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## PHET COLORADO TO APPROACH OBLIQUE LAUNCHING: EXPERIENCES IN THE PHYSICS PEDAGOGICAL RESIDENCY

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## EXPANDED ABSTRACT

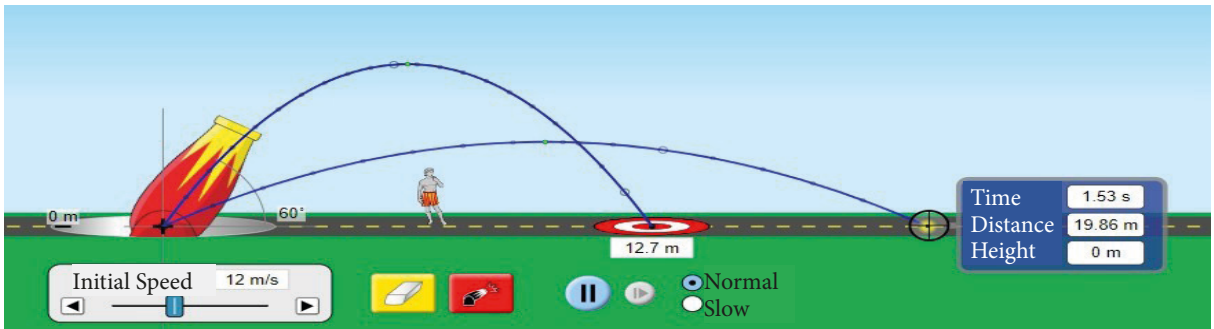
According to Pauli (2015), Physics is one of the subjects that fails the most. According to Miranda Neto (2019), the subject causes a lot of disinterest among students. According to Oliveira (2022), the excess of mathematization and problems without contextualization in Physics causes a lot of demotivation and lack of interest among students. In view of what the three authors advocate, we propose an activity in which Physics is contextualized through a subject of general interest, soccer, while at the same time making it easy to visualize the phenomenon through a simulator.

Between 2020 and 2021, many classes had to be held remotely due to the Covid-19 pandemic. Oliveira (2022) argued that to make better use of remote classes, activities should be carried out with online simulators, such as the one indicated by the author, Phet Colorado, which allows the simulation of various physical phenomena in the most different conditions. The aforementioned work mentions a way of approaching parabolic motion at home, since this was a demand at the time. However, it is possible to do this activity in person in the school environment.

In this study, approved by the UTFPR Research Ethics Committee (number 68894723.0.0000.5547), we present specifications for the development of this activity, in person, in the context of the Physics Pedagogical Residency Program (PRP) in a 3<sup>o</sup> year Administration Technician (TA) class in the first semester of 2023, at the Santa Cândida State College, Curitiba, Paraná. Figure 01 shows the simulator already adjusted to the parabolic motion function. The aim here is also to highlight the potential and limitations associated with using the Phet Colorado simulator to approach Oblique Launching in Physics classes.

In the Phet activity, the aim was to give the students a practical and meaningful experience, making them see the phenomenon. To conduct the activity, a lesson plan was followed by the preceptor teacher, which involved demonstrating the phenomenon of oblique launching in a vacuum, exploring the variables involved and collecting data. The activity was developed after three theoretical lessons given by the resident on the subject of “Football and Physics Teaching”, with a greater focus on the oblique throw. Trigonometry in right-angled triangles was taught in the first lesson, vector decomposition in the second, and parabolic motion in the third. In all the lessons, they talked about real and hypothetical soccer moves. At the end of the third lesson, an activity was left on Google Forms, which was a question adapted from a Unesp entrance exam, about a goal missed by Pelé in the 1970 World Cup after a shot taken at 30 m/s with an angle of 30° to the horizontal, and it was suggested that the students should later simulate the shot on the Phet Colorado. In the fourth lesson, a similar activity was carried out in the school’s computer lab with two exercises on goals from the Senegal 4 x 2 Brazil friendly match held in June 2023, as reported on the ESPN (Entertainment and Sports Programming Network) Brazil portal. You can watch the goals on GE’s YouTube channel.

On the day of the activity, the students were asked to access the Google form, created by the teaching resident but made available by the preceptor teacher in Google Classroom. After everyone had logged in, the resident asked them to adjust the initial parameters in the Phet Colorado simulator according to the instructions (Exercise 1 initial speed of 15 m/s and angle of 30° and Exercise 2 initial speed of 12 m/s and angle of 60°) and then in the simulator to change the position of the target up to the point where the ball reached. Once



**Figure 01:** *Oblique launch in vacuum simulated with all the information*

this was done, the students were asked to mark the alternative on the Google form with the interval to which the value found in each exercise belonged. Of the 35 students in the class, 29 were present on the day, all of whom answered the questions, 28 answered both correctly and 1 got the first one wrong.

In Oliveira's dissertation (2022), it was possible to see that there was an improvement in the students' understanding of the concepts involving oblique throwing after using the Phet Colorado. The pedagogical resident worked more with the calculations, but was able to observe that compared to the previous lesson, when he worked with the blackboard and chalk and made the students do the math in their notebooks, the students' performance was much better, since they made far fewer mistakes.

The activity gave the students a better understanding of oblique launching, once they had seen the situation. For the resident, the activity made it possible to explore the potential of technology as a support tool for

teaching physics. Among Phet Colorado's limitations, Matias (2019) mentions that one possible one is in relation to the schools' computer equipment. Fortunately, on the day the pedagogical resident developed the activity, all the computers chosen by the students worked without any problems. Matias (2019) also points out that in simulators a physical system can always be idealized as it usually is in high school problems, which can cause some confusion in students if they later carry out a real experiment. Because real experiments are subject to systematic errors in the equipment, or those unforeseen errors that involve the experimenter's ability to read and manipulate the instruments. The simulator itself works with a maximum initial speed of 30 m/s and a minimum initial angle of 25°, so the simulations with Phet are within these limits.

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## REFERENCES

OLIVEIRA, R. R. B. **Estudo do lançamento de projéteis usando o simulador Phet**. 2022. Dissertação (Mestrado Nacional Profissional em Ensino de Física) - Instituto de Ciências Exatas, Universidade Federal Fluminense , Volta Redonda , 2022.

MIRANDA NETO, H. S. **Uma proposta de ensino de força e movimento no ensino fundamental através do futebol**. 2019. Dissertação (Mestrado Nacional Profissional em Ensino de Física) - Programa de Pós-Graduação em Ensino de Física, Instituto Federal do Espírito Santo, Cariacica, 2019.

PAULI, A. M. **Física e o futebol no Ensino Fundamental**. 2015. Dissertação (Curso de Pós-Graduação em Educação Matemática e Ensino de Física da Universidade Federal de Santa Maria, UFSM-RS) - Programa de Pós-Graduação em Educação Matemática e Ensino de Física, Universidade Federal de Santa Maria, Santa Maria, 2015.

MATIAS, M. P. **Simulação no Phet(Physics Education Technology) para lançamento de projéteis e oficina de construção e lançamento de foguetes de garrafas pet**. 2019. Dissertação (Mestrado Nacional Profissional em Ensino de Física) - Programa de Pós-Graduação, Universidade Federal Rural de Pernambuco, Recife, 2019.

Questão Vestibular Unesp “O gol que Pelé não fez” disponível em: <https://www.fisicainterativa.com/cinematica-questoes-resolvidas/>. Acesso em 17 mar. 2023

ESPN. Ainda sem técnico, Brasil leva virada de Senegal e perde último amistoso antes das eliminatórias da Copa. 2023. Disponível em: [https://www.espn.com.br/futebol/selecao-brasileira/artigo/\\_/id/12216556/ainda-sem-tecnico-brasil-leva-virada-senegal-perde-ultimo-amistoso-antes-eliminotorias-copa](https://www.espn.com.br/futebol/selecao-brasileira/artigo/_/id/12216556/ainda-sem-tecnico-brasil-leva-virada-senegal-perde-ultimo-amistoso-antes-eliminotorias-copa). Acesso em: 13 jul. 2023.

BRASIL 2 X 4 SENEGAL | MELHORES MOMENTOS | AMISTOSO SELEÇÃO | ge.globo. S.I: Grupo Globo, 2023. Son. color. Disponível em: [https://www.youtube.com/watch?v=\\_REjaOdxczE](https://www.youtube.com/watch?v=_REjaOdxczE). Acesso em: 13 jul. 2023.

Phet Colorado. Disponível em: [https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion\\_en.html](https://phet.colorado.edu/sims/html/projectile-motion/latest/projectile-motion_en.html) Acesso em: 13 jul. 2023