

Helping teachers bring modern physics into the classroom: an example of collaboration between University and School

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Abstract. Creating a fertile space where University and School share knowledge and experiences is increasingly important, and teachers' professional development initiatives can be the right place to do it. For this reason, at the Department of Mathematics and Physics of Roma Tre University we realized a course on modern physics where, after a brief introduction to the main topics, participants were asked to design high school lessons complete with all the related teaching material, under the guidance of University tutors. Some of the produced materials have already been tested by the involved teachers or will be tested in the coming months.

1 Introduction

In recent years more and more efforts are made to introduce modern physics at pre-university levels, and thus give a more realistic and updated view of physics to high school students. In this context, Universities may play a key role in teachers' professional development on the most recent aspects of scientific research, and Physics Education Research can represent the driving force capable of nourishing not a mere passage of physics notions, but the cooperative development of teaching materials that can be immediately used in the classroom. The professional development courses usually offered by Universities to high school teachers - such as the many initiatives from the Italian/National PLS-Piano Lauree Scientifiche (plan for science degrees) [1,2] - can provide the environment in which teachers and researchers can meet, discuss and analyse the new concepts and the way of bringing them within the classrooms, thus building together that Pedagogical Content Knowledge so crucial to create effective teaching. Following this idea, at the Department of Mathematics and Physics of Roma Tre University we realized an online teachers' professional development course during which, after a brief introduction to the main topics treated, participants created themselves didactic materials concerning modern physics under the guidance and supervision of University tutors.

2 Results

The teachers' professional development course was held entirely online in the period October 2020 - January 2021 and involved about 50 high school teachers. We used Zoom for the online synchronous meetings during which all teachers and tutors could intervene like in a virtual classroom; moreover, a Moodle platform was used as a space in which to collect materials and share comments and ideas among participants. The course started with the presentation of a series of theoretical materials prepared by the Department that could be immediately used by teachers in their classrooms with their students. As participants already had basic knowledge of modern physics, these materials also served as a short theoretical review of the main concepts. In addition to these resources, we also shared with the teachers some more practical and laboratory proposals. For example, regarding Einstein's Relativity, we introduced a series of activities based on the use of the rubber sheet as a space-time simulator [3-5]. All the presented activities were discussed among participants, and their positive and negative aspects, together with and their feasibility at school, were evaluated. This initial phase thus also served to break the ice, start discussions, and create the group.

We then moved on to the most active work phase. Participants, divided into small groups of 3-4 people, began to autonomously work on a topic provided for by National Indications for high school, with the guidance of a University tutor. The aim was to design lessons complete with all the related teaching material: presentations, insights, bibliographies and laboratory sheets. Once a week a common virtual synchronous meeting updated everyone on the state of the work, and provided the opportunity to discuss limits, potential and possible improvements of the materials produced together with University staff. At the end of the course all the groups presented and shared the teaching materials they produced.

3 Conclusion

The teachers' professional development course we proposed was very well received by participants, as confirmed not only by evaluation questionnaires we administered, but also by the enthusiasm with which participants actively got involved in the work. At the end of the course a series of ready-to-use educational

materials on modern physics were produced combining teachers' educational experience with University expertise. Some of the materials have already been tested by participants with their students, but further tests will be carried out in the coming months.

References

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