# School-work experiences with Smartphone APPs

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**Abstract**. To promote students' working competences, an educational strategy, named "school-work integration" was implemented in Italian secondary school curricula. 17-18 y.o. students from 12 classes of three Scientific Lyceums were involved in a 200-hours activity during which they performed technical analysis of mobile APPs on sound, mechanics and spectroscopy providing technical reports and designing experiments. The aim is to go beyond the simple use of APPs in physics lab, creating an opportunity for students to re-elaborate their knowledge and offering them a working experience. Students' needs and difficulties are systematically monitored thanks to a tight cooperation between school and university.

## 1 Introduction and goals

In order to promote students' working competencies, autonomy in study and orienting skills, the Italian Ministry of Education introduced a mandatory school-work integration for students attending the last three years of secondary school [1] consisting in a 200-hours cooperation between school and employment reality. Public institutions, University in particular, are possible contexts for those kind of working experiences. Very often the opportunity is misinterpreted, and students are involved in teaching activities or passive employments: they are not asked to produce something new or to work on a project.

Our Physics Education Research Unit promotes Smartphone mobile APPs as a context to integrate new technologies in teaching/learning physics offering, at the same time, a working experience. Research in physics education can contribute to the design of such educational and formative modules focusing on a specific topic. In order to promote analysis of the technical charachteristics of different APPs, to stimulate students in working in a data collection plan for producing a significant technical and data reports, three different modules, centered on mechanics, sound and optics were designed and carried out with three Italian Scientific Lyceums of three different Italian cities.

## 2 Implementation of the modules

The focused topic was decided in a cooperation between the involved teachers and our research group. Research questions are:

1. How do students get engaged in preparing a manual on APPs for peers, identifying peculiar characteristics of the APPs?
2. How do students perform the tasks in order to analyze APPs?
3. How do students test the APPs, suggesting significant measurements and experiments?
4. How does technical lab work activate scholastic knowledge and in which measure does it play a role as a link between cultural and technical competences?

42 17-18 y.o. students from Scientific Lyceum Flaminio participated in the scholastic year 2016/17 to the "City Soundscape Project" wich aimed at collecting data of ambient noise making use of a specific APP sharing them on a cloud-based website [2]. The project was implemented in the curriculum according to the following stages: (a) introductive lessons at school on wave and sound phenomena; (b) intervention module on 4 APPs performing sound measurements and analysis; (c) individual technical exploration of every APP making use of a specific rubric; (d) encontered difficulties were discussed and guidelines for the designing of a

collective technical booklet were given; (e) data collection for the monitoring of ambient noise and performing of the planned experiments; (f) reports, analysis and discussion.

6 classes of 16-17 y.o. students form Scientific Lyceum da Vinci are involved in the scholastic year 2017/18 in the school-work integration module on mechanics. During the first plenary meeting, students are shown the functionalities of 7 different mobile APPs able to perform measures on mechanics discussing with them an overview of the possible experiments that could be performed. At the end of the activity, students were asked to prepare for the next session ideas for implementing the use of APPs in experimental activity, together with an individual study of the technical carachteristics, potentialities and limits of every APP. On the second meeting students shared and discussed in groups their experimental proposals. Guidelines for comparing different APPs and for designing a technical handbook were provided.

The school-work integration on spectroscopy involves 24 volunteers 17-18 y.o students from 4 classes of Scientific Lyceum Berto. The module consisted in an initial stage in which students are introduced in an interdisciplinary approach on the chosen topic, by means of the artifacts method: students are shown cheap spectroscopes and they are asked to infer the structure, the functioning accounting for the observations of different spectra. The aim is to guide them to the role of spectroscopy in physical analysis, in order to make them able to build their own spectroscope and perform simple quantitative measurements with the aid of a mobile APP and specific software for digital image analysis. Students are asked to prepare a short individual report on different kind of existing light sources and their functioning, allowing an analysis from a technological point of view, as well as the functioning of a spectroscope.

The outcome of every activity is the editing of a multimedial booklet contatining APPs technical review, a report on the experimental activities, physical and mathematical aspects.

## 3 Conclusions

Students individually designed a technical booklet describing 2-3 APPs, evidencing potentialities and limits and pointing out encountered difficulties. In this stage, students showed good critical skills and in several cases they enriched the analysis with tests and measures. Cooperative comparisons of those preliminary analysis did not produce richer outcomes, evidencing a poor ability in using individually-produced resources. Very rich, on the other hand, was the operative work of experimental data collection in group. (RQ1 and RQ2). In the majority of the cases, students made use of their studies on the involved topics designing experiments integrated in their curriculum; in other cases, explorations have been conducted on the internet in order to find original and unusual experiments (RQ3). Specific requests of building simple devices and analyzing APPs from a technical point of view guided students in revising studied contents and in designing experiments to be offered to their peers in order to enrich content knowledge as well as in giving them some instruction concerning the editing of a technical report. This task engaged students in focusing the important elements to be noticed and in deciding how to perform the analysis of the technical aspects. The discussion concerning which elements should be inserted in the report and how to describe them was very rich, starting from a research concerning modalities in which technical reports of lab equipment are structured (RQ4).

## References


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