**AggiornaMenti: an INFN Project for the Education of Junior High School Science Teachers**

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### Background
- Junior high school (middle school) represents the weakest sector of the education system in Italy and perhaps in other countries.
- Science teachers usually do not receive specific training in physics.
- They tend to avoid addressing important aspects of physics.
- They usually use a traditional lecture approach.
- No practical and experimental activities are usually proposed to the students.
- Most schools have very little or no laboratory equipment.
- Laboratories are rarely used in the classroom.
- Science teachers usually do not receive specific training in physics.
- The students are rarely trained in the labs by the researchers.
- They are provided with a series of objects to be used in the classroom.
- They gain confidence in their own abilities.
- They change their teaching approach.
- The students discover how they can experiment with science and learn that physics enters every aspect of daily life.
- **Strongly disagree**
- **Strongly agree**

### Target
- **Direct target:** Middle school teachers.
- **Final target:** Students aged 11-13.
  - They make important choices for the rest of their life.
  - The discovery of science can have a strong social impact.
  - We turn to teachers to reach more students.
- **Strongly disagree**
- **Strongly agree**

### Methods
- **Experimental activities** which can be carried out in any context.
- Use of cheap materials which can be found at home.
- The teachers:
  - They are trained in the labs by the researchers.
  - They are provided with a series of objects to be used in the classroom.
  - They gain confidence in their own abilities.
  - They change their teaching approach.
- Students discover how they can experiment with science and learn that physics enters every aspect of daily life.
- **Strongly disagree**
- **Strongly agree**

### Collaborations
- The activities are carried on in close collaboration with Universities of Cagliari, Ferrara, Genova, Perugia, and Pisa.
- Fruitful collaborations with social and educational agencies have also been established: Fondazione Golinelli [www.fondazionegolinelli.it], Next-Level [www.next-level.it] and Laboratorio Scienza [www.laboratorioscienza.it]

### Editions
- Since 2018, AggiornaMenti has spread throughout Italy and today involves 10 local INFN sections.
- It is now a national project supported by the INFN third mission commission.

### Outcome
- So far, around 500 science teachers have attended our educational program.
- The practical activities covered many aspects of classical physics: mechanics, fluid dynamics, thermodynamics, acoustics, optics, electromagnetism... 
- During the pandemic, the activity was carried out mainly in an online format.
- Experiences linking physics with life and earth sciences have been proposed.
- From 2021 INFN-Ferrara offers an online programming school on Scratch and Arduino (about 30 participants / year).

### Feedback from the Teachers
- **Did you use the supplied material?**
  - **YES**
  - **NO**
  - **Strongly disagree**
  - **Strongly agree**
- **How many students have benefitted from this way of teaching?**
  - **<25**
  - **25-50**
  - **50-100**
  - **>100**
  - **Strongly disagree**
  - **Strongly agree**
- **Did you put into practice what you learnt in the course?**
  - **YES**
  - **NO**
  - **Strongly disagree**
  - **Strongly agree**
- **Have you changed the way you evaluate learning outcomes?**
  - **YES**
  - **NO**
  - **Strongly disagree**
  - **Strongly agree**
- **The course enabled me to carry out a “learning by doing” science lesson.**
  - **Strongly disagree**
  - **Strongly agree**
- **The students have appreciated this teaching method.**
  - **Strongly disagree**
  - **Strongly agree**
- **This new way of teaching science can influence the students’ choice of high school.**
  - **Strongly disagree**
  - **Strongly agree**
- **This approach has increased the participation of less interested students.**
  - **Strongly disagree**
  - **Strongly agree**
- **I would recommend the course to my colleagues.**
  - **Strongly disagree**
  - **Strongly agree**

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