDO; NUNES, 2008).

Poems can be used to contextualize the contents present in textbooks, thus improving comprehension. The use of poems, integrated with the exposition of scientific concepts and terms, can facilitate the students' understanding, so that the class becomes more pleasurable and interesting, contributing to improve the teaching-learning process (RIBEIRO; MUCCI, 2015).

Today, it is necessary to think of methodological approaches that place the student as the center of knowledge, that arouse curiosity and promote critical thinking, given that it is necessary to have students who understand the importance of science, its applications in daily life and who know how to combat fake *news* that is constantly disseminated and using poems presents itself as a tool that can enable these learnings, in addition to improving the interpretation of texts and increasing criticality. However, one of the difficulties throughout the elaboration of the activity was caused by remote teaching and the lack of internet access by students, this ended up generating some lags in teaching, since there were no debates that could have been built in a more complex way in person.

However, today remote teaching is our reality and we must adapt, promoting quality teaching among the tools we have. The great challenges faced occurred due to access to the internet and how to use technological tools that were not so present in our lesson plans

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before.

At first we were very scared by this new reality, but little by little we adapted to the routine, but now some barriers must be destroyed: "How to bring quality education to all students and especially to those who do not have access to the internet?" "Isn't remote learning causing the exclusion of many students?" "Does this type of education cause school dropout?" These are some questions that always come to us in the midst of the current reality, but we must not give up, it is possible to bring quality education, in which the focus is on students, we all have the same goal of bringing quality education to everyone, no matter the tools and methodologies used.

FINAL CONSIDERATIONS

The work developed demonstrates the positive results of the use of the poem in the teaching of chemistry. From the results it can be concluded that it helped the students in the process of knowledge construction, and can be considered an ally in the development of learning. Although the number of students who did not know some chemical concepts was high, the data obtained show that many students were able to interpret the poem and helped in the conceptions of scientific terms that were addressed throughout the APC, facilitating the understanding of the content.

The use of the poem had the purpose of introducing the content of atomistics, stimulating chemical understanding and assisting in the interpretation of text, decision making and stimulation of critical thinking, but some difficulties in applying the activity were related to the access to the internet that the students do not have, so the activity was made available in the form of printed APC, There is a lag in some debates that would be more complex in person. Apart from this, the *feedback* on the development was extremely positive, the students were able to understand the poem and consequently the content.

Making use of poems in the classroom can serve as a stimulus, because in addition to reading, it is necessary to interpret the text, to understand what the poem wants to portray, in this way students do not memorize concepts and formulas, but rather interpret the content, in which it can be a facilitating agent for contextualization.

The poem, as a playful activity, is capable of facilitating the teaching of Chemistry. In this sense, teaching needs changes, both in basic education and in the university, because we have not yet reached what would be ideal in the form of teaching, there are several limitations, such as: precarious infrastructure, lack of support from the school, lack of

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motivation of teachers/students, not knowing how to use methodologies in the classroom, in short, there are many factors that can affect teaching-learning.

However, today we are able to glimpse some changes that are taking place in teaching, we are moving towards a higher quality education, in which the student has more autonomy within the classroom, taking into account their experiences for the construction of knowledge. Therefore, using literature for scientific knowledge is to give wings to the student's creativity and demonstrate that science is inserted in everyday life and is not methodical and mechanical knowledge, and can be learned in a lighter way.

In order to minimize the difficulties faced in the school environment, chemistry content can become more interesting and motivating for students, when the reality to which they are inserted is presented, in this sense the poem comes to help as a tool to work with, trying to improve the student's teaching and providing the understanding of the practical application of certain content in their daily lives.

In general, it can be said that the use of poems will be motivating, arousing interest and improving the understanding of the chemical contents, also promoting an interaction with the student's reality, thus facilitating the understanding of the content worked.

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