

Catch the Balance: DIY toys for inquiry physics

Mirela Kaczmarek

Institute of Experimental Physics, University of Wrocław, Max Born Square 9, 50-204 Wrocław, Poland

Abstract During the workshop, participants will make their own physics toys to help build intuition related to learning physics, especially about mechanics and center of mass. They will also discover practical ways to use such toys at different stages of education to build engagement and interest in science subjects. Simple toys made from accessible materials are a pretext for teaching through inquiry.

Introduction

Toys accompany children from an early age and are a natural part of their childhood. There are a number of toys on the market that are advertised as educational toys to support a child's development at different levels, both physical and intellectual, tailored to the child's cognitive abilities at a particular stage of development. As the child develops, he or she also develops intuitions about how the world works through experience, understood in the broadest sense. At later stages of development, children go to school where they learn, among other things, laws and principles about how different parts of the world work.

Science subjects appear in different countries at different stages of education and take different forms, such as interdisciplinary STEM education or nature (in the Polish education system), and at later stages are more divided into, for example, physics, mathematics and chemistry. The use of toys in physics education, although not a new concept, still leaves a lot of room for new ways of using them. Especially when these toys can be built by the children themselves, allowing them to question and explore the principles of the toys themselves. This attractive form can be an experiment on specific physics topics.

The toys are also useful for teaching physics to students at the university and for popularisation demonstrations. At the Faculty of Physics and Astronomy, physics toys have been in the showcase for many years, delighting students during various demonstrations. They were made by one of the professors, Stanisław Sendek [1], and are an expression of his fascination with physics hidden in toys. Many of these toys are in the form of birds that work on the basis of various physical laws. They make interesting use of physical phenomena from mechanics, thermodynamics, electromagnetism and optics.

Toys in Teaching Physics

Physics toys are an important part of physics education and can be used to demonstrate various physical phenomena from different areas such as mechanics, thermodynamics and others [1,2]. They can also be used as a the basis for scientific inquiry [3]. Although the use of toys is considered appropriate in the early stages of education and childhood, they can also serve to increase the interest and involvement of students in high school education [4]. Making their own toy allows students to better understand the principles of the toy, especially when the toy does not work properly.

Balancing bird and other toys - DIY, a basis for inquiry

At the beginning of the workshop, several of Professor Sendecki's toys will be shown. As these are more sophisticated constructions, they can provide inspiration for more complex student projects or motivation for the teacher to develop his or her passion.

As the resources available in schools are usually limited for the widespread use of toys and their construction in the classroom, the main part of the workshop will focus on simple physical toys and their use in the learning process. The workshop was inspired by the search for simple physics toys that can be built by children themselves to explore the principles of physics. The use of toys also makes it possible to increase interest in science subjects and build positive associations even in the early stages of education.

Two main toy proposals will be built as part of the workshop: a balancing bird, which is a classic, well-known toy, this time made from the author's proposed materials (Figure 1), and a bird that lifts its head by using buoyancy. The second toy is inspired by Professor Sendecki's collection (Figure 2).

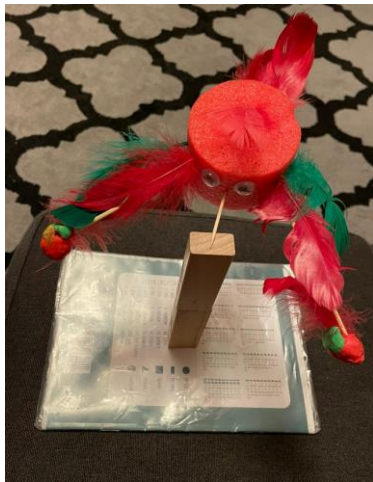


Figure 1: Balancing bird



Figure 2: Bird raising its head [1]

During the workshop, participants will build simple toys and learn how to use the working method in physics and STEM lessons. They will also be introduced to the possibilities of using these toys in inquiry-based learning. The materials presented in the workshop can be used at both the elementary and high school levels. The workshop will conclude with a discussion and exchange of experiences on the use of toys in physics education, as well as an exchange of good practices and ideas between participants.

References

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