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Development Of An Educational Tic-Tac-Toe Game For Teaching Fundamental Concepts Of Electricity

Solange Do Nascimento Victor[1], Laffert Gomes Ferreira Da Silva[2], Mauro Guilherme Ferreira Bezerra[3], Cléver Reis Stein[4]

[1](*Federal Institute Of Education, Science, And Technology Of Rondônia, Calama Campus, Brazil)*
[2](*Federal Institute Of Education, Science, And Technology Of Rondônia, Calama Campus, Brazil)*
[3](*Federal Institute Of Education, Science, And Technology Of Rondônia, Calama Campus, Brazil)*
[4](*Federal Institute Of Education, Science, And Technology Of Rondônia, Calama Campus, Brazil)*

Abstract:
The subject of Physics is considered by many students to be one of the most challenging in the curriculum. To help facilitate study and learning, we present in this article an adapted tic-tac-toe game designed to support the teaching and learning process of introductory content and fundamental concepts of electricity. The prototype was developed with the goal of combining the desire to win a competition with the need to learn the concepts in order to score during the game, thereby encouraging students to study and assimilate the material to succeed in the competition. The game is versatile, dynamic, and engaging, sparking interest in studying in a playful way. Additionally, it stands out as an excellent didactic tool to assist teachers in evaluating student performance.

Key Word: *tic-tac-toe game; electricity; playful learning.*

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I. Introduction

Physics is a science dedicated to the detailed study of natural phenomena, ranging from the movement of subatomic particles to the dynamics of celestial bodies such as planets and galaxies. This broad scope allows for a deep and diverse understanding of the universe, encompassing both simple and complex interactions. Physical concepts not only explain the functioning of the world around us but are also essential for developing meaningful learning (PAVIANI, 2009). When these concepts are integrated into problem-solving through mathematical tools, Physics provides a more complete and precise understanding. This interdisciplinary approach makes the study of Physics both qualitative, by exploring fundamental principles, and quantitative, by enabling accurate measurements and predictions. Thus, the study of Physics is crucial for developing critical and analytical thinking, equipping students to tackle complex challenges with rigor and creativity.

Due to its complexity and breadth, Physics is widely regarded as one of the most challenging subjects for students. The difficulty in understanding physical concepts largely stems from the need to grapple with abstract ideas that do not always have a direct correlation with students' everyday experiences. This gap between theory and practice makes learning even more arduous, contributing to the low performance of many students. Furthermore, the pedagogical approaches often adopted in teaching Physics can exacerbate this situation. The excessive emphasis on repetitive mechanical exercises, without proper contextualization, tends to demotivate students and limit their deep understanding of phenomena (LOPES, 2001). The lack of connection between classroom content and real-life situations causes students to fail to see the relevance of Physics in their lives, which ultimately reduces their engagement and interest in the subject. To reverse this scenario, it is crucial that Physics education adopts more interactive and contextualized methodologies that bring physical concepts closer to students' realities and foster more meaningful and applied learning (SOUZA, 2014).

Given this scenario, it becomes imperative for teachers to advance in adopting new methodologies and didactic tools, recognizing that traditional teaching methods, often centered on expository and repetitive approaches, no longer fully meet the needs of contemporary students. Integrating innovative techniques into the educational process is crucial for promoting a more dynamic and effective learning environment, one that not only facilitates content comprehension but also sparks students' interest and curiosity. This can include the use of educational technologies (STAREPRAVO, 1999) such as interactive simulations, digital learning platforms, and virtual experiments, which allow students to visualize and manipulate abstract concepts in a concrete and practical way (RODRIGUES, 2017). Additionally, active methodologies like project-based learning and the flipped classroom can encourage active student participation, promoting more meaningful and personalized learning. By addressing the individual needs of students while connecting content with real-world situations, these innovative approaches have the potential to significantly improve academic performance and better prepare students for future challenges. Therefore, advancing the use of new pedagogical tools and methodologies is not only

desirable (SCHAEFFER, 2006) but essential for the evolution of education and the success of students in an increasingly complex and ever-changing world. To contribute to the teaching and learning of fundamental concepts of electricity, this article presents a playful game designed to engage students through competition while they learn about electrical phenomena. The game uses a board in the format of the classic tic-tac-toe game, where competitors must demonstrate knowledge about the content related to each square on the board. If they fail to answer correctly, they cannot mark the square with an X or O. This approach aims to make learning more interactive and engaging, encouraging students to delve deeper into the concepts studied to advance in the game.

II. Material And Methods

The first methodological step in constructing the didactic tool involved studying the content and preparing the questions and answers that would be placed on the board as well as on the game pieces, with the aim of achieving the intended purpose. The second step involved building the board and the pieces. In each square of the board, concepts of electricity related to the X or O pieces were inserted. For a student to fill the desired position on the board, they must correctly answer the question, identifying the piece corresponding to the question.

The materials used in constructing the electricity-themed tic-tac-toe board were: poster board, brushes, adhesive tapes, glue, A4 sheets, and scissors.

Once construction was completed, the didactic game was ready to be used in the classroom as a tool to support the teaching and learning process of fundamental concepts of electricity. Before using the game, the teacher should explain the content covered on the board and then begin the gameplay, allowing the reinforcement of the topics to occur in a playful manner through competition.

III. Result

Through the execution of this project, a prototype board was developed as a valuable didactic tool for teaching fundamental concepts of electricity.

The prototype, which incorporates content related to electricity, is shown in Figure 1.

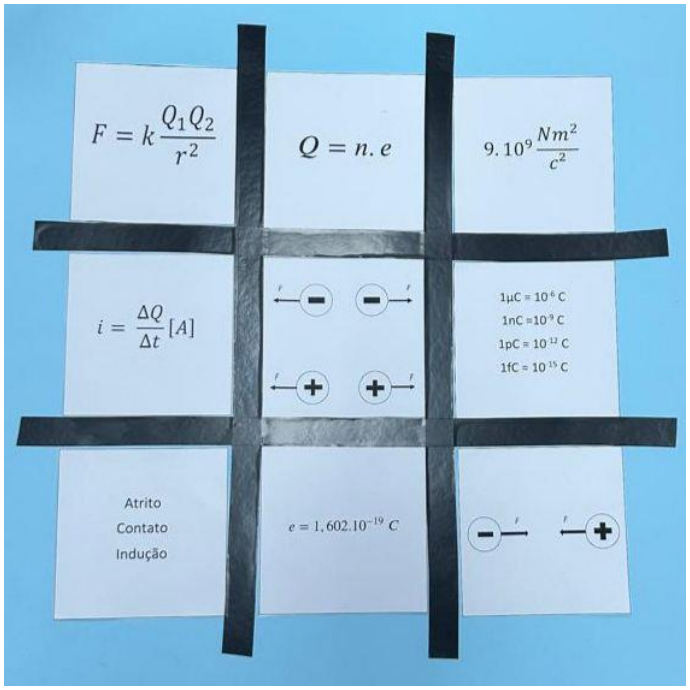

Figure 1: Educational Tic-Tac-Toe Game for Teaching Fundamental Concepts of Electricity. Each square on the board contains conceptual information about electricity, making learning more interactive.

Each square on the board is associated with a fundamental concept of electricity, and the student must recall this definition to fill in the square on the board. If the student does not know the answer or marks it incorrectly, the move is voided by the teacher, and the turn is passed to the opponent. This mechanism ensures that the squares are filled based on the correct knowledge of the concepts, promoting a more accurate assessment of the students' learning.

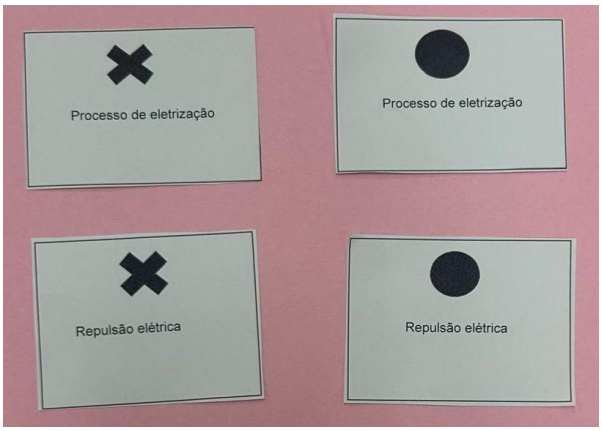

Figure 2: Cards for the Educational Tic-Tac-Toe Game for Teaching Fundamental Concepts of Electricity. Each set of cards (X or O) is identical, ensuring that all players have the same conceptual information about electricity.

Each player holds nine cards, which must be placed on the square that corresponds to the information on the board. The X and O card sets contain the same information, allowing players to make their moves based on their knowledge. To do so, they must correctly match the description on the card with the one on the board. If the match is incorrect, the move will not be valid, and the player will lose their turn.

This mechanism ensures that filling in the squares is based on accurate knowledge of the concepts, motivating students to learn in order to make the correct move. In this way, students are encouraged to learn both through the competition in the game and the desire to win.

IV. Discussion

This carefully crafted board offers an innovative and interactive approach that facilitates the understanding of the topics covered in the classroom. By integrating elements of competition, the tool allows the teacher not only to reinforce the knowledge already taught but also to dynamically and engagingly assess the students' level of learning. The competition encouraged by the game fosters a more active and participatory learning environment, where students have the opportunity to apply and consolidate their knowledge in a practical and playful manner. Additionally, the use of the board provides immediate feedback on the understanding of the concepts, enabling adjustments in the teaching process and increasing the effectiveness of learning. In this way, the developed prototype not only enriches the educational experience but also significantly contributes to the retention and application of electrical concepts in an engaging and meaningful way.

V. Conclusion

This work presented the development of a didactic tic-tac-toe prototype aimed at teaching fundamental concepts of electricity. The product can be used as a tool to validate the knowledge explained in the classroom, as participants can only make moves if they know the correct answers to the questions posed on the squares of the board. Thus, in addition to stimulating learning, the game makes the process more enjoyable, as the challenge of defeating the opponent depends on knowing the correct answers. In summary, this work offers an alternative to assist the teacher in the process of teaching and learning the introductory concepts of electricity. Furthermore, the game can be adapted for other content and subjects, demonstrating its great applicability and versatility as an educational tool.

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