

T.I.M.E. Projects 2018-2019

[Highlight misconceptions in Physics, Maurizio Zani]

Final report, January 2019

Summary of the Project

This project aims at identifying, comparing and overcoming the most significant and widespread misconceptions shown by first-year university students enrolled for engineering, in relation to their basic knowledge of Physics, with specific reference to Mechanics, Thermodynamics and Electromagnetism.

Our project consists of three main stages which are closely connected with each other.

First of all, data about the above mentioned misconceptions are gathered by each technical institution through the use of an ad hoc test. Hence, every stakeholder classifies and arranges data according to the theme that they refer to: for instance, kinematics, heat engine, electric field, among others.

The second stage focuses on comparing and contrasting the misconceptions expressed by the students attending the different universities involved in the project. Among the most widespread and noteworthy mistaken ideas on some Physics topics highlighted, some misconceptions related to a specific heading are selected for the third step.

Throughout the third and final stage of our project, a trial video is developed to enable students to overcome these mistaken ideas on the specific heading being analysed. The educational video on physics phenomena related to these misconceptions plays a paramount role: not only are specific experiments videoed, but a physics professor illustrates them in order to highlight the reasons why misconceptions are based on faulty thinking.

Results of the Project

Firstly, data were gathered with relation to the possible courses in basic Physics involved in the research, with specific reference to their topics, number of students who might attend them, study course, number of sections at one time, professors involved and term.

Secondly, taking into account these data, the specific test was created, written in Italian, translated into English and further translated into Japanese and Russian. Moreover, it was administered to the students of the technical institutions involved in the research.

Thirdly, the mistaken ideas on those Physics topics expressed by the freshmen attending the different universities were compared and contrasted. Furthermore, some common misconceptions on static friction were selected as subjects of the educational trial video.

Fourthly, the following paper: *Matteo Bozzi, Patrizia Ghislandi, Gwenaëlle Guillerme, Maurizio Zani*; HIGHLIGHT MISCONCEPTIONS IN PHYSICS: A T.I.M.E. PROJECT has been accepted (oral presentation) in the INTED2019 Conference and it will be insert into the ISI Conference Proceedings Citation Index.

Finally, the material to develop and video the experiment on static friction was ordered in December, even though it will unfortunately be delivered only next February. **In order to record the video in the optimal condition, we ask to delay the contract for a couple of months.**

Target group/s and impact

Target group: first-year university students enrolled for engineering who are attending or will be attending a basic Physics course.

Expected impact:

- a) compared recognition of some student misconceptions about basic knowledge of Physics in

three rather heterogeneous educational and cultural environments: Italy, Japan and the Russian Federation;

- b) realisation of a trial video which will serve as a first model for the next series of videos characterised by the same format in order to allow the students to overcome their misconceptions; a subsequent check of the effectiveness of these videos is planned.

Sustainability of the programme

The programme covers completely the costs of data collection, their comparison and dissemination (conference and paper) and allows to purchase a small proportion of the devices which are necessary to record a trial video.

Project expenses

To date

- Devising and distributing tests in relation with the collection of data, plus secretary costs related to project management between partners: 2000 € for each university which takes part in the project, overall **8000 €**
- Attendance at the international conference INTED2019 (registration fee): **900 €**
- Purchase of an initial quantity of devices in order to record a trial video: **3000 €**

Future expenses

- Attendance at the international conference INTED2019 (room and board, transport and any other costs related to the conference): **1100 €**
- Scientific open access publication in an international specialised journal: **2000 €**

Members of the consortium

1. Politecnico di Milano [IT] (**Coordinator**)
2. Università degli Studi di Trento [IT]
3. Doshisha University [JAP]
4. Bauman Moscow State Technical University [RUS]

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