

The educational role of a scientific museum: a case study

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Abstract. The purpose of this work is to present an ongoing physics education project based at the Museum of Physics of the University of Turin, whose goal is studying the educational significance of the history of physics. The major targets of this project are: compiling a census of the collections of instrument of historical-scientific interest preserved by a significant sample of schools in Piedmont, Italy; designing experimental activities rooted in the development of the physics instruments displayed in the Museum and in the school collections detected; finally, testing the efficacy of these activities.

1 Background

The Department of Physics hosts the Museum of Physics of the University of Turin, preserving a collection of about 1300 physics instruments, the oldest of them dating back to the early 1700s. Much of the oldest instruments now preserved by the Museum were acquired in 1829 by G.D. Botto, then Professor of Experimental Physics in Turin.

The historical collections preserved by University-based physics museums, such as the one the Museum of Physics in Turin, are usually made of instruments originally acquired for teaching *and* research. Yet, the sad state of affairs of most of these collections is that these instruments are by and large unused *neither* in research (a wholly understandable thing) *nor* in teaching (and this is far less understandable). This state of affairs is made even more sad by the growing awareness in the science education community of the science education functions of science museums [1][2] as well as of the advantages of introducing history of science topics into the teaching of science. [3][4]

2 The “Toward an integrated Museum of Physics” project

To partially reverse this state of affairs, we have launched a collaborative effort between Museum of Physics of the University of Turin and the old Cabinets of Physics of a significant sample of secondary schools in Turin and Cuneo provinces, in northwestern Italy. [5] It is our hope that this effort, which is part of the PhD project “Toward an integrated Museum of Physics”, will serve as a catalyst to the rescue, preservation and diffusion of the scientific heritage and can play a seminal role in transforming dusty and directionless sets of display cabinets into tools of education.

The project started with a census of the collections of physics instrument of historical-scientific interest preserved by the most ancient public and private secondary schools in the selected provinces. Out of this sample we have so far identified 17 nineteenth century classical lyceums and gymnasiums preserving significant collections of scientific instruments that were formerly part of the old Cabinets of Physics. These collections are very diversified in terms of size, state of conservation and degree of cataloguing.

The second part of the program is aimed at designing and testing experimental activities rooted in the development of the physics instruments displayed in this “integrated museum”, that is both in the Museum of Physics and in the collections detected by the census. In order to investigate the motivations that drive (or discourage) the choice of using the historical approach to introduce scientific themes and concepts, since Spring 2017 we have been

administering a questionnaire to the (mainly) secondary school in-service teachers participating to training seminars in physics education organized by the University of Turin.

The analysis of a first sample of questionnaires has shown a substantial agreement of the teachers involved in the administration with the view that it might be helpful to bring a historical approach to the normal disciplinary teaching. [6]

3 Experimental activities

The experimental activities are addressed to students and teachers from the schools identified by the census and participating to the project and are carried out both at the Museum of Physics and at the schools. The activities at the Museum include the administration of questionnaires on students' prior knowledge concerning the physics contents embodied in a given set of physics instruments; then, a number of hands-on activities with low-cost materials obtained by artifacts inspired on the historical instruments displayed are arranged in a specially dedicated laboratory of the Museum. Finally, the program includes a guided visit to the Museum with a focus on the scientific instruments previously addressed in the questionnaires and the hands-on activities.

The activities performed in the schools are largely dependent on the current state of organization of the local cabinets of physics, that is experimental activities inspired by the local collection when this one is relatively well surveyed and catalogued, or census of instruments and historical research on the physics behind the instruments when the collection has not yet reached an adequate level of organization. In both cases the students are expected to be active protagonists of the designed intervention.

4 Conclusion

So far, the project here discussed has revealed a number of interesting points. First, the census has evidenced a substantial heritage of historical scientific instruments of potential educational value. Second, the preliminary results of teachers' questionnaires suggest that the teachers more active in the in-service training activities do not question the validity of the historical approach but, rather, fear that factors like the lack of time or the lack of adequate preparation in the undergraduate years might compromise the outcome of this approach. Finally, the analysis of the educational significance of the experimental activities carried out in Museum and schools has yet to be probed in full since the project is still ongoing. The preliminary results, however, suggest that the history of physics plays a relevant motivational role in the physics learning.

References

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