INTRODUCING COMPUTATIONAL THINKING IN ITALIAN SCHOOLS: A FIRST REPORT ON "PROGRAMMA IL FUTURO" PROJECT

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Abstract

In the contemporary society, informatics plays a role similar to that played by mathematics in 19th and 20th centuries and the need of properly educating students in school to the scientific principles underlying information technologies is now widely recognized. In the spring of 2014 we decided with the Italian Ministry of Education, University, and Research to launch a project to change the way informatics is taught in primary and lower secondary Italian schools. We created a portal through which teachers could access the Code.org courseware and tools, and we produced additional material in Italian specifically designed. We framed the project to schools in term of learning "computational thinking", to de-emphasize the technical and technological aspects of coding in favour of the logical ones and presented them at the end of September 2014. The response has been enthusiastic: at the end of November 2014 we reached more than 5.000 registered teachers and we had more than 80.000 students completing at least one hour of code.

Keywords: Coding, computer science education, computational thinking, courseware.

1 INTRODUCTION

In the contemporary society, informatics plays a role similar to that played by mathematics in 19th and 20th centuries and the need of properly educating students in school to the scientific principles underlying information technologies is now widely recognized [1].

Currently, UK is the only European country where informatics is a mandatory subject for all schools, both primary and secondary ones. In the USA, few of the states had it in their curricula. To counter this situation, the no-profit organization Code.org launched in 2013 the "Hour of Code" project, with the initial goal of having each student in the world do at least one hour of programming and the final goal of having for each student a proper teaching in informatics.

The project is made up by a set of web-based tutorials, each of them composed by a variable number of stages, each organized as a series of 10 to 20 programming exercises. Tutorials are based on video games and cartoons characters, making them highly attractive to students. Students define their programs by combining visual blocks, much like it happens in Scratch. But differently from this platform, where the student is exposed since the beginning to the entire set of instructions, here the initial exercises are very trivial (e.g. have a bird move straight of 3 steps). The difficulty degree increases very slowly from one exercise to the next. A teacher is therefore able to follow her students during these tutorials with very little specific training in informatics.

This setting makes the "Hour of Code" project very well suited for a mass action in education, since being based on the support of only the local teacher it scales up seamlessly through the Internet. In 2013 alone, more than 40 million students did their first hour of code all around the world.

In March 2014 we agreed with the Italian Ministry of Education, University, and Research to use such a project to change the way informatics is taught in primary and lower secondary Italian schools. Our universities are members of a national consortium in Informatics, which was appointed the operating organization for the project, called "*Programma il Futuro*" (Program the Future), spanning 3 school-years.

For this goal we entirely translated the textual material of the tutorials, paying particular attention to scientific precision and consistency. We framed and presented the project to schools in term of learning "computational thinking", so as to de-emphasize the technical and technological aspects of coding.

We implemented a support site (http://programmailfuturo.it) to allow teachers and students to register to code.org directly through us, so as to give us the possibility of building an Italian community of users. Following a carefully designed communication plan, our site provides a comprehensive guide for teachers. Moreover, we implemented a forum, structured in a set of threads, some of general nature (e.g., how to manage a class) others focused on the various tutorials. These last ones are staffed with informatics teachers of higher secondary schools, that can thus provide a proper training feedback on questions relative to specific issues of those tutorials.

The response has been enthusiastic: in just two months since advising schools about the project existence we have obtained more than 5.000 registered teachers and we have had more than 80.000 students do at least one hour of code (http://italia.code.org). Real life experience are reported through the Facebook page of the project.

In the following of the paper we will report about the results and we will give a few reflections of what we believe is at the basis of this quite impressive success.

2 BRINGING CODING INTO ITALIAN SCHOOLS

Italy is a contradictory society with reference to technology and computers. On one side we have a very dynamic economy, where start-ups, SME and large enterprises are capable of creating an highly competitive ICT ecosystem. Universities and vocational schools contribute to the creation of a skilled workforce that is appreciated in Italy and abroad. On the other side we have a very traditional school system in which, aside for dedicated technical schools, there is no specific space for computer technology and programming competencies. In the past years we have had a few experiments to introduce computer science into the regular programs at the high-school level, but with very limited success, so that these attempts have been now cancelled.

In spite of this, or more probably to try to reverting this situation, in the recent years several attempts have been made to bring coding and computing back to students. These attempts, such as the CoderDojo movement, have been based on the idea that these competences can and must be thought externally, by means of coding events external to the official school program development.

However, in spite of a good educational and technological value of many of them, these attempts have failed to bring computing to the vast majority of Italian students, particularly at the primary and secondary school level, since they have been limited to community-based activities to be held after normal teaching hours.

Since in late 2013 the US no-profit organization Code.org was able to bring more than 40 million students by using a set of cleverly designed web-based tutorials we decided to try the same approach in Italy as well. Their tutorials are organized around a variable number of stages, each composed by a series of 10 to 20 programming exercises, each one accompanied with instructions, executed in the browser and providing immediate feedback to the student. Settings for the tutorials are based on video games and cartoons characters, making them highly attractive to students, which tend to consider them more as videogames than as studying material.

In each exercise students define their programs by combining visual blocks, much like it happens in Scratch. But differently from this platform, where the student is exposed since the beginning to the entire set of instructions, in the Code.org platform the initial exercises are very trivial (e.g. have a bird move straight of 3 steps). The difficulty degree increases very slowly from one exercise to the next. Students are therefore able to easily progress from one step to the following, and are able to learn keeping the pace better matching their needs. Moreover, since the overall plan of the tutorials and what to do at each step is defined in each detail, teachers do not generally require a specific training in informatics.

This approach made it ideal for a mass action in informatics education, as shown by the number of participation in US. Moreover, the running platform of Code.org courseware allows the translation of the textual material of the tutorials, allowing them to present it in the native language of students.

We were therefore able to convince the Italian Ministry of Education, University, and Research (MIUR) in March 2014 to start a trial project, named "*Programma il Futuro*" (Program the Future) in Italian schools using Code.org tools as instruments to teach the basics of informatics. At the same time we

signed an agreement with Code.org to become their “Chapter” for Italy, that is their unique coordinator and entry point for all activities going on in Italy.

3 PROGRAMMA IL FUTURO

The project “Programma il Futuro” has a span life of three years and is managed by CINI (Consorzio Interuniversitario Nazionale per l’Informatica), an Italian consortium of 39 universities doing teaching and research in Informatics and Informatics Engineering.

We proposed to schools, for the first year, the choice between following either a shorter 1-stage tutorial (Hour of Code) or a longer 10-stage one (K-8 Introductory Course). Each stage typically require 1 hour. The longer tutorial may be followed either in the standard interactive version, via Internet, or in an unplugged version, where students are led to work on the same set of concept by using paper, pencil and everyday objects.

The textual material was entirely translated and adapted, paying particular attention to scientific precision and consistency. The entire effort was presented to schools in terms of learning “computational thinking”, following the expression popularized by Jeannette Wing [2], so as to de-emphasize the technical and technological aspects of coding. On the other side, it has been stressed the cultural value of “computational thinking” as an ability useful to everybody in her working life, since everybody has to tackle and solve complex problems, to define solutions involving many stages and cooperation of many entities, to clearly describe what to do and when.

We prepared also a few ad-hoc video tutorials in Italian. We were not allowed to dub in Italian the standard video-tutorials accompanying the interactive and unplugged lessons, but we translated all their captions.

We implemented a support site (http://programmailfuturo.it), referred to by the Italian subdomain (http://italia.code.org) of code.org, to allow teachers and students a unique entry point to the project. This means teachers and students just register to our site, and our system (through a bridge we implemented ad hoc) register them to code.org. In such a way teacher and students avoid to go through two registration processes at two different sites (ours and code.org’s) and avoid to go through a registration process in a foreign language. Moreover, this approach give us the possibility of directly knowing who are the users going to use the code.org courseware and enable us to directly interact with them. Following a carefully designed communication plan, our site therefore provides a comprehensive guide for teachers to all steps both for registering and for using teaching material.

The main sections of our site (see Fig. 1) are:

- **Il progetto** – a general description of the project and its background, featuring also a constantly updated press review and press material
- **Chi** – a description of the various kind of supported users (teachers, students, others) and how they can benefit from the project
- **Perché** – a set of pages explaining the role and the importance of informatics in modern society and how computational thinking is an ability every person in the third millennium has to possess
- **Percorsi** – a description of the different ways of using teaching material available in the code.org courseware
- **Aiuto** – the help section, addressing to FAQs, forum and to the help forms
- **Partner** – the page acknowledging institutions supporting our project.

Figure 1. The web site of “Programma il Futuro” project.

Our site features also a set of FAQs, addressing more common problems, and we provide an help desk, accessible through a form on the site, providing e-mail assistance to answer and address specific problems.

Moreover, we implemented a forum, structured in a set of threads, some of general nature (e.g., how to manage a class) others focused on the various tutorials. Around this forum a community of interested teachers is born and is growing. The threads focused on specific tutorials are staffed with informatics teachers of higher secondary schools, that can thus provide a proper training feedback on questions relative to specific issues of those tutorials. These higher secondary schools teachers belong to the ANDINF association, one of the partners of our project.

The project runs on funds provided by the partners of the project (http://programmailfuturo.it/partner), a set of companies trusting in the importance of an initiative fundamental for cultural growth and economic development of Italian society.

We have also set up a Twitter account (https://twitter.com/ProgrammaFuturo), used to give update on the project, and a Facebook page (https://www.facebook.com/programmailfuturo) collecting first-hand accounts by the teachers participating to the project.

4 MEASURING THE IMPACT

The project was officially communicated to all Italian schools on September 23rd, calling for a first trial to be held during the European Code Week (http://codeweek.eu) held October 11-17, 2014. During that period a total of 3.451 users had registered to our support site (and through it to code.org). See Fig. 2 for their distribution according to their type.

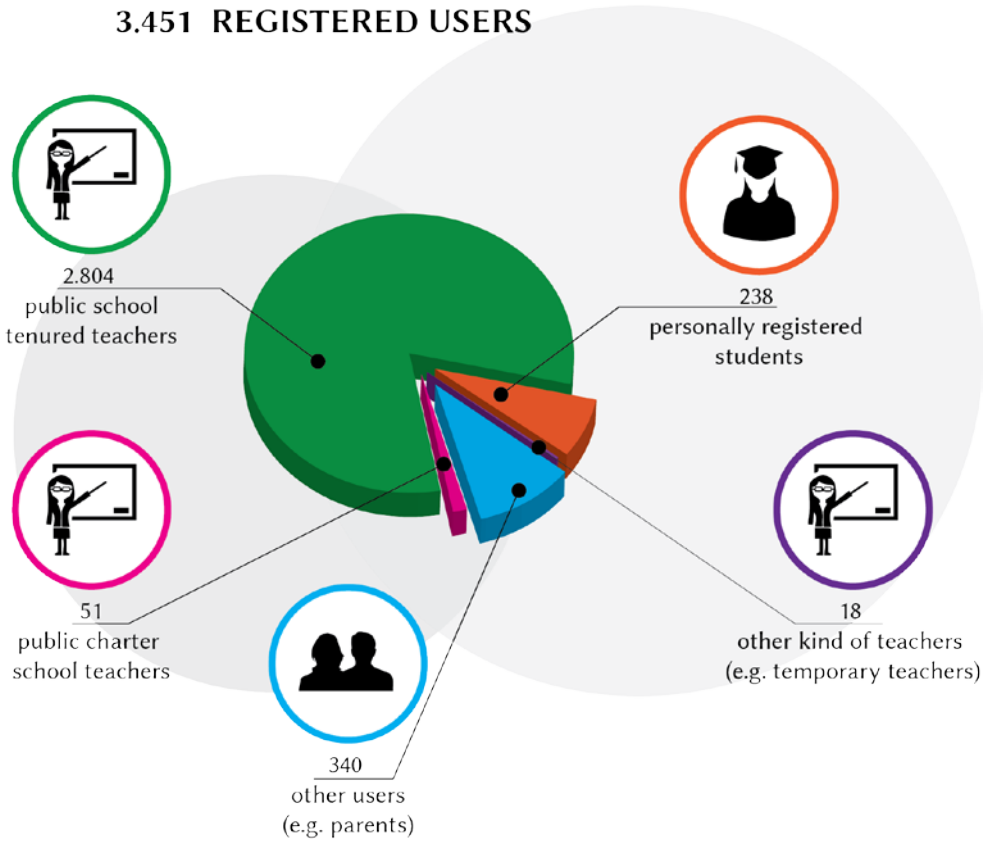

Figure 2. Registered users during the European Codeweek.

Their participation to the trial was large (see Fig. 3).

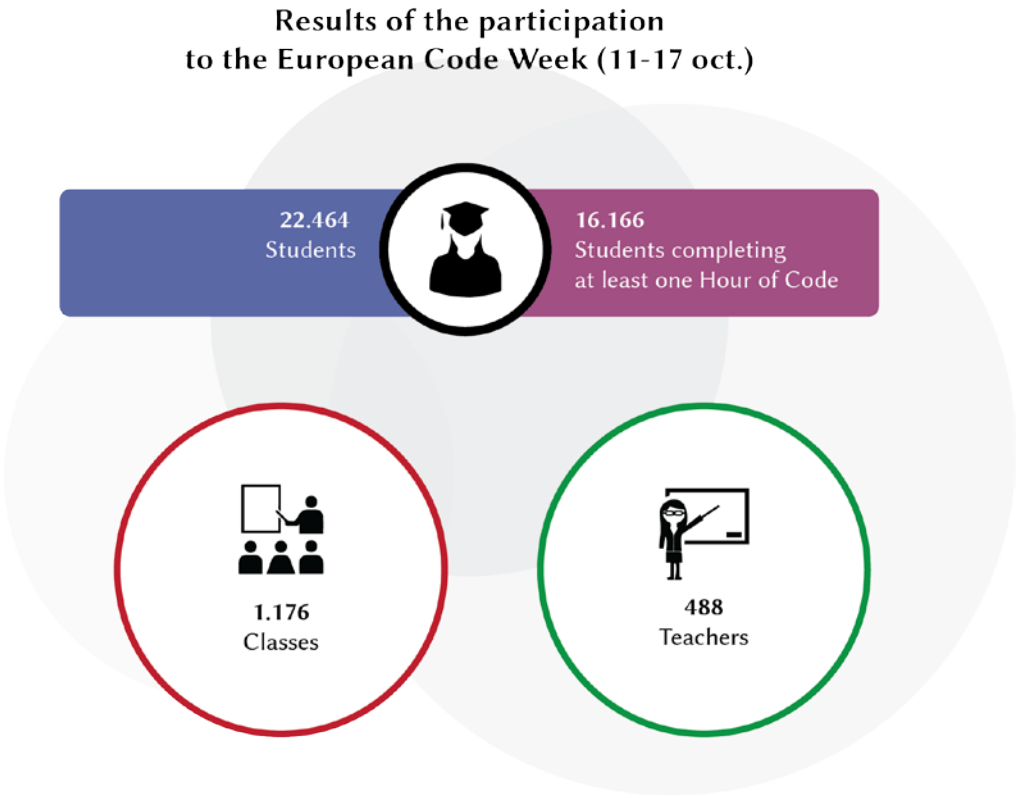

Figure 3. Registered users during the European Codeweek.

The overall evaluation of participating user was enthusiastic, as you can see in Fig. 4.

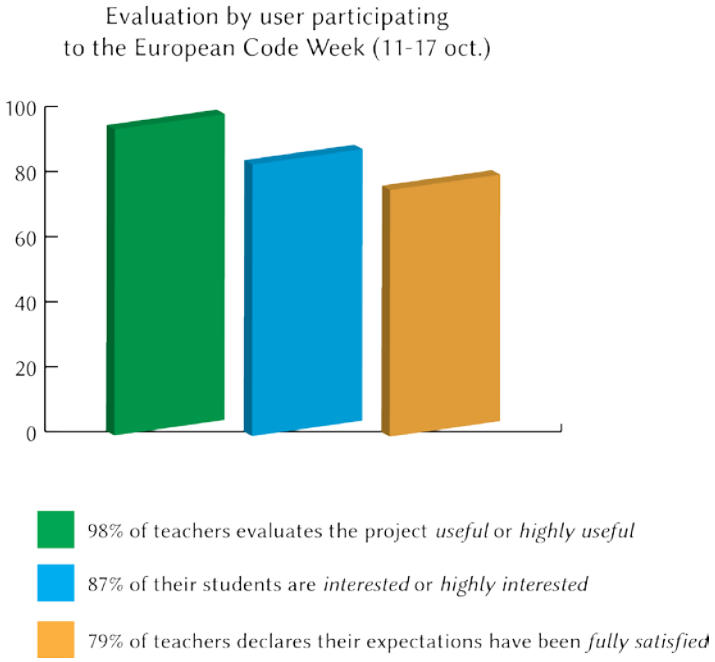

Figure 4. Evaluation of participating users during the European Codeweek.

At the end of November (two months after the start of the project) participation increased to more than 5.000 users (see Fig. 5).

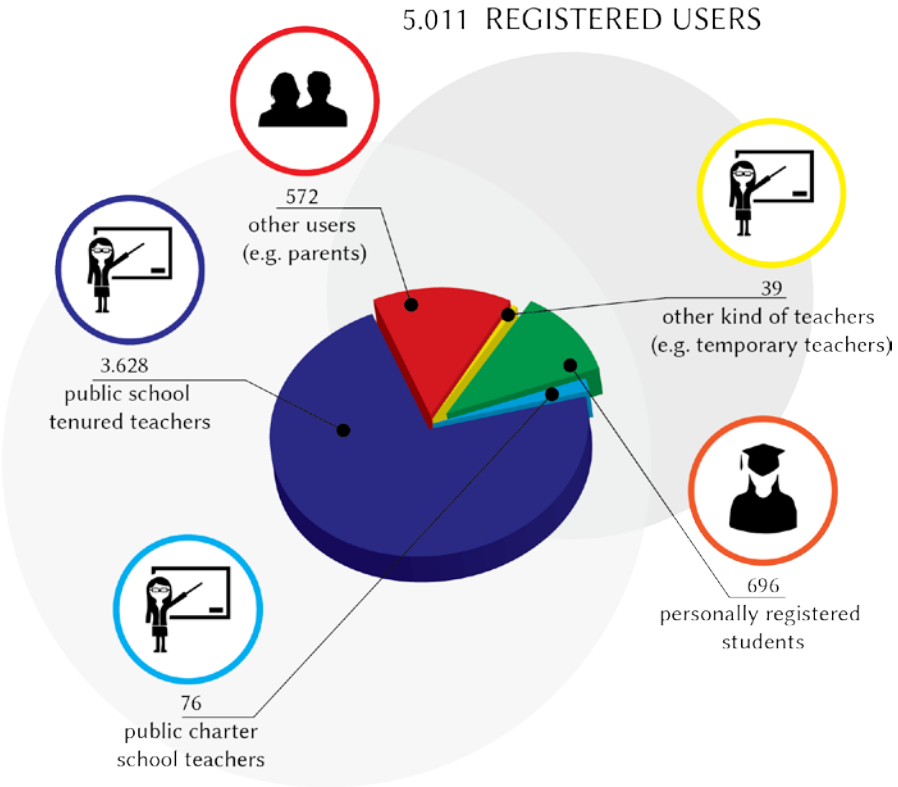

Figure 5. Registered users at the end of November 2014.

It is also interesting to have a look at the distribution of students participating to the European Codeweek by region (see Fig. 6)

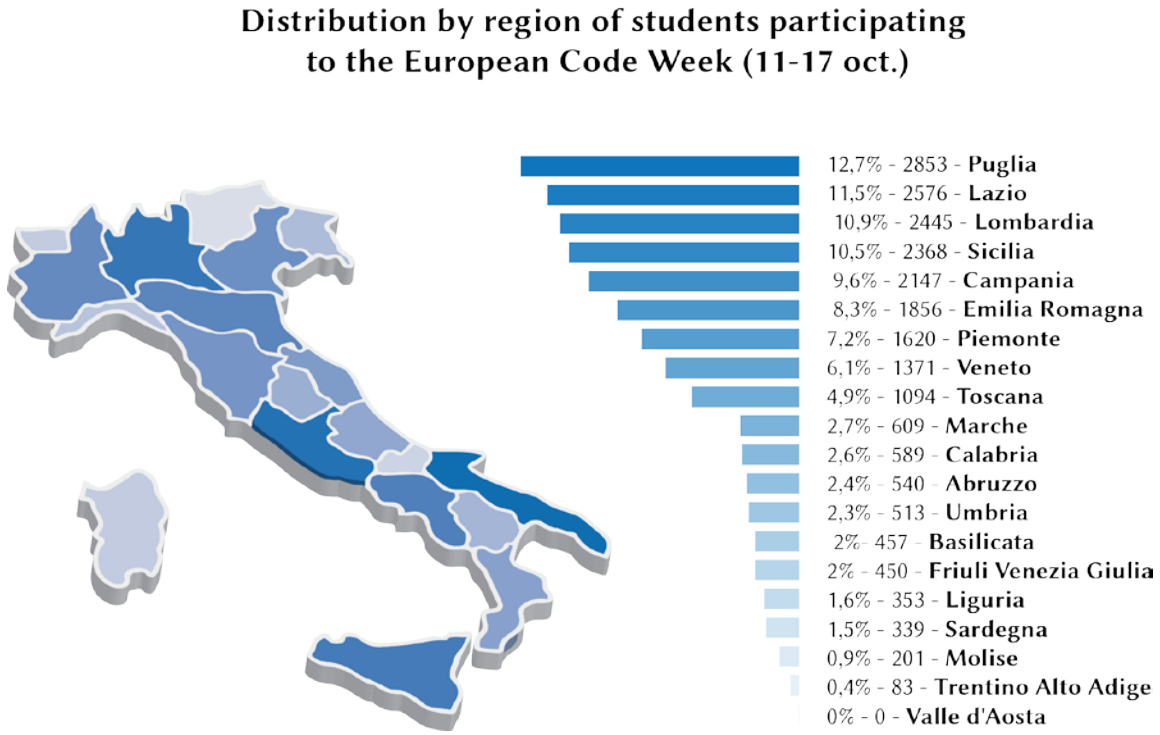

Figure 6. Distribution of participation by region.

The next big event for our project is the Hour of Code, in December 2014 where, on the basis of end of November data, we expect more than 3.900 teachers, 8.900 classes and 170.000 students involved (see Fig. 7).

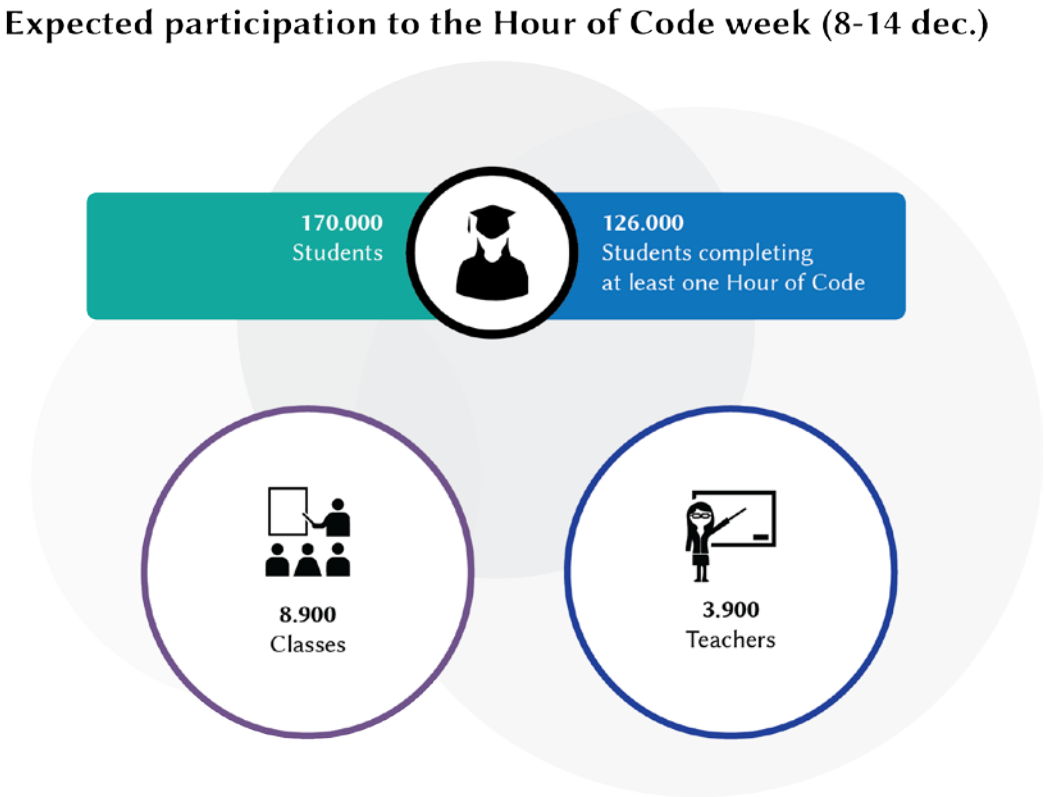

Figure 7. Expected participation for the Hour of Code 2014.

5 CONCLUSIONS

In this paper we have given a first account of the project “Programma il Futuro” aiming at introducing computational thinking in Italian schools. The very first months of the project have shown an enthusiastic participation to the activities. We look forward to report in a future paper on the outcome of next months of activity of the project.

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REFERENCES

[1] Informatics Europe and ACM Europe: “Informatics education: Europe cannot afford to miss the boat”, April 2013, http://www.informatics-europe.org/images/documents/informatics-education-europe-report.pdf

[2] Wing, J. (2006). Computational thinking. Comm. ACM 49(3), pp.33-35. http://www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf