Application to the Informatics Europe Best Practice Award 2017

Class'Code, France

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Abstract

Class'Code is an open participative solution from France to help teachers, educators and children activity organizers to introduce informatics to girls and boys.

Class'Code is a free innovative blended learning program that places computer science at the heart of our educational system; our goal is to train members of the educational & informatics communities to teach young people from 8 to 14 basic programming and computer science. This includes creative programming, information coding, familiarization with networks, fun robotics, and the related impacts of technology in our society. It will help familiarise our children with the concept of algorithms, computational thinking and thus have control over the digital world.

Since September 2016 the program has already reached 15.000 subscribers and around 3.200 learners are attending the meetings regularly setup by more than 40 structures all over France. All over France, our partners are encouraging a focused audience to join us at a local level. Class'Code is growing fast.

The Class'Code project is supported by both academic and industrial federations in computer science, led by the SIF (Société informatique de France) and managed by Inria (the French Research Institute in computer science and applied mathematics). Magic Makers is in charge of the pedagogy, Open Classrooms drives the production while the deployment on the territories is under the leadership of *Les Petits Débrouillards*.

1 Introduction

In 2013, the French *Académie des Sciences* released a document, titled "L'enseignement de l'informatique en France: il est urgent de ne plus attendre", which paved the route to the introduction of the teaching of informatics in France [L'A13].

This French manifesto was published as other organisations in the world were themselves putting forward the need to deal seriously with the issue of teaching informatics in schools [Eur15]. Some important guidelines set up by the *Conseil National du Numérique* [CNN14, CNN15] were present. More generally, the questions and ideas are global and both researchers and militants have analysed with care how policies have been changed and what the main arguments are toward this [FWC+16].

It was immediately identified that, at least in France, the crux would be in finding and/or training the teachers: up to then, any ambition policy-makers could have would be blocked by the lack of trained teachers; conversely, it seemed impossible or illogical to train the teachers given an empty curriculum.

As an answer to this chicken-and-egg question, the *Société informatique de France* (SIF) built a large consortium (see Fig. 1) to propose help towards forming educators and teachers to coding and computational thinking. This consortium won a grant in 2015, by the French funding scheme *Investissements d'Avenir*, which gave the means to launch project Class'Code [Cla15]. The consortium was led by Inria and comprised 16 organisations: Universities, industry representations, popular education actors, two regions and some companies whose know-how in MOOCs or in addressing the teaching of code to children was to be an important asset to the project.

During the next few months Class'Code received further support from actors representing the informatics industry, universities and research teams, fablabs, local and nationwide community organisations... (see Fig. 2).

Figure 1: The initial consortium

Figure 2: Organizations supporting Class'Code

In a nutshell, Class'Code has the ambition is to help train teachers and educators, through the conjunction of:

- MOOCs prepared specifically to introduce different aspects of informatics: coding, data, networks, project management, robotics. Each MOOC represents a three week course and requires 10 to 20 hours of individual work. The pedagogical team is directed by Magic Makers, a small company who has acquired a strong experience at teaching code to the children. The MOOCs are realised and run by OpenClassrooms, a key European actor in MOOCs and on-line education.
- An internet platform with, progressively, the features of a social network for learning together. It combines the possibilities of publishing and sharing resources of a content man-

agement system with innovative features in digital pedagogy. Indeed, in order to fight some of the negative effects of MOOCs, this platform allows the different actors and participants of Class'Code to easily meet and exchange in real life, using simple but effective web interfaces. Developments are made iteratively in agile mode, and new features continue to be deployed on the platform every month, depending on the needs expressed by the users. It is a successful co-construction experience.

- A global network involving many actors spread out over all of France: coordinators in each region are to help solve the many local questions which arise daily, with the help of members of the many supporting organisations. *Les petits débrouillards*, a nationwide community association has led the different initiatives toward creating a global network. The platform has a double front-end in order to both serve as a resources platform (`pixees.fr`) and a learning platform (`classcode.fr`) with a common back-office and infrastructure, this mutualization allowing us to optimize the human resources serving the project.

- The capacity of getting the contribution of all the actors who wish to participate: if the choice was to build an initial large consortium, which has risen in size since, this was not just to show that so many people agree on the importance of teaching informatics. This was also to ensure that the relay points existed everywhere capable of disseminating. More importantly, Class'Code faced the problem of the lack of first generation teachers (ie those capable of teaching the next generation) by developing the concept of *facilitators*: informatics professionals prepared to give a hand by intervening locally during the reunions (called *temps de rencontre*) and helping in many ways the teachers and educators.

The project was launched in September 2015, ran its tests during the spring 2016 and has been open to the public since October 2016.

Class'Code is supported under the PIA (*Programme Investissements d'Avenir*), following the call for projects "Culture of Innovation and Entrepreneurship" launched under the National Innovation Fund. This action is managed by the *Caisse des Dépôts* on behalf of the French State with the assistance and follow-up of the *Commissariat Général à l'Investissement* and the Ministries responsible for the National Education, Higher Education and Research and the Economy, Industry and Digital.

The official Class'Code web-page (`https://classcode.fr`) is the entry point for the general public, for those who want to learn, to find resources, to contribute by organizing sessions or becoming *facilitators*.

The project web-page (`https://project.inria.fr/classcode/`) contains the documentation relevant to the project, the media coverage elements, the different articles and communications, the position papers.

2 Names and addresses of the applicants

The application is written on behalf of the Class'Code consortium.
`https://project.inria.fr/classcode/classcode-qui-fait-quoi/`

3 Description of the achievements

Class'Code has to address a very global question involving many interlinked aspects. Even if Class'Code works in partnership with other projects, it has to address pedagogical concerns, research concerns, political concerns...

For example, in order to be accessed by schoolteachers, it has been necessary to fully understand their background, the way their training works; be present at many meetings at ministry level, but also at regional and local level (there is –perhaps to our surprise– a high level of autonomy in decision making in the *Education Nationale*, who employs more than 1 million persons); think the pedagogical material with these audiences in mind; make the right technological decisions allowing to ensure the type of openness we desire and at the same time safeguard the privacy of the learners, develop new activities for our *temps de rencontre*, convince the school inspectors that they should

help by allowing the teachers to attend these *temps de rencontre* inside their school hours, be present at events involving teachers, librarians, parents, politicians, media, associations,...

In order to deal with the complexity of the situation, the variety of points of view and to attempt to steer a straight course, Class'Code defined early (in the document https://project.inria.fr/classcode/classcode-ses-valeurs/) four shared values:

1. Using code as a starting point to (computer) science, technology and society,
2. Territorial equity, ie. the fact that a learner in a small remote village should be able to learn in similar conditions as one in a big city;
3. Reinforcing innovative pedagogical practices at a community level, ie. attempting to promote learning as a local social practice;
4. Taking gender issues seriously.

For these values to be defended we put forward three levers:

1. Usage and production of Open Educational Resources (OER),
2. The support of the Informatics community,
3. Research.

The ambitions of Class'Code, the values and the levers all define the project.

3.1 Pedagogical achievements

In 2015, Class'Code had to decide upon its pedagogical commitments before the Ministry of Education produced its own guidelines.

- 5 MOOCs have been produced (see Section 5.1 for details): these contain many videos. The production required the work of two different teams: the first, operational, prepared the proposal. A second circle, comprising the representative of various partners, was encouraged to work on this material, intervene, propose corrections, etc. This organization allowed to create a form of unity around the pedagogical choices which were made.
- New activities have been created, corresponding to the choice of producing blended MOOCs. The purpose of these is to provide sister activities which can be run during the *temps de rencontre*; these activities should be accessible to all, even in unfriendly environments (insufficient number of computers, no wifi, no informatics professional to serve as facilitator). These activities were tested during the spring of 2016 with, in each case, a neutral observer documenting the sessions and allowing a thorough analysis to be made.
- Additional resources have been added. These are being collected on the Pixees website. It should be noted that by providing all its pedagogical material as OER (Open Educational Resources), Class'Code has encouraged other players to also share their courseware.

Some pedagogic choices

The MOOCs have been designed by a team led by Magic Makers. Magic Makers has been been a pioneer in teaching children creative computing in France since 2013 with a constructionist approach : teaching computational thinking through experimentation.
The choices has been largely supported by other experienced actors in teaching code, computational thinking and digital activities to children.
The MOOC design has relied on 4 strong educational principles:

1. *"I understand by experimenting and creating"*. Simple and reproducible activities are supplied to enable learners to experiment creating their first programming projects.

2. *"I put things into perspective and I ask myself « How »"*. Learners take some time to ponder and understand the computational concept they have handled when experimenting. Specially designed content helps them relate those concepts to a historical and social perspective.

   Unplugged activities are also introduced as a great way to support computational concept grasping [BWF+15].

3. *"How can I teach children, with and and without computer?"* Learners work on how to reuse and adapt activities to their own teaching context, designing their own teaching strategy for computational thinking.

4. *"I share with the community"*. Learners are encouraged to share their questions, difficulties and achievements with other learner in real life meet-ups, thus creating local educational helping communities.

   This approach has been inspired by the work of the Lifelong Kindergarten team from the Media Lab, creators of `Scratch`, an online tool to learn coding.

These choices are apparent when consulting the web-pages of Class'Code (see Table 1) or the different textbooks authors of Class'Code material have produced recently [KTC16, CHW16].

3.2 Training achievements

The MOOCs have not only been produced, they are being run, every day. Teachers are being trained, successfully, either in formal training programmes organised, approved by the different regional organisations (*Rectorats*) or more informally when a teacher chooses to do this on her spare time https://pixees.fr/classcode/accueil/aide/je-veux-venir-me-former/.

Teachers and Educators

In the French system (as in April 2017), the question of teaching code (or informatics) is addressed both by the schools and the councils. The councils are in charge of the extracurricular activities, ie activities organised out of school times under the responsibility of the councils.
This introduces a number of opportunities (use competencies outside the formal education world) but also difficulties (how to avoid the schoolteacher being left in a difficult position if the exciting stuff is done out of school?).
Class'Code works towards both these audiences by trying to form the teachers and the education professionals who work in the context of the extracurricular activities.

3.3 Dissemination achievements

In the first months it became rapidly clear that Class'Code was not necessarily in conquered ground. In several ways, the answers provided by Class'Code corresponded to questions which were not even raised yet!

For the general public, it was not even clear that the topic (informatics) needed to be studied. The keyword was something called *Le Numérique* which was a generic term used by politicians, the media, and also the producers of hardware which may be sold to the schools. Class'Code did have an answer: "Informatics", but the question ("What should be taught?") wasn't really posed.

Furthermore, Class'Code gives an answer requiring training the teachers. But this answer may not suit policy makers: both time and money are needed for teacher training.

Another obstacle is that Class'Code's solution was not orthodox. The free OER proposal is thus somehow too novel for the policy makers.

These issues meant that part of the activities supported by Class'Code, during the first few months, have concerned attending meetings, giving talks, proposing Class'Code activities in forums, conferences, workshops. The goal being to be accepted as a possible answer to a question which was taking form (see Section 5.3 for numbers and some examples of events).

Therefore, participating (and often co-organizing) these events obeys to a number of reasons:

- building the notion that anyone can train, participate, whether as a teacher wanting to learn about code and computational thinking or as a computing professional wanting to learn how to teach it to children and help the teachers do this;
- convincing policy-makers that they should make room for the training of their staff with Class'Code;
- testing the pedagogical material in a variety of settings;
- relating Class'Codes with projects and initiatives in France and outside France.

3.4 Innovation achievements

When launching the project, in 2015, the problems which required attention were quite new: how to form, cheaply, hundreds of thousands of teachers to technology and science, when their background is usually in humanities, and with the right ambition?

To our knowledge, the situation in France was sufficiently new and different to not allow to reuse solutions tested elsewhere. So we had to innovate in a number of ways:

- A new model of learning, without *teachers of teachers*, was designed.

> **The *temps de rencontre***
>
> Class'Code has to solve two separate problems: on one hand there are no teachers of teachers, or first generation teachers, so the training process needs to be cold-started. Second, there is the fixed objective of being accessible everywhere, not just in the large cities. Third, the attrition numbers typically found for MOOCs require an adapted answer. The blended MOOC model proposed by Class'Code attempts to give answers to these three issues. During each 3-week MOOC two *temps de rencontre* are proposed. These are organised locally and have the participation of a *facilitator*. This is a student, teacher, researcher, technician or engineer in informatics who volunteers to be present and help the other learners. The facilitator will also be learning, presumably at least as to how to teach the subject to young children. The *temps de rencontre* lasts 2 hours. A script is proposed enabling activities to take place. Of particular importance here are those activities known as *Computer Science Unplugged* [BWF+15].

- To make possible the organization of these *temps de rencontre*, the sharing of teaching materials and the creation of a community bringing together learners and *facilitators*, Class'Code needed the right platform. We had 3 major constraints: short deadlines, few technical resources - part time of an computer science engineer - and a strong social network component to imagine. So we made pragmatic choices, and the project was conducted in an agile manner. All innovations are more about using existing tools wisely rather than creating new tools. Each contributor living in a different area of France, we needed tools to work remotely and efficiently. Only the most useful ones were used:

  - a pad (`https://framapad.org/`) to track the users requests and their implementations;
  - a shared space to store and share documents; describing the project, models, design elements, etc.;
  - a repository to share the source code;
  - mail, instant messaging and most importantly, video conferencing software.

  The result is a hybrid platform between a Content Managing System and a social network through which learners, *facilitators* and coordinators can not only share and access teaching resources but also organize / participate in real-life Class'Code meetings close to their homes. The platform provides web interfaces for managing these meeting times for organizers, as well as search interfaces for everyone to find the *Temps de rencontre* adapted for them. It also contains advanced profile management and allow Class'Code participants to find and contact each other directly, based on their locations.

- Research projects linked with Class'Code have been encouraged:

  - Marine Roche's PhD at Nantes University is on the impact of blended MOOCs like Class'Code on the training of teachers. The thesis is in the field of Educational Sciences and constitutes a nice example of scientific interdisciplinary work.
  - The INRIA team flowers in Bordeaux is investigating how using playful robotics is a lever to teach code and computational thinking (`https://hal.inria.fr/hal-01144435`) and also working on the application of machine learning for human learning.
  - Following the success of the Orphee workshop on instrumentation, a *Computational teaching* group was set up nationally: a fact is that many computer scientists have developed tools enabling their own students to learn aspects of informatics. The goal of the group is to encourage synergy, enable common projects (`https://wikis.univ-lille1.fr/computational-teaching/accueil`).
  - Margarida Romero heads the LINE laboratory and works on disruptive pedagogy beyond beyond computer science initiation, i.e., from computing to computational thinking.
  - X5-gon is a recently accepted Horizon 2020 project whose goal is to allow the interconnection and recommendation of open educational resources, across themes, languages, modes, cultures, and platforms. The development of informatics education is leading to the creation of many resources, yet there are no tool allowing a seamless navigation through these (`http://www.k4all.org/project/x5gon/`).
  - It should be noted that research over these issues is also a strong way to build international cooperation. This has already started to take place with several countries having shown interest in Class'Code of which two of them are actually deploying it (Tunisia and Morocco). Contacts with other countries have taken place and the project has been presented in Canada, Japan, the UK,...

3.5 Political achievements

The global ambition of Class'Code and some of the choices which were made early on paved the way to important contributions[1] towards policy changes at all levels:

[1] The actual political impact of Class'Code cannot be demonstrated of course; the elements in this section may be just speculations.

- Cooperation has been enabled thanks to the initial decision of using and producing only OERs (open educational resources): this allowed very quickly cooperation along the line: *"If you want to keep your pedagogical autonomy, if you don't like some particular aspect of the material we have produced, if you want to also introduce your own pedagogical ideas, then Class'Code fits your program: because the material is openly licensed, you can apply the 5 "R"s: Retain, Reuse, Revise, Remix, Redistribute,..."* (https://en.wikipedia.org/wiki/Open_educational_resources).
- General interest has been obtained towards the choices made: vocabulary questions (at last) are being better understood. The debate can now take place between people who understand each other better than before. The distinctions between the different aspects of what an education for the digital society, all of which are important, are being understood: informatics, digital literacy, media education.
- Ambition (by the ministry) has increased over the past few months [Min15a, Min15b]. The fact that the question of training the teachers is starting to find a solution[2] seems to help policy makers to consider long-term policies.
- The question of supporting the development of the informatics education by research is emerging. Such research, whether it concerns didactics, sociology, or instrumentation should be encouraged in the future.
- We believe that the actual model proposed by Class'Code can be exported to other fields and other countries as an answer to the problem of training teachers to technologies (an important part of UNESCO's sustainable development goal (SDG) 4: http://en.unesco.org/sdgs).

Gender issues

An important concern of the project, right from the start, has been to take gender questions very seriously. The editorial and pedagogical committees have been asked to systematically scrutinize all the produced material under this parameter. The management of the project is also careful in sharing the responsibilities and making sure that decisions are taken by groups and committees in which gender equilibrium is reached.

4 Evidence of availability of the curricula materials to the teaching community

Most of the curricula materials can be found on the Class'Code page or when following the MOOCs, on the OpenClassrooms relevant webpages (https://openclassrooms.com/courses?q=classcode).

4.1 MOOCs

Class'Code is composed of 5 MOOCs, each covering a specific theme.

The first MOOC, titled *Programmation Créative* is accessible to beginners and helps them learn to code, to understand computational thinking, and transmit the important notions to children. The MOOC uses Scratch as programming language and also offers many historical examples. (https://openclassrooms.com/courses/decouvrir-la-programmation-creative and https://pixees.fr/classcode/formations/module1/)

The second MOOC on data and information manipulation teaches how the information is stored, transmitted, encoded, encrypted, compressed... Again, many historical facts as well as unplugged activities are used. (https://openclassrooms.com/courses/manipuler-l-information and https://pixees.fr/classcode/formations/module2/)

[2] It should be noted that Class'Code makes it clear that it does not have the ambition of training the teachers specialising in Computer Science. This is a different issue which should be addressed as such.

The third MOOC concerns (very basic) robotics. You learn how to program a robot (in this case Thymio) and also how to build one (using Arduino). (https://openclassrooms.com/courses/s-initier-a-la-robotique and https://pixees.fr/classcode/formations/module3/)

The fourth MOOC explains how networks function. Of course, the world wide web gets a special mention and writing webpages receives attention. Protocols are studied too. (https://openclassrooms.com/courses/connecter-le-reseau and https://pixees.fr/classcode/formations/module4/)

The fifth MOOC is about developing and managing a project... with children. The (programming) project can be linked with several technological choices (Scratch, Thymio, Arduino...) and the MOOC relies a lot on testimonials by programmers, IT professionals and teachers. (https://openclassrooms.com/courses/gerer-un-projet-informatique-avec-des-enfants and https://pixees.fr/classcode/formations/module5/). This MOOC is produced and will be launched at the end of May 2017.

4.2 Videos

A complete set of videos has been realized. All the videos can be viewed inside the MOOCs but are also offered as OER and can be viewed separately: https://vimeo.com/search/page:2?q=classcode. These videos include tutorials, elements of computer science history, and interviews reporting on how learning happens with children.

Module	Theme	# videos	link
1	Creative Programming	34	https://pixees.fr/classcode/formations/module1/
2	Information	31	https://pixees.fr/classcode/formations/module2/
3	Robotics	21	https://pixees.fr/classcode/formations/module3/
4	Networks	10	https://pixees.fr/classcode/formations/module4/
5	Pedagogy	15	https://pixees.fr/classcode/formations/module5/ (available end of May)

Table 1: The videos produced by Class'Code

4.3 Activities for the *Temps de rencontre*

Two activity sheets have been prepared for each MOOC. These can be accessed at the web-pages corresponding to each module (see Table 1).

Typically an activity sheet proposes a script to be used during a *temps de rencontre*. In this script the participants are encouraged to help each other, code together, run one or two unplugged activities, discuss some point often related with the impact of informatics over society. If an informatics professional is present at the meeting, she is asked to facilitate things without taking control of the meeting.

4.4 Other material

In the presentation of each module links are proposed allowing to access extra material, produced by others...

The Class´Code project also supports "1,2,3 codez": this paper book with online free resources and share forum, offers fully validated ready to use activities for teachers initiating kids from 6 to 10 about computer science, while the second volume dedicated to 12 to 15 years old pupils is about to be finished. More than 15,000 teachers are using these resources today.

The Class´Code project has also produced a MOOC for high-school teachers for ICN (Computer Science and Digital Creation "Informatique et Création Numérique", an optional course for 16 year old students), with almost 8000 followers today.

5 Evidence of impact

We give here some numbers, objective elements and links showing the different forms of impact made by Class'Code.

At the end of April 2016, more than 15,000 people had enrolled in on-line courses linked to primary and secondary schools (over 50% of which have benefited from training) and 4500 had registered on the meeting times (some 100 of which have already been trained) ; More than 7,500 have enrolled for on-line training at the MOOC ICN (of which more than 750 have completed training after two months); The associated resource site pixees receives about 500 visits / day (since January 50,000 sessions of 37,000 users with a bounce rate <56%, for example 4500 visits of 10 minutes on average on module 1 and> 12000 visits on the homepage), and the on-line reception office manages several requests per week (> 500 requests since the launch of the project). The Net Promoter Score is between 8.68 and 9.01 for the three first modules, which rather high. Beyond these numbers qualitative feedbacks are pretty good, but even better is the fact that the formation is permanently adapted and improved, as a function of these feedbacks.

Class'Code MOOC-ICN extension: there are more than 7500 registered on May 1st (according to the first 500 answers to the questionnaire regarding the profile, there are 47.53% of teachers, 11% of 10% in the public service, 10% looking for a job, 8% in students and 5% are retired ... For secondary school teachers who are directly concerned by this MOOC, mostly teachers of mathematics (46%) and physics (15%), 11% in engineering, 8% in technology. As far as informatics is concerned, they are either beginners (38.40%) or intermediate (40.49%). The satisfaction rate measured at 3 weeks is 84% of satisfied or very satisfied, and the qualitative returns are unanimously positive, several hundred messages on the forum are exchanged, allowing this formation to not only be a "course" but a real place of exchange and mutual aid.

5.1 Pedagogical achievements

Five MOOCs have been produced. There are 2 fundamental (or transversal) modules, and 3 specific ones: it is recommended that a learner takes at least the 2 fundamental modules and one specific one.

1. Fundamental module: *discover creative programming*
2. Thematic module: *manipulate information*
3. Thematic module: *begin robotics*
4. Thematic module: *connect the network*
5. Fundamental module: *the process of creation from A to Z*

Coding and Computational thinking

The age group indirectly targeted by Class'Code is the 8-14 year old. The goal is to teach a large amount of educators so that they can be aware of informatics, and can initiate things. Of course, for older children and, even more importantly, children who will have been introduced to the topic, teachers will require much more training and probably will want to have studied informatics at university. The choice defended by Class'Code is to centre the initiation around coding and computational thinking [Win06, Tch16], put these questions in perspective by providing elements of context, both from history and from the society challenges of today.

5.2 Training achievements

The project being based on open educational resources, when measuring impact of the project, we should distinguish two populations:

- Those directly trained through the Class'Code platform. We provide some numbers here: by the end of April 2017, 15000 persons had registered to the different courses concerning first and second grade education, and more than 50% have effectively followed some courses. 4500 learners have been to some *temps de rencontre*. Furthermore 7500 have registered for the ICN Mooc. The pixees website (https://pixees.fr) gets 500 visits per day (since January 2017 50000 sessions for 37000 users with a rebound rate of less than 56%, or 4500 visits (average length 10 minutes) on module 1 and more than 12000 visits to the main page. Our help-desk has received more than 500 queries since the beginning of the project.
- Those trained by others using Class'Code material or only using the material as independent resources. In this case we can only estimate the impact by showing websites advocating to their members the use of Class'Code. For instance:
  - an association of technology teachers https://technologieeducationculture.fr/article.php?sid=973;
  - Associations representing the mathematics teachers, such as the APMEP, or the IREM;
  - the MEDEF (MEDEF is the largest entrepreneur network in France with 750 000 members), with their website for education http://www.eduquerformer.fr/actus/code-informatique-langue-plus-vivante/;
  - The parents organization PEEP;
  - A number of blogs and websites about education, and best practices concerning teaching coding skills, have advocated in favour of Class'Code: L'étudiant, Educscol, quoideneuf-doc, Adjectifs-Analyses...
- We were also recommended in talks given by leading public figures, such as the previous minister of Education, Madame Najat Vallaud-Belkacem or the mathematician Cédric Villani.

Surveys have taken place:

- during the experimenting phase (spring 2016), we observed closely the deployment in two regions in order to test the pedagogical setting;
- during the autumn of 2016, an on-line survey allowed to understand the issues. Preliminary results showed that the learner's goal was to be able to transmit coding notions (60%), and a majority of learners were prepared to recommend Class'Code to friends and colleagues more than 80% graded Class'Code with a score of 7 (out of 10) or higher.
- A new survey is being conducted in 2017, with the schoolteachers targeted: the goal is to measure if tools like Class'Code are able to help training as well as normal courses.

5.3 Dissemination achievements

Class'Code members have participated to more than 60 events in France and abroad, since launching the project. These comprise large education gatherings, conferences and workshops.

For example:

- We have run Class'Code demonstrations, learning labs with very different audiences including policy makers, teachers, parents...
- We have participated to panels on teaching informatics, coding with children, proposals for teachers;
- We have given invited talks at conferences, workshops and events;
- We have co-organized events.

Some of these events are itemized in Table 2.

Event	Audience	Location	Date	Type
European Code Week	General public	Paris	oct-15	Invited talk and demos
Fête de la Science	School children	Nantes	oct-15	Demos
Congrès de l'ADBU	librarians	Besançon	oct-15	Invited talk
POSS	Open software community	Paris	nov-15	Invited talk
Congrès de la SIF	Computer Scientists	Strasbourg	jan-16	Invited talk
Journée de la PEEP	Parents	Paris	feb-16	Invited talk
OE Global 2016	Open Education community	Krakow	apr-16	workshop organisers
Rencontre de l'ORME	Education specialists	Marseille	jun-16	Demos
Scratch conference	Scratch enthusiasts	Boston	aug-16	Talk
Code Week 2016	General public	France	oct-16	Demos
Décodez le Code	Code community	Paris	oct-16	Co-organisers
Salon de l'éducation	Education specialists	Paris	oct-16	Event
Adaweek	Women	Paris	nov-16	Invited talk
Paris Open Source Summit	Geeks	Paris	nov-16	Panel
IREM de Bordeaux	Mathematics teachers	Bordeaux	jan-17	Invited talk
Orme	Education specialists	Marseille	may-17	Panel and demos
Scratch'17	Scratch enthusiasts	Bordeaux	jul-17	Co-organizers

Table 2: Some dissemination actions

5.4 Innovation achievements

As presented in Section 3.4, new solutions had to be found to fulfil the goals and ambitions of the project. These made us rely on technology and research.

The Class'Code platform designed by a team at Inria was operational in only a few months.

- For the sake of efficiency and pragmatism, the development is based on the opensource Wordpress content management system (https://wordpress.org/) wich was already used to host https://pixees.fr and a lot of learning materials. This choice make it easy for anyone in the Class'Code team to publish content and share resources without knowing any strong computer skills

- As it is based on an opensource software with a strong community, security is less an issue than in a platform fully made from scratch. The source code of the application core is often checked and audited by developers around the world and security patches are quickly delivered as soon as a vulnerability is detected.

- Wordpress is extendable (https://wordpress.org/plugins/), so the first step was to search for existing plugins providing functionalities that seem useful. When it was really the case, these were integrated into the platform. Otherwise (when no plugins existed or weren't fully adapted), as was the case for the *temps de rencontre* or the Dashboard, home made plugins were developed using web standards.

- The core team used a functional approach to be able to divide the development work into small independent tasks in order to easily distribute the tasks among the contributing good wills. As a positive side effect, all developments can be easily reused in other contexts that use the same technological bases, allowing for the sharing of innovations.

- Most of the code is written in PHP and javascript, using Jquery (https://jquery.com/) and Google Maps API (https://developers.google.com/maps/?hl=en), languages that can easily be understood and used by beginners.

- By doing so, colleagues who are no professional computer engineers are able to co-maintain the platform. The goal was not to find the best solution in the absolute, but the one that would best work for this community. Indeed Class'Code forms to the code, so its platform can evolve with people initiated to Class'Code.
- All data on the *temps de rencontre* organization are collected and can be anonymized for future research needs.
- The platform is hosted by the Inria IT service and benefits from their expertise in monitoring, backup and security. It also ensure the operation and hardware maintenance of the server hosting the platform in the Inria data-centre, ensuring data confidentiality and network access redundancy.
- Regarding the platform usage, we have 4500 users with an activity of 400 to 500 visits / day on week days (See the training achievements section 5.2 for more informations).

Research groups over France have shown increasing interest. Furthermore, contacts have been taken with researchers on similar topics around the world. A first workshop was organised during the Open Education Global conference in 2016 and we expect also to meet researchers during the Scratch conference in 2017.

The innovative model proposed by Class'Code has been the basis of a proposal to the Unesco, which, in May 2017 has labelled a Unesco chair at University of Nantes. Are partners of the University, for this chair, Inria, Société informatique de France and the Knowledge for All foundation.

5.5 Political achievements

It is of course impossible to claim full credit for the impressive progress made in the past two years when it comes to the development of informatics in the school curricula in France. Yet the following elements can arguably be put forward:

- A common position has been defended by a large number of institutions [The16, Cla16].
- Common work is being done with the ministry with regular meetings taking place.
- Whereas the situation was in 2013 very confusing conceptually, possibly because of the lack of a uniform vocabulary (*numérique, informatique, sciences de l'information, code, codage,...*), Class'Code has contributed to clarify this vocabulary. This can be noticed for instance in the different debates that still take place (*in situ* or on-line).
- Media have reported the actions of Class'Code more than hundred times: https://project.inria.fr/classcode/ils-elles-parlent-de-classcode.

6 The future

The conclusion in May 2017 is that Class'Code is running but remains fragile as it still very much depends on the role of policy makers.

The infrastructure is set up and capable of meeting the necessities which have been foreseen: possibly 300,000 teachers and educators.

One (hidden) goal of Class'Code is to provide some kind of uniformisation of vocabulary, notation, pedagogical choices. Of course, this should be done whilst respecting the capacity of innovation of the teachers. But there is a serious risk that the backgrounds of the teachers being so different, if their training is also very different from one region to another, one school to another, one age group to another, the result on the children may be wrong.

A better understanding of the functioning of Class'Code is the purpose of the Unesco Chair, with the hope that the lessons learnt will help others.

The conclusion as to the teaching of informatics is still to be written. Clearly Class'Code is going to have an impact on the emergence of the topic in schools. But will the model be able to follow with the increasing demands which are bound to arrive due to the pressure of the learners?

Because Class'Code is more an ecosystem than a project, we believe that it will provide the common house to the development of school informatics in France.

7 Support letters

We include a support letter by Gérard Berry, from the Académie des Sciences and another one by Jean-Louis Pierrel, from IBM France. A number of other testimonials can be found on the web: pixees.fr/classcode/accueil/actualites/.

References

[BWF+15] T. Bell, I. H. Witten, M. Fellows, R. Adams, J. McKenzie, M. Powell, and S. Jarman. *CS Unplugged*. csunplugged.org, 2015.

[CHW16] C. Calmet, M. Hirtzig, and David Wilgenbus. *1, 2, 3... Codez !* Le Pommier, 2016.

[Cla15] Class'Code. Maaison : Maîtriser et accompagner l'apprentissage de l'informatique pour notre société numérique. Submitted file, 2015. https://drive.google.com/drive/folders/0B42D-mwhUovqQ1RyOW01WUtyR1k.

[Cla16] Class'Code. En 2016, le code informatique arrive à l'école. Position paper, le monde, november 2016, 2016. http://www.lemonde.fr/sciences/article/2016/11/02/en-2016-le-code-informatique-arrive-a-l-ecole_5024344_1650684.html#3qqBE4rcRY9iiwfp.99.

[CNN14] CNNum. Jules ferry 3.0, bâtir une école créative et juste dans un monde numérique. Position document, Conseil National du Numérique, 2014. http://cnnumerique.fr/wp-content/uploads/2014/10/Rapport_CNNum_Education_oct14.pdf.

[CNN15] CNNum. Avis sur l'enseignement de l'informatique en France. Position document, Conseil National du Numérique, 2015. http://cnnumerique.fr/enseignementinformatique/.

[Eur15] Informatics Europe. Informatics education: Europe cannot afford to miss the boat. Technical report, 2015. http://www.informatics-europe.org/images/documents/informatics-education-acm-ie.pdf.

[FWC+16] A. Fluck, M. Webb, M. Cox, C. Angeli, J. Malyn-Smith, J. Voogt, and J. Zagami. Arguing for computer science in the school curriculum. *Educational Technology & Society*, 19(3):38–46, 2016.

[KTC16] L. Khamsay, C. Terosier, and G. Capelle. *Apprends à programmer avec Scratch: Crée tes jeux et tes animations !* Gallimard Jeunesse, 2016.

[L'A13] L'Académie des Sciences. L'enseignement de l'informatique en France – il est urgent de ne plus attendre. Technical report, 2013. http://www.academie-sciences.fr/fr/activite/rapport/rads_0513.pdf.

[Min15a] Ministère de l'éducation nationale, de l'enseignement supérieur et de la recherche. Le socle commun de connaissances, de compétences et de culture. Policy document, 2015. http://eduscol.education.fr/pid23199/ecole-elementaire-et-college.html.

[Min15b] Ministère de l'éducation nationale, de l'enseignement supérieur et de la recherche. Programmes d'enseignement du cycle des apprentissages fondamentaux (cycle 2), du cycle de consolidation (cycle 3) et du cycle des approfondissements (cycle 4). Policy document, 2015. http://www.education.gouv.fr/pid285/bulletin_officiel.html?cid_bo=9514.

[Tch16] P. Tchounikine. Initier les élèves à la pensée informatique et à la programmation avec scratch. Research paper, 2016. http://lig-membres.imag.fr/tchounikine/PenseeInformatiqueEcole.html.

[The16] The Class'Code Steering Committee. Vive la rentrée du "code" à l'école ! Position paper, libération, september 2016, 2016. http://www.liberation.fr/debats/2016/09/11/vive-la-rentree-du-code-a-l-ecole_1493477.

[Win06] J. M. Wing. Computational thinking. *Communications of the ACM*, 49(3):33–35, 2006.