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Environment

Plastic balance: a chemistry didactic game integrating plastic waste awareness

Plastic balance: um jogo didático para o ensino de química com interlocução com a reciclagem do plástico

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ABSTRACT

Environmental Education in the school context strengthens students' cognitive, educational, and motivational aspects, in addition to interaction between theory and practice, as well as between thought and action, in the teaching and learning process. In this sense, this study aimed to assess the contributions of the didactic game Plastic Balance to Chemistry teaching, with emphasis on plastic recycling. To this end, the didactic game Plastic Balance was created using recycled plastic caps in the PLASTIMAKER Laboratory at Franciscan University (UFN) in Santa Maria, RS. Additionally, qualitative applied research with a documentary approach was conducted, enabling a deeper exploration of the results within the studied educational context. The research was carried out with students from two classes of elementary school at a private institute in the municipality of Santiago, RS, during 9th-grade Science classes. During the application of Plastic Balance, students were able to compare quantities of reactants and products involved in chemical transformations, as well as enhance the development of the skill proposed in the National Common Curriculum Base (BNCC), which is related to Environmental Education through the recycling of plastic caps.

Keywords: Plastic recycling; Didactic game; Science education

RESUMO

A Educação Ambiental no contexto escolar fortalece os aspectos cognitivos, educacionais e motivacionais dos estudantes, além de proporcionar a interação entre teoria e prática, pensamento e ação, no processo de ensino e aprendizagem. Nesse sentido, o presente trabalho objetivou verificar as contribuições do jogo didático *Plastic Balance*, para o ensino de Química, com ênfase na reciclagem do plástico. Para esta finalidade, foi criado o jogo didático *Plastic Balance* a partir da reciclagem de tampinhas plásticas, no Laboratório PLASTIMAKER da Universidade Franciscana (UFN), em Santa Maria, RS. Além disso, realizou-

se uma pesquisa de abordagem qualitativa, de natureza aplicada e de cunho documental, o que possibilitou a busca por resultados mais aprofundados, inseridos no contexto educacional estudado. A pesquisa foi desenvolvida com alunos de duas turmas dos Anos Finais da rede privada do município de Santiago, RS, durante as aulas da disciplina de Ciências, no 9º ano do Ensino Fundamental. Durante a aplicação do *Plastic Balance*, os alunos conseguiram comparar quantidades de reagentes e produtos envolvidos em transformações químicas, bem como, potencializou o desenvolvimento da habilidade proposta na Base Nacional Comum Curricular, que está relacionada à Educação Ambiental, através da reciclagem de tampinhas plásticas.

Palavras-chave: Reciclagem do plástico; Jogo didático; Ensino de ciências

1 INTRODUCTION

Natural Sciences Education is becoming increasingly demanding in the sense that students can assimilate scientific and technical knowledge in order to apply it to improve society's quality of life. In this scenario, Environmental Education in the school environment constitutes a space that enhances students' cognitive, educational, and motivational aspects, as well as integrates theory and practice, thought and action, in the development of Science and Chemistry teaching.

Chassot (1990) points out that the way in which Chemistry teaching is developed has minimal impact on transforming students into protagonists of their own social role, and also advocates in favor of a questioning and liberating approach to Chemistry education.

Santos and Maldaner (2010) state that teaching Chemistry nowadays is considered a difficult task for educators since classes in many schools are still conducted through activities of repetition, fragmentation, and disconnection from social relevance.

According to Silva and Almeida (2023), didactic games serve as an educational-pedagogical resource that represents an effective strategy in the teaching-learning process when used with proper planning.

Therefore, creating a didactic game from recycled materials, especially plastic caps, represents a viable pathway which integrates environmental and chemical

questions and enables students to become their own protagonists in their process of investigation and knowledge construction.

In this sense, the present study sought to assess the contributions of the didactic game Plastic Balance to Chemistry teaching with emphasis on plastic recycling.

The game was created using recycled plastic bottle caps at the PLASTIMAKER's laboratory of Franciscan University (UFN) in Santa Maria - RS, Brazil.

2 THEORETICAL BACKGROUND

2.1 Environmental Education and Sustainability in Elementary School

Natural Sciences teaching in Elementary School, specifically in 9th grade, includes in its curriculum – guided by reference documents – the competency: Biodiversity Preservation. Within this competency, there is the specific skill: 'Propose individual and collective initiatives to solve environmental problems in the city or community, based on the analysis of successful conscious consumption and sustainability actions.'

Environmental Education has six main goals: awareness; knowledge; behavior; competence; evaluation ability; and participation (Silva & Oliveira, 2019). Based on this, teachers can use practices beyond the educational field as a way to understand student behavior, aiming to implement, according to the National Common Curricular Base (BNCC), dynamic classes that enable working with Environmental Education and Environmental Issues related to quality of life (Silva & Oliveira, 2019).

In light of this, Moretti and Rocha (2022) show that the Environmental Education concepts linked to the educational approach in schools have stood out due to the valorization of issues emerging from students' daily lives in relation to curricular content.

Pinho et al. (2021) affirm the importance of not only contextualizing Chemistry teaching but also enabling a better awareness process about Environmental Education, showing students the value of understanding the theme and disseminating acquired knowledge to others, making learners active agents in their own learning process.

Arrigo et al. (2018) argue that, regarding Chemistry teaching, many researchers advocate adopting a new approach, followed by work that relates chemical knowledge in a problematized way to the social reality in which the student is inserted.

Pugliese (2020, p. 114) states:

> [...] sustainable thinking is a stance that involves protagonism, knowledge and critical sense, which one assumes and should be considered in all actions to break pre-established conceptions and understand issues from a scientific viewpoint, so we may act in the most adequate way possible.

According to this scenario, the contextualization of Chemistry as a Science that investigates the constitution and transformation of matter in light of technological demands to provide quality of life for society, requires dialogue between Chemistry and the development of citizens who are more aware of the importance of protagonism for society and the environment.

2.2 Plastic recycling process

One of the most evident impacts of increasing population density is the precariousness of public infrastructure for collection and final disposal of urban solid waste. According to Abdalla and Sampaio (2018), regardless of size, most cities in the so-called 'third world' countries present problems in their environmental public policies, as well as little financial incentive and lasting environmental education actions.

In face of this, solid waste has become a major contemporary concern, with aggravating factors being changes in consumption patterns, industrial development and technological advancement that led to alterations in the composition and quantity of waste generated (Góes, 2011).

Sustainable development seeks to guarantee that natural resources remain available for future generations. Related to this definition is the possibility of maintaining human activities for several generations, and for this to occur, it is of utmost importance to integrate the common good of living beings, nature, people, and the planet (Silveira, 2017).

In the solid waste scenario, plastics have become the most prominent materials for reduction due to their chemical and physical properties, as well as their efficiency in recycling, repurposing, and reuse.

Plastics are synthetic polymers whose main raw material is petroleum. Domestic plastic waste resulting from human consumption remains in the environment for a long period of time and generally takes more than 400 years to degrade spontaneously (Valencia et al., 2012).

According to information from the website "Movimento Circular: por uma economia circular no mundo", there is a movement focused on circular initiative whose main implementation tools are education and culture, encouraging sustainable development of new processes, products and attitudes for a society with no waste.

Therefore, the Circular Movement acts closely associated with the Sustainable Development Goals (SDGs) foreseen in Agenda 2030 and defined by the United Nations Organization (UN).

Thus, if these wastes are correctly sorted, they will become good-quality raw materials and may undergo reuse processes, possibly even adding greater value if processed through washing, shredding, screening, pressing, baling, and composting.

2.3 Didactic games in Elementary School's Science Teaching

In the current context, access to scientific information is instantaneous, influencing people's lives, and scientific knowledge has ceased to be confined to the academic sphere and has become part of citizens' daily lives. For this reason, it is important that Science teaching in schools is offered in a systematic way, bringing students' daily lives closer to scientific knowledge.

The study of Science favors students' inclusion in the contemporary world as it promotes the development of understanding about the reality that surrounds them and enables their relationship with the natural environment. In this way, students learn to interpret the complexity of the world (Fonseca; Duso, 2018, p. 24).

According to Silva and Almeida (2023), the act of teaching becomes a daily challenge, as there is no one-size-fits-all approach for all students, since each one responds in a particular way to classroom activities. For some, what is interesting favors learning, while for others, it may have no meaning at all. The incorporation of games in school daily life is very important, mainly due to the great influence they exert on students, for when they are emotionally involved in the action, the teaching-learning process becomes easier and more dynamic. However, working with didactic games in the classroom requires well-defined planning, clear objectives, appropriate methodology and adequate vocabulary.

Educational games are presented as a good strategy in the teaching-learning process; however, this strategy requires planning, making clear the objectives, conceptual basis, rules, tasks, and competencies to be performed by both the teacher and the students, otherwise it may not fulfill what it proposes as a didactic-pedagogical resource (Silva; Almeida, 2023, p. 03).

Games, according to the literature, can have two distinct functions: educational and playful. When it presents only the objective of teaching, it is considered educational, but if it also presents the function of entertainment, it can be considered playful. The intention when working with games is that they balance these two functions, the educational and the playful, because if they do not present an educational function, they will be just like any other game, and if they are only playful, they will be a game for the sake of a game, without an educational character (Ramos; Santos; Lamburú, 2017, p. 120).

Therefore, it should be noted that the mere implementation of a game does not guarantee learning. To achieve its didactic objective as a learning resource, it cannot be considered merely 'playful', but must also be linked to an object of knowledge that becomes engaging and relevant for the development of a critical and reflective student.

3 MATERIALS AND METHODS

This research presented a qualitative approach, with an applied nature and a documentary character, which enabled the search for more in-depth results, integrated in the studied educational context.

For this purpose, an outline of the skills associated with Environmental Education and chemical reactions was developed, as outlined in the Basic Education guiding documents, such as the BNCC, the Referencial Curricular Gaúcho (RCG), and the Documento Municipal Orientador de Santiago (DOM-SAN), for the 9th year of Elementary School.

This research was developed with students from two classes of the Final Years of the private education network in the municipality of Santiago, RS, during Science classes in the 9th year of Elementary School. Subsequently, the didactic game Plastic Balance was applied to the forty students participating in the research.

3.1 Development of the Didactic Game 'Plastic Balance'

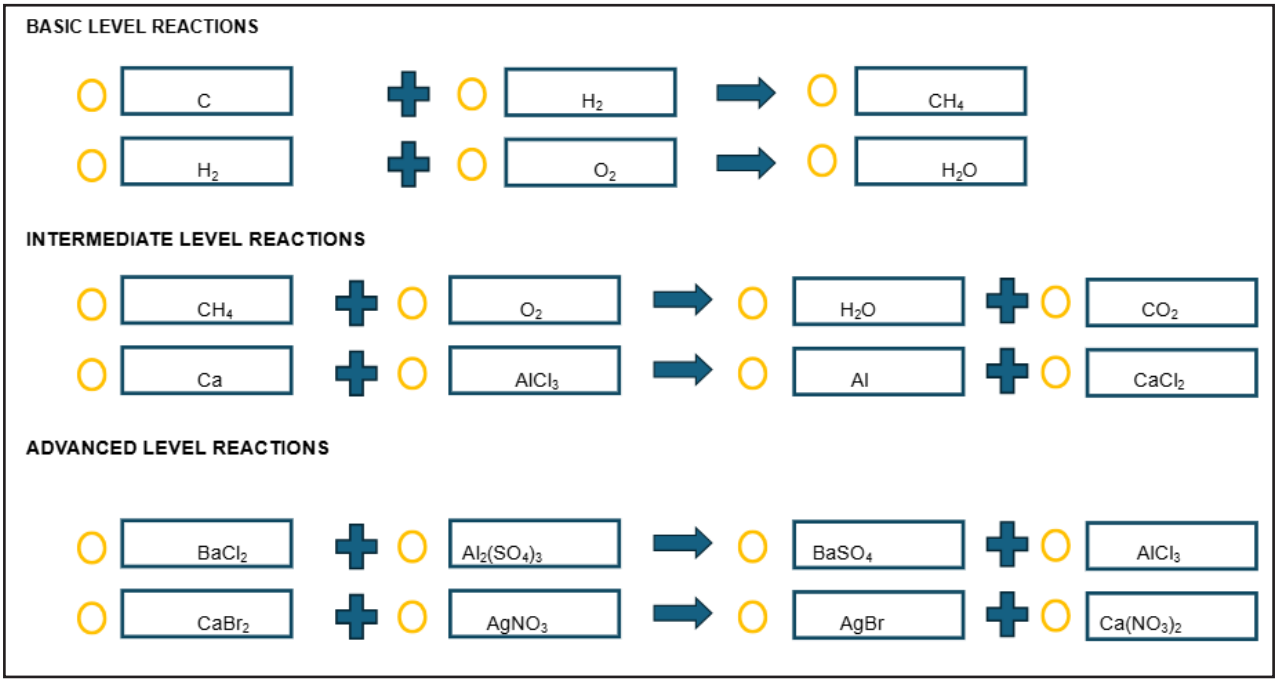
'Plastic Balance' is a didactic game that was produced from the recycling of plastic bottle caps, in the PLASTIMAKER Laboratory of the Franciscan University (Santa Maria, RS).

In this study, polypropylene plastic (PP) was chosen, which is used in numerous everyday materials, being an easily accessible element. It is classified as a thermoplastic, which means it can be easily melted, allowing it to be molded, extruded and pressed in various forms.

3.2 Methodology of application of the Didactic Game Plastic Balance

Plastic Balance is composed of pieces formed by circles, rectangles, arrows, cross and plus signs. These pieces represent the components of the chemical reaction, as shown in the sketch in figure 1.

Figure 1 – Plastic Balance's sketch



Source: developed by the authors

Plastic Balance was planned so that students would recognize the plastic recycling process and the need to keep constant the quantity of products and reactants in a chemical reaction.

Table 1 demonstrates the stages and the description of the actions that were carried out for the application of Plastic Balance.

Table 1 – Stages and activities of the educational product's methodology

Stage	Activity
1st	Presentation of a video about PLASTIMAKER
2nd	Exploring the game kits
3rd	Hand-in of the preliminary investigation worksheet
4th	Teaching-learning class
5th	Playing Plastic Balance
6th	Hand-in of the follow-up investigation worksheet
7th	Reflective discussion circle about the game's effects

Source: developed by the authors

4 RESULTS AND DISCUSSION

According to Costa, Monteiro and Ribeiro (2019), education within the context of Circular Economy presupposes a conceptual change relative to linear economy, recycling and sustainability. Teachers have a fundamental role to sensitize students in the implementation of new behaviors.

Moretti and Rocha (2022) affirm that the conceptions of Environmental Education articulated with the educational perspective in schools have stood out due to the valorization of issues that emerge in students' daily lives in relation to curricular content.

In this sense, Pinho et al. (2021) state the importance of not only contextualizing Chemistry teaching, but also enabling a greater awareness process about Environmental Education, showing students the importance of understanding the theme and disseminating the acquired knowledge to other people, in a way that students take an active role in their own learning process.

For Leite and Ritter (2017), the official documents must serve as a basis for the structuring of teaching proposals, therefore they are considered guidelines or orientations.

In BNCC's introduction, the text points out that education should promote transformation in favor of a more just society and in tune with nature preservation. For this purpose, it highlights the 2030 Agenda for sustainable development and the 17 SDGs as models to follow.

On the other hand, Lopes and Rodrigues (2023), through a more attentive analysis of BNCC, observe that an interdisciplinary perspective permeates the entire document. Regarding the area of Natural Sciences and their Technologies, the articulation between Biology, Physics and Chemistry becomes evident, as well as that the specific knowledge of each discipline proposes an integrated work between them.

From this perspective, BNCC brings a concern in preparing teachers for the new contemporary society, in which learners have easy access to information and technologies, and teachers should seek an innovative and inclusive lens, contextualizing the knowledge that students bring to class. This should occur in a way that students take, from this, a participatory and critical opinion about what is information and what is, in fact, knowledge (Callai, Becker and Sawitzki, 2019, p. 8).

4.1 Implementation of the Didactic Game Plastic Balance

Plastic Balance is a game composed of pieces that represent the components of the chemical reaction (Figure 2).

Figure 2 – Parts of the game Plastic Balance

Source: author's personal archive (2024)

For this study, two Plastic Balance games were produced, since the plastic recycling process requires considerable time and a large amount of raw material (plastic bottle caps). Therefore, six kits were made (2 basic-level kits, 2 intermediate-level kits, and 2 advanced-level kits), with a total of 44 circular pieces and 44 rectangular pieces. The 20 plus-sign pieces and 12 arrow-sign pieces were made from cardboard boxes.

Table 2 shows the results of the didactic game application.

Table 2 – Results of Plastic Balance's implementation

(To be continued...)

Stage	Activity
1st	**Presentation of a video about PLASTIMAKER**  Source: author's personal archive A video was presented about the process of obtaining materials from plastic recycling, developed at the PLASTIMAKER Laboratory of Franciscan University. Afterwards, the teacher challenged students about the importance of plastic recycling and specially emphasized about plastic bottle caps and their multiple possibilities of repurposing and transformation. In this perspective, the teacher requested students to collect plastic bottle caps in their households during a two-week period, which totaled approximately 300 plastic bottle caps, so that, in the future, they could be sent to the PLASTIMAKER laboratory.
2nd	**Exploring the game kits** Subsequently, the game Plastic Balance was presented so that students could observe and handle the pieces and understand how they were produced, making connections to the video they had watched. Next, the teacher split students into groups. Class A was split into 5 groups (groups 1 to 5) and Class B into 6 groups (groups 6 to 11). Two groups in each class sequentially received: a basic kit, an intermediate kit, and an advanced kit of Plastic Balance. The remaining groups in the classes alternately and randomly received: a basic kit, an intermediate kit, and an advanced kit of the game, thus being able to explore the possibilities of organizing a chemical reaction.  Source: author's personal archive (2024)

Table 2 – Results of Plastic Balance's implementation

(To be continued...)

Stage	Activity
3rd	**Hand-in of the preliminary investigation worksheet** Subsequently, a pre-investigative worksheet was given to each group. This worksheet had blank spaces for students to fill in the organization of the chemical reactions (reactants and products) for the basic, intermediate, and advanced levels. Each group was given 5 to 10 minutes to complete each level. After they finished filling out the worksheet with all levels, the teacher collected the worksheets. Out of the 11 groups, only 7 groups failed to complete it within the time limit.  Source: author's personal archive (2024) Group reports while handling the game pieces: - "*Teacher, why isn't there space on the worksheet to use the numbered cookies?*". - *"Teacher, the numbers on the elements in the substances don't match – the reactants are different from the products!".*
4th	**Teaching-learning class** In the following class, the teacher conducted an explanation of the relevant knowledge about chemical reactions and balancing, using the subject's instructional material and the board, in an expository and dialogic manner with the students.  Source: author's personal archive (2024)

Table 2 – Results of Plastic Balance's implementation

(To be continued...)

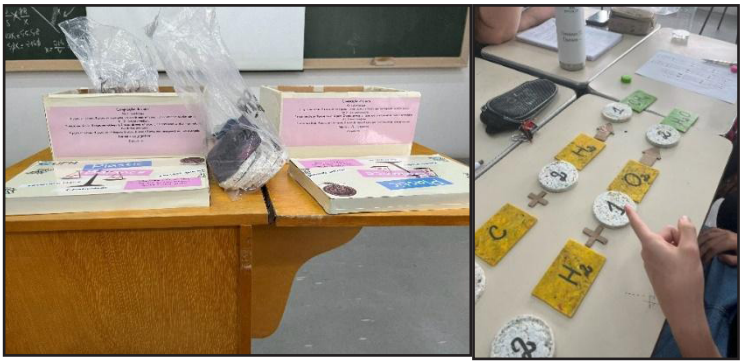
Stage	Activity
5th	**Playing Plastic Balance** Next, the groups were reorganized. Two groups in each class sequentially received: a basic kit, an intermediate kit, and an advanced kit of Plastic Balance. The remaining groups in the classes alternately and randomly received: a basic kit, an intermediate kit, and an advanced kit of Plastic Balance, thus being able to perform the assembly and balancing of the chemical reactions.  Source: author's personal archive (2024)
6th	**Hand-in of the follow-up investigation worksheet** After assembling the chemical reactions, each group received a post-investigative worksheet to fill in the blanks for the basic, intermediate, and advanced levels. Once completed, the teacher collected the worksheets and presented the answer key, which showed the correct organization and balancing of the chemical reactions.  Source: author's personal archive (2024)

Table 2 – Results of Plastic Balance's implementation

(Conclusion)

Stage	Activity
7th	Reflective discussion circle about the game's effects

Source: author's personal archive (2024)

Finally, students discussed and reflected on the game and its potential for solving chemical reaction balancing.

Students' reports:

- "*The game made it easier to understand balancing.*"
- "*Teacher, it's faster to understand because we swap the cookies around and can see if the quantities match up.*"
- "*Teacher, it would be good if we had a game like this during the test.*"
- "*Teacher, we could make the game with other materials, right?*"

Source: developed by the authors

5 CONCLUSION

Schools are democratic places and have an essential role in student development, which goes beyond teaching and learning specific scientific knowledge, surpassing the physical walls that surround it. It is in the school environment that students undergo an immersion, learning to socialize, acquiring principles and constructing their values.

According to Pinho et al. (2021), it is not enough to just contextualize Chemistry teaching, but also to show students that the acquired knowledge should be disseminated to others, allowing for a far more significant process and thus enabling students to take an active role in their teaching-learning process, as in environmental awareness, for example.

In this sense, placing emphasis on the environment aids society's understanding of Chemistry's scientific knowledge, for the socio-environmental theme will act as a didactic instrument for knowledge contextualization, instigating the importance of some concepts present in daily life and maintaining Chemistry's connection with reality.

BNCC defines the minimum contents to be developed in students' basic education, with the purpose of promoting and guaranteeing full cognitive, social and cultural development of learners.

The study of the guiding documents for Basic Education (BNCC, RCG and DOM-SAN) for the Science curricular component in the 9th year of Elementary School enabled the theoretical foundation for discussion and reflection in the classroom, as well as a better understanding of the specific Skills for teaching chemical reactions and plastic recycling.

The development of the didactic game Plastic Balance as a facilitator for teaching chemical reaction balancing in the 9th year of Elementary School provided student engagement through reflection, construction and organization of reaction participants, as well as establishing proportions between these reaction participants.

In this perspective, Chemistry teaching requires that alternative methodologies are proposed in order to make it more attractive and contextualized for students, given the many difficulties Chemistry teachers face when they develop this discipline's specific content, sometimes for working with the abstract, sometimes for being something difficult to be tangible.

The conception of the didactic game Plastic Balance is an argument to be shown to students that enhances the development of the skill proposed in the BNCC, which is related to Environmental Education, and which aims to propose individual and collective initiatives for solving environmental problems of the city or community, based on analysis of successful conscious consumption and sustainability actions.

Therefore, with the application of Plastic Balance during the study of chemical reaction balancing, students were able to compare quantities of reactants and products

involved in chemical transformations, establishing the proportion, a skill foreseen in BNCC for Chemistry teaching in the 9th year of Elementary School for Science curricular component. It has also enhanced the development of the skill proposed in BNCC, which is related to Environmental Education, through the recycling of plastic bottle caps.

REFERENCES

Abdalla, F. A., & Sampaio, A. C. F. (2018). Os novos princípios e conceitos inovadores da economia circular. *Revista Entorno Geográfico*, (15), 82–102. https://entornogeografico.univalle.edu.co/index.php/entornogeografico/article/view/6712

Arrigo, V., Alexandre, M. C. L., & Assai, N. D. S. (2018). O ensino de química e a educação ambiental: Uma proposta para trabalhar conteúdos de pilhas e baterias. *Experiências em Ensino de Química*, 13(5), 306–325. https://fisica.ufmt.br/eenciojs/index.php/eenci/article/view/105/87

Brasil. Ministério da Educação. (2017). *Base Nacional Comum Curricular.* http://portal.mec.gov.br/index.php?option=com_docman&view=download&alias=79601-anexo-texto-bncc-reexportado-pdf-2&category_slug=dezembro-2017-pdf&Itemid=30192

Brasil. Organização das Nações Unidas. (2022). *Objetivos do desenvolvimento sustentável.* https://brasil.un.org/pt-br/sdgs

Callai, A. N. A., Becker, E. P., & Sawitzki, R. L. (2019). Considerações acerca da educação física escolar a partir da BNCC. *Conexões*, 17, 019–022. https://periodicos.sbu.unicamp.br/ojs/index.php/conexoes/article/view/8654739/21555

Chassot, A. I. (1990). *A educação no ensino da química*. UNIJUÍ.

Costa, M. Q., Monteiro, I., & Ribeiro, V. R. (2019). Educar para economia circular: Uma experiência inovadora na formação de professores. *Revista Saber & Educar*, (27), 370–421. http://revistaold.esepf.pt/index.php/sabereducar/article/view/370/421

Fonseca, E. M., & Duso, L. (2018). Reflexões no ensino de ciências: Elaboração e análise de materiais didáticos. *Revista de Produtos Educacionais e Pesquisas em Ensino*, 2(1), 23–44. https://seer.uenp.edu.br/index.php/reppe/article/view/918/884

Góes, H. C. (2011). Coleta seletiva, planejamento municipal e a gestão de resíduos sólidos urbanos em Macapá/AP. Planeta Amazônia: *Revista Internacional de Direito Ambiental e Políticas Públicas*, (3), 45–60.

Leite, R. F., & Ritter, O. M. S. (2017). Algumas representações de ciência na BNCC – Base nacional comum curricular: Área de ciências da natureza. *Temas & Matizes*, 11(20), 1–7. https://saber.unioeste.br/index.php/temasematizes/article/view/15801

Lopes, M. D., & Rodrigues, C. T. (2023). Nanociência e nanotecnologia: Uma análise documental a partir da BNCC. *Revista Física no Campus*, 3(2). https://revista.uepb.edu.br/fisicanocampus/article/view/2367

Moretti, A. A. da S., & Rocha, Z. F. D. C. (2022). A articulação entre a educação ambiental transformadora e os pressupostos de CTSA em uma oficina temática aplicada no ensino de química. EDUCERE – *Revista de Educação*, 22(2), 391–409. https://riut.utfpr.edu.br/jspui/handle/1/32954

Pinho, J. S. A. de et al. (2021). Contextualização do ensino de química através de temas sobre reciclagem e reaproveitamento. *Brazilian Journal of Development*, 7(9), 90019–90029. https://ojs.brazilianjournals.com.br/ojs/index.php/BRJD/article/view/36015/pdf

Pugliese, G. O. (2020). Novo ensino médio: Projetos integradores – *Ciências da natureza e suas tecnologias* (1ª ed.). Scipione.

Ramos, E. S., Santos, F. A. C., & Laburú, C. E. (2017). O uso da ludicidade como ferramenta para o ensino de química orgânica: O que pensam os alunos. *ACTIO: Docência em Ciências*, 2(2), 119–136. https://revistas.utfpr.edu.br/actio/article/view/6810/4449

Santos, W. L. P., & Maldaner, O. A. (Orgs.). (2010). *Ensino de química em foco*. UNIJUÍ.

Silva, P. L., & Almeida, V. R. (2023). O uso de jogos didáticos-pedagógicos no ensino de ciências como método de ensino e aprendizagem na EMEF Brigadeiro Haroldo Coimbra Veloso em Itaituba-PA. *Revista de Iniciação à Docência*, 8(1), 1–18. https://periodicos2.uesb.br/index.php/rid/article/view/11643/7407

Silva, W. I., & Oliveira, J. G. R. (2019). Práticas de educação ambiental nas aulas de geografia do ensino médio: Reciclando velhos hábitos. Revista Brasileira de Educação Ambiental, 14(1), 316–361. https://periodicos.unifesp.br/index.php/revbea/article/view/2706/1646

Silveira, J. H. P. (2017). *Sustentabilidade e responsabilidade social: Artigos brasileiros.* Poisson.

Valencia, D. R., et al. (2012). Nuevas alternativas en la construcción: Botellas PET con relleno de tierra. Apuntes: *Revista de Estudios sobre Patrimonio Cultural*, 25(2), 292–303. https://revistas.javeriana.edu.co/index.php/revApuntesArq/article/view/8813

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