FISIDABO Project: Bringing Science to TIBIDABO Amusement Park

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Abstract. An amusement park is a giant physics laboratory where Newton laws come to live in a very intense way. Taking advantage of this fact we have developed an educative project in Barcelona's amusement park TIBIDABO to bring science in general, and specifically physics, to young students and to the general public. Under the generic name FISIDABO we have developed a series of activities that are targeted to different publics:

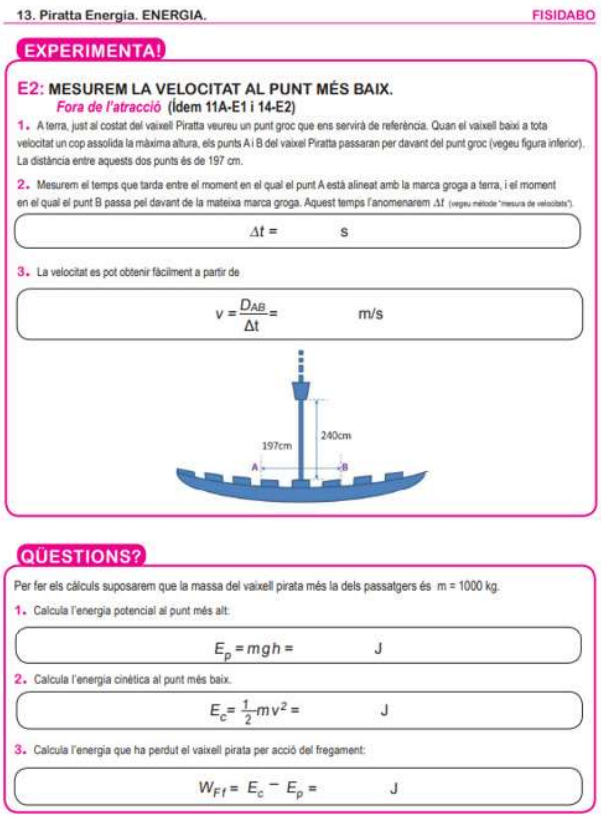
- **FISIDABO 2K**: is dedicated to 15-18 years old students that perform a series of experiments in the amusement park.
- **FISIDABO formació**: teachers are taught how to use the sensors of the mobile phone to teach physics in the classroom… and also in the amusement park.

Figure 1. Performance in FISIDABO LabShow: physics and music

- **FISIDABO HIPATIA**: is dedicated to highly talented students, also 15-18 years old, that bring their own experiments to TIBIDABO.
- **FISIDABO LabShow**: are a series of scienticfic shows open to all the visitors of the amusement park.

  FISIDABO Experimenta!: has been created to reach little scientists that are visiting the amusement park.

FISIDABO 2K: TIBIDABO amusement park is closed one day to visitors and dedicated exclusively for two thousand students that will perform several physics experients in the amusement park during one morning. Most of the experiments are performed using the sensors of the mobile phone: students can record the acceleration of the rides or calculate velocities and trajectories analyzing the videos, using different mobile phone apps. All the experiments are designed to be performed in the amusement park, but data can be exported to perform a deepeer analysis of their results in the classroom. The experiments are clearly explained in a series of documents that can be downloaded for free from our web page [1].


13. Piratta Energia. ENERGIA. FISIDABO

EXPERIMENTA!

E2: MESUREM LA VELOCITAT AL PUNT MÉS BAIX.
Fora de l'atracció (Idem 11A-E1 i 14-E2)

1. A terra, just al costat del vaixell Piratta veureu un punt groc que ens servirà de referència. Quan el vaixell baixi a tota velocitat un cop assolida la màxima altura, els punts A i B del vaixell Piratta passaran per davant del punt groc (vegeu figura inferior). La distància entre aquests dos punts és de 197 cm.

2. Mesurem el temps que tarda entre el moment en el qual el punt A està alineat amb la marca groga a terra, i el moment en el qual el punt B passa pel davant de la mateixa marca groga. Aquest temps l'anomenarem Δt (vegeu mètode "mesura de velocitats").

$\Delta t =$ s

3. La velocitat es pot obtenir fàcilment a partir de

$v = \frac{D_{AB}}{\Delta t} =$ m/s

QÜESTIONS?

Per fer els càlculs suposarem que la massa del vaixell pirata més la dels passatgers és m = 1000 kg.

1. Calcula l'energia potencial al punt més alt:

$E_p = mgh =$ J

2. Calcula l'energia cinètica al punt més baix.

$E_c = \frac{1}{2}mv^2 =$ J

3. Calcula l'energia que ha perdut el vaixell pirata per acció del fregament:

$W_{Ff} = E_c - E_p =$ J

Figure 2. Example of experimental sheet

More invisible but also (even) more important is **FISIDABO formació** [2]. This is an open activity for teachers in which we explain how to perform physics experiments in the classroom

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with the help of the mobile phone. One objective is to teach teachers how to use the apps used in FISIDABO 2K. The main goal is, though, to provide them with a set of “stand alone” experiments that can be performed in the classroom, and that are freely accessible in our web page.

Figure 3. Teachers ready to measure acceleration

The activity **FISIDABO Hipàtia** [3] takes place the same day than FISIDABO 2K in the evening. In this case highly talented students bring *their own experiments* to the amusement park. We must point out that the experiments are designed and built by the students. The results of some of the experiments have been published in the peer reviewed journal European Journal of Physics [4-6].

Although engaging students in science is the main gol of our project, it must not be forgotten that the seed of the interest in the STEM areas must be planted well before the students have to choose their studies. For this reason, we have two activities dedicated to the general public, specifically to small boys and girls.

Fisidabo LabShow [7] consists on a series of scientific shows peformed in the amusement area accessible to everybody (public does not have to pay to see the show). The shows want to be a true scientific performance leaving behind an increasing trend of designing scientific events in which experiments and spectacularity are ruling the script, instead of a scientific idea or concept. We have performed different shows but, as an example, we would like to highlight the one mixing physics and the music of a (live) Dixie Big Band and also the one about brain and perception performed by neuro-scientists.

Finally, we have just started a new project called **FISIDABO experimenta!** We would like that visitors that are queuing use their (otherwise wasted) time to perform some simple experiences by looking at the rides. This is done by scanning a QR that is found in the queues, that directs to a video in which the experiment is explained. The target audience for the video are children in primary school.

Once the experiment is done, measured data can be uploaded in a web-page from the university. This is important to convey the idea that science is a collective process. Data is also “open access” and can be downloaded from the same web page.

All in all, we think that, together with the proactive workers and administration of the amusement park, we have created a whole educative project accessing a whole range of public that (to the best of our knowledge) is unique. Although some amusement parks do allow students to make physics experiments and do have some educational activities, in our case we have created a whole project to be reached by students, teachers and the general public involving them in shows and experiments that can be performed by everybody.

Figure 4. FISIDABO Hipatia experiment: studying the effects of microgravity

Keywords. Mobile Phone, Digital Learning, Amusement Park, Physics, Maths.

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