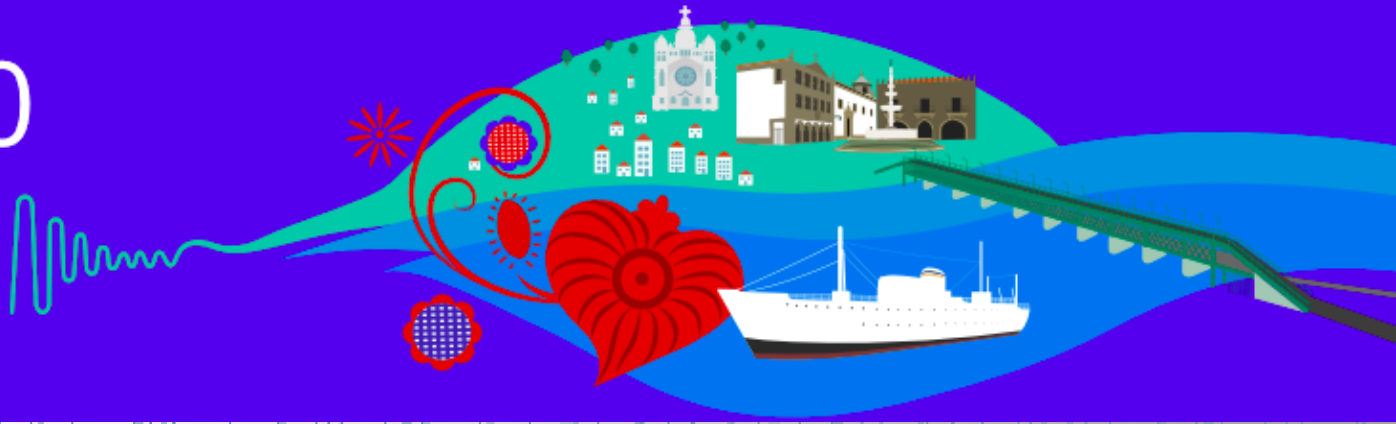
HSCI2020

Viana do Castelo
Portugal
13-17 July 2020



Physics and Math Integration using Digital Tools

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Our Background

Some distancies:

- Belo Horizonte to Timóteo

~ 200 km

- Belo Horizonte to Rio de Janeiro

~ 440 km

- Belo Horizonte to São Paulo

~ 590 km

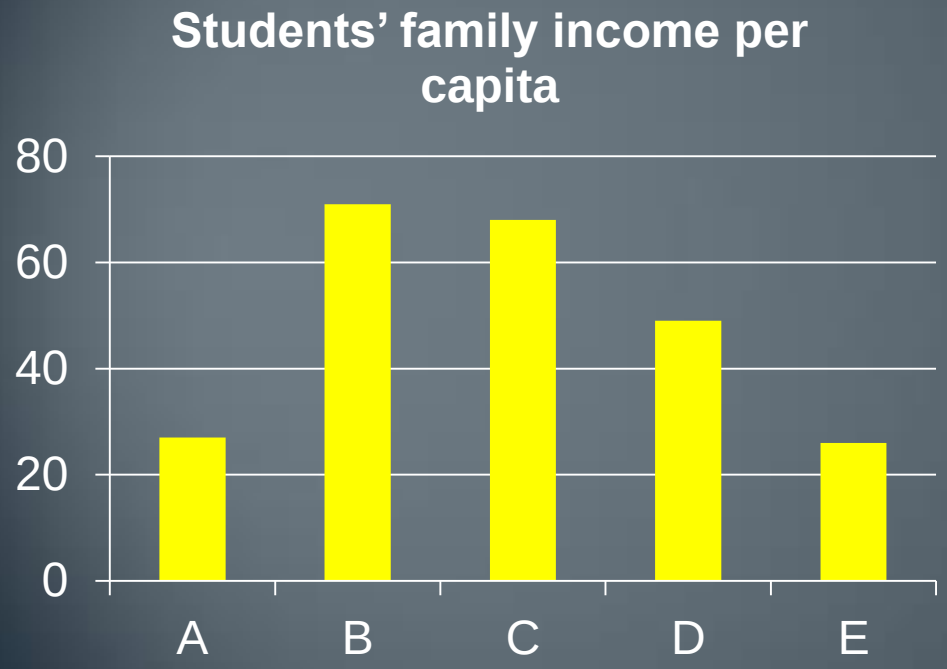
Our Background

Our Background

- 53 % of our students come from government funding schools
- About 38% of students need some financial support
- The monthly mean income for their families is about R$ 500 per capita (€84)*
- This low income is related with poor education and high rates of reading and mathematical illiteracy of entering students

* Minimum wage in Brazil is about R$1000 (€167)

Our Background



Category	Income per capita
A	€ 24
B	€ 52
C	€ 86
D	€ 121
E	€ 152

Mathematical Illiteracy

- Math illiteracy, or innumeracy, is the “inability to deal comfortably with the fundamental notions of number and chance”

As seen in Innumeracy: Mathematical illiteracy and its consequences (2001)

Common mistakes and misconceptions:

$$x = \frac{1 + \cancel{2}\sqrt{3}}{\cancel{2}} = 1 + \sqrt{3}$$

$$x = x_0 + vt \quad \Leftrightarrow \quad y = Ax + b$$

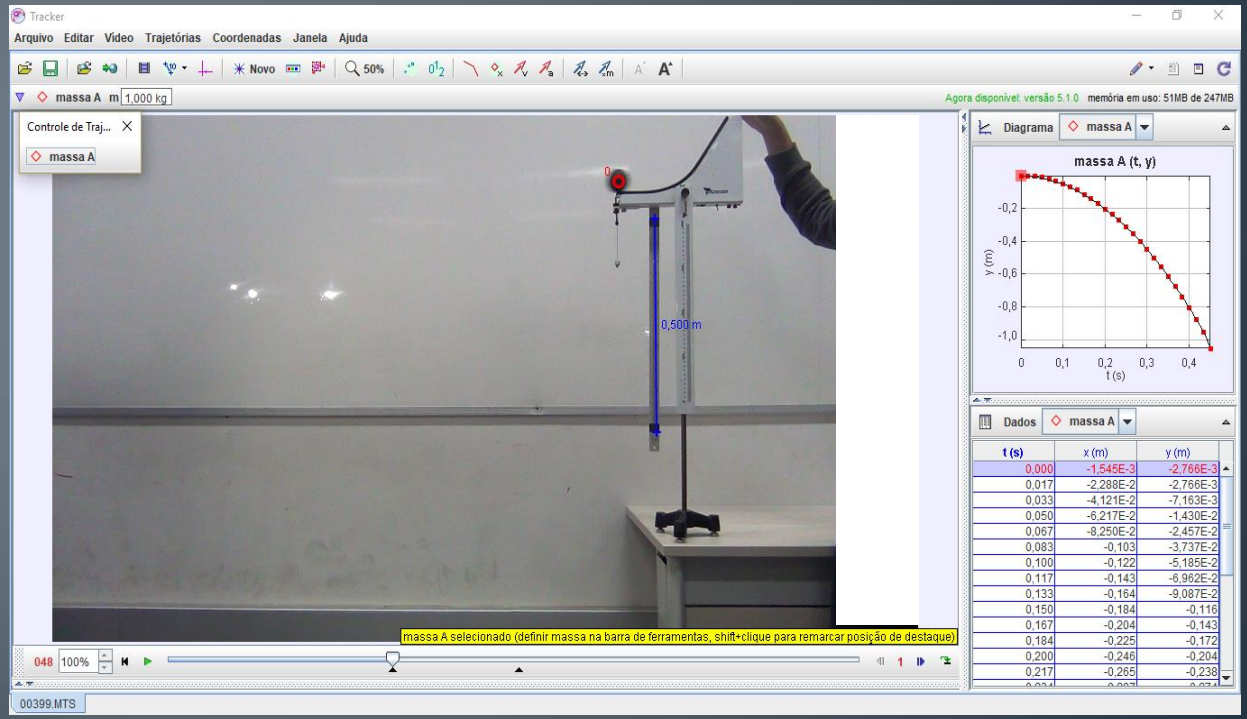
The Project

- Aims to work mathematical language with the concepts seen in physics
- Shows the interdependence between physics and mathematics
- Brings the experimentation into classroom with the use of DICTs (digital information and communications technologies)

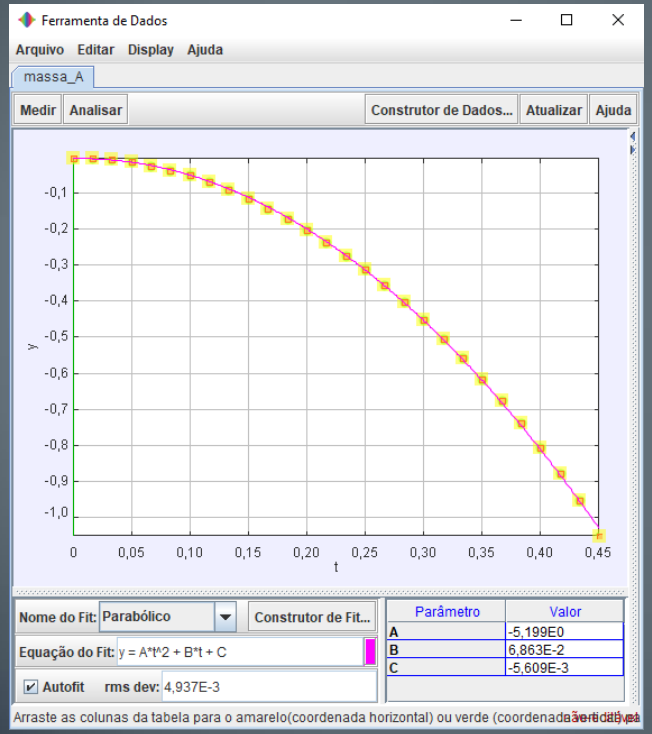
The Project

- It was performed in three consecutive years:
- In year one, the experiment was with a ball thrown horizontally from a slope;
- In the second year students used a game scene;
- And in the third year they recorded a chosen scene.

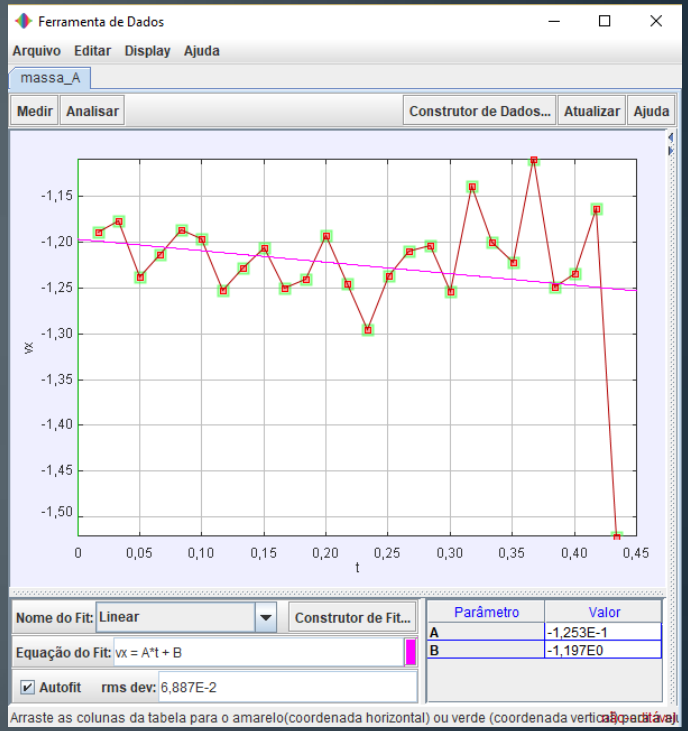
The Project: ball thrown horizontally



The Project: ball thrown horizontally

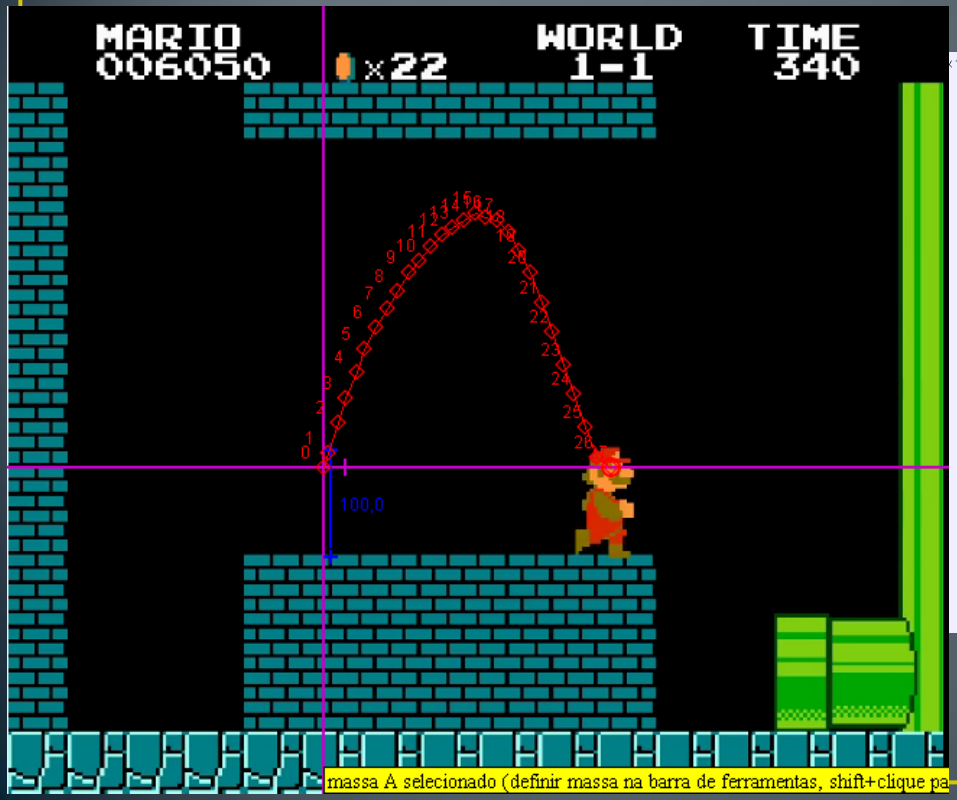


Time dependence of the vertical position

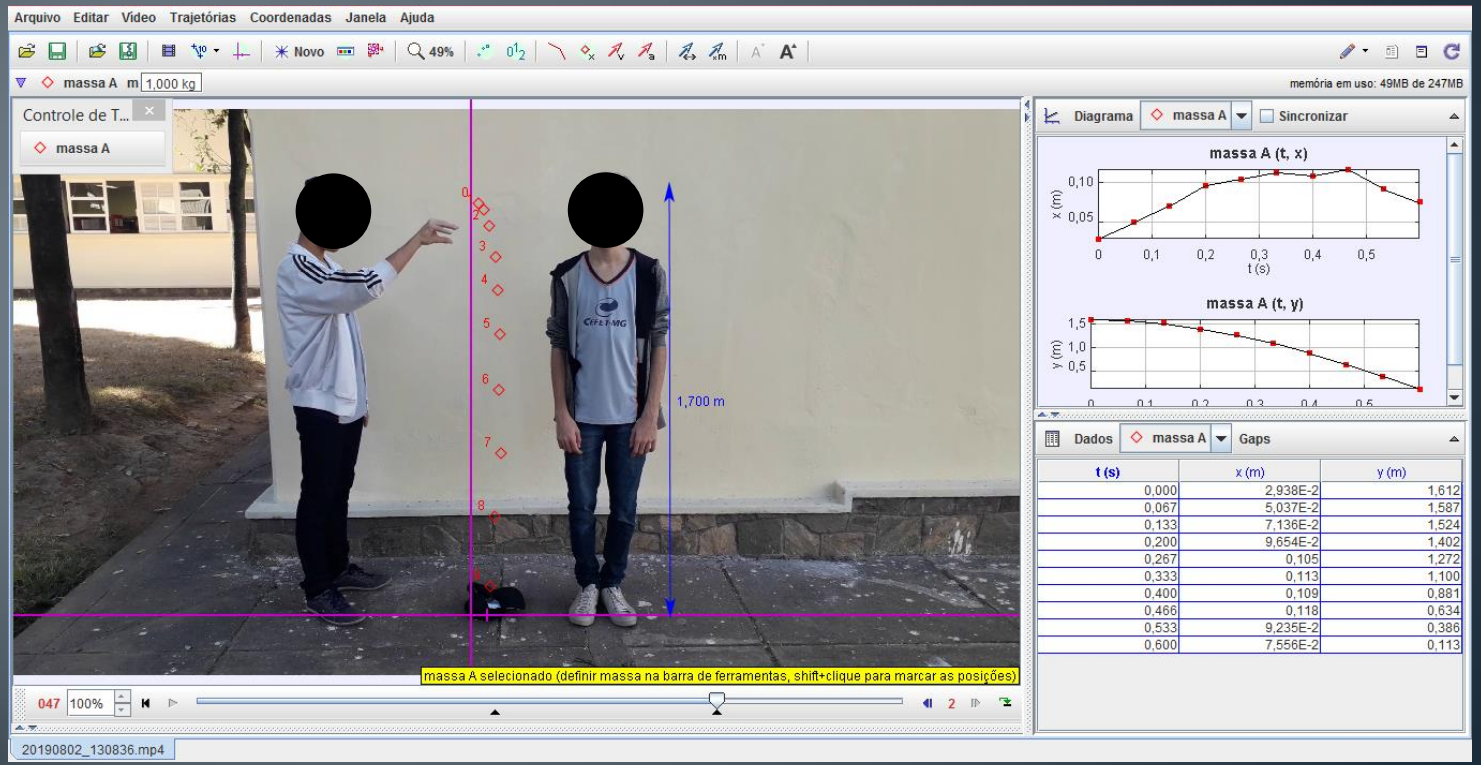


Time dependence of the horizontal velocity

The Project: game scene

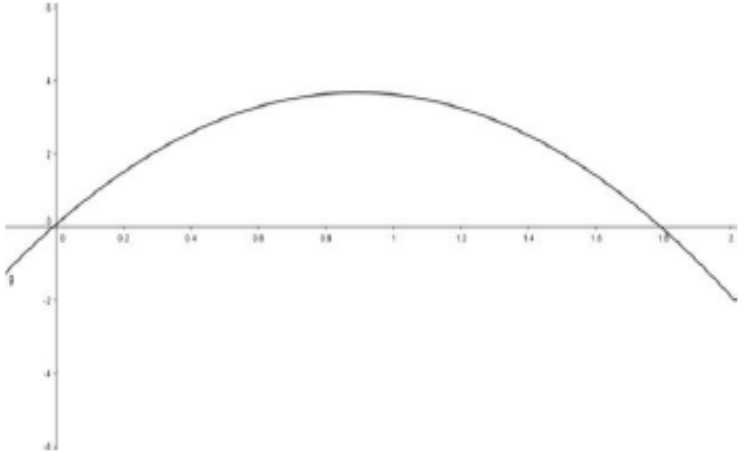


The Project: recorded scene



The Project: representation with Geogebra

A – Time dependence of the vertical position of a character of a game made via Tracker.

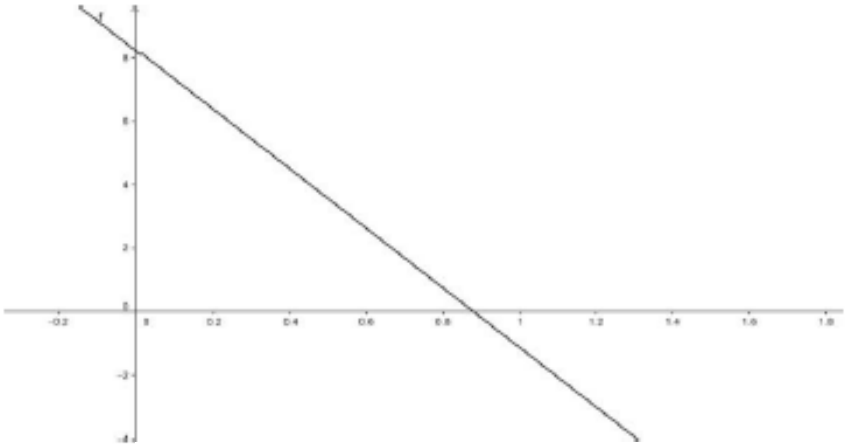


B – Plot of the movement in A, deduced by students using Geogebra.

The Project: representation with Geogebra

Fig3.Velocidade em Y do Tracker

C – Time dependence of the vertical velocity for the movement in A, using Tracker



D – Deduced curve of C using interpolation in Geogebra

Conclusions and Future

- The difference between the fit equations and the observed graphics stimulates a rich debate.
- Sometimes the games do not follow the physics law, which arises the discussion about reality and virtualized entertainment worlds.
- The experimentation, allied to simulation, engages the students in the comprehension of the phenomena, as compared with only conventional exercises.
- The results are presented in paper format, which assist their writing skills.

Conclusions and Future

- Evaluate the improvement of the students learning
- Develop specific students training in math and physics
- Start specific programs for math and physics collaborative teaching in basic education
- Select other software and apps that can be used in classroom

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Thank you