White Paper

Teaching basic through advanced programming skills in schools and universities using a Web based coding platform.

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Problems faced by Government and Political Bodies

Teaching children and students to code has is now firmly on the global agenda and rightly so. Cambridge University, one of the top Computer Science departments in the world, has the following to say …

*We became concerned about the **year-on-year decline in the numbers and skills levels of students applying to read Computer Science**. From a situation in the 1990s where most of applicants were coming to interview as experienced hobbyist programmers, the landscape in the 2000s was very different; **a typical applicant might only have done a little web design**.*

This is a very bleak scenario for any western economy that prides itself in being at the forefront of key technologies; and a very positive one for developing economies looking to build a global reputation in a sector that requires very little capital investment.

Computing is now perhaps more fundamental to an economy as engineering was a century ago. Many countries, such as the United Kingdom, were very happy to see their engineering skills decline in preference to industries such as banking and finance, very much to their detriment. Allowing a population to be merely ardent consumers of apps and applications rather than being able to create them would a mistake that cannot be easily corrected if it computing does not become a part of our Education DNA at the same level as subjects such as biology, history and languages.

Codio is certainly not the first to recognize the urgency and importance of the problem and companies like Code.org, Codecademy, Khan Academy and Team Treehouse have sprung up to try to shore up the damage.

In many countries, it is now not at all unusual to hear parents demand that their children be taught to program. So, pressure is being applied at all levels to address the problem.

A platform for local and Global, Crowdsourced coding

At Codio we believe that the global community of teachers and education oriented developers is best placed to produce high quality content.

One only has to look to the Open Source community for an excellent analogy. Developers all over the world have contributed to an extraordinary number of very high quality libraries and tools that now power almost every web application from the likes of Google, Facebook and Twitter to millions of smaller ones. At the heart of this lies GitHub, a platform that is now used by almost all Open Source projects to collaborate on Open Source code.

Codio proposes a similar format for teaching coding. As you will see below, Codio is a superb platform for both teachers and students. Codio does not provide any actual teaching content, which is left entirely in the hands of teachers and education oriented developers. Crowdsourcing features enable coding courses to be created and shared freely amongst schools, universities and individuals seeking a self-teaching approach.

We will now look at the problems faced by teachers and students of coding and then discuss how Codio addresses each of these problems.

Specific problems faced by Teachers

There are a number of real world problems faced by teachers that severely impact their ability to teach this subject in a modern, efficient way that takes advantage of all that web technologies have to offer.

Stack Hell

Stack Hell is something that almost all teachers will be familiar with today. It refers to the need for teachers to ensure that every one of their students has a correctly configured programming environment. This is extremely difficult as each student will have a different combination of machine type (PC, Mac Linux) and Operating System versions. Added to that is the need to choose desktop IDEs that may only work on certain operating systems and that are generally far too complex for novices. And beyond that, there is the need to install and configure many components such as languages and databases.

The net effect of Stack Hell is that many teachers are finding that it takes as much as 3 weeks of actual course time until all students are in a position to write their first line of code.

A Web IDE that is friendly enough for beginners yet built to meet the needs of professionals avoids Stack Hell entirely. Additionally, Codio provides the ability to install stacks with a single command using Codio Box Parts. Codio also offers ‘Clonable Boxes’ so teachers can preconfigure and entire development stack as a part of a Course Module. When the module is cloned, the entire stack is also cloned, so students can avoid (if desired) the entire stack setup process.

Accessing student assignments

Once students have begin coding, teachers need to access student code projects whether to offer general assistance or to grade. Current systems are entirely unsatisfactory and require either attaching code as attachments, which then need to be loaded into the teacher’s IDE, or require that the teacher access code that has been uploaded to a web server, which results in further complications and costs.

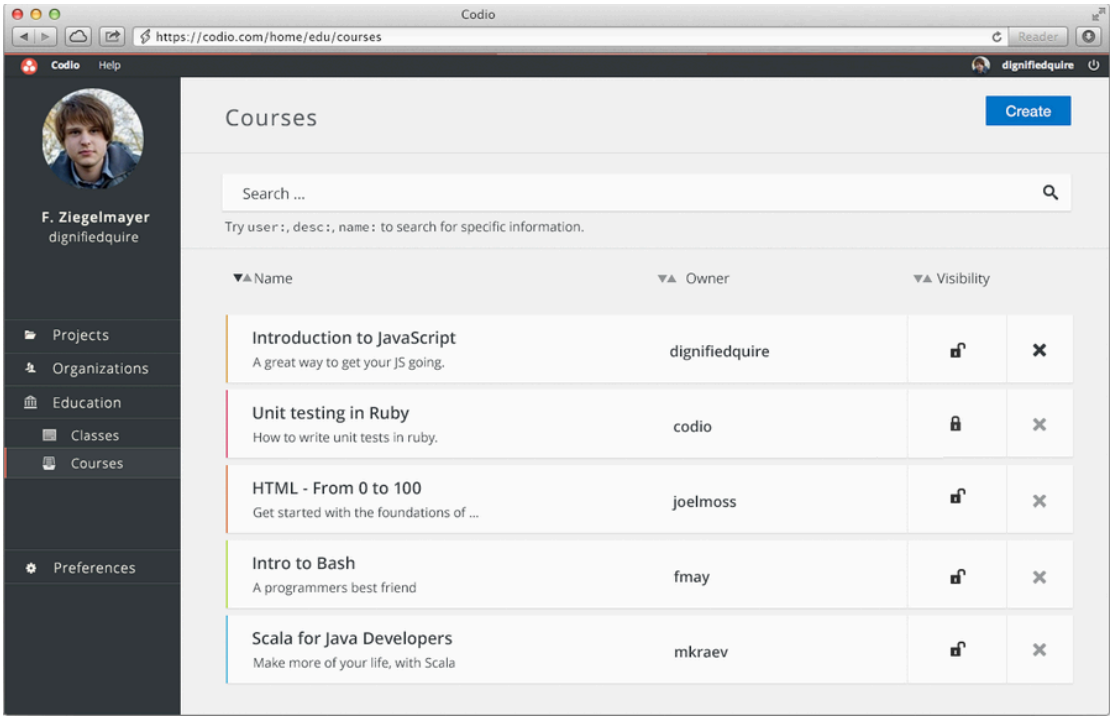
Codio addresses these issues by allowing teachers to access student code with a single click thanks to Codio's administrative capabilities, which are detailed below.

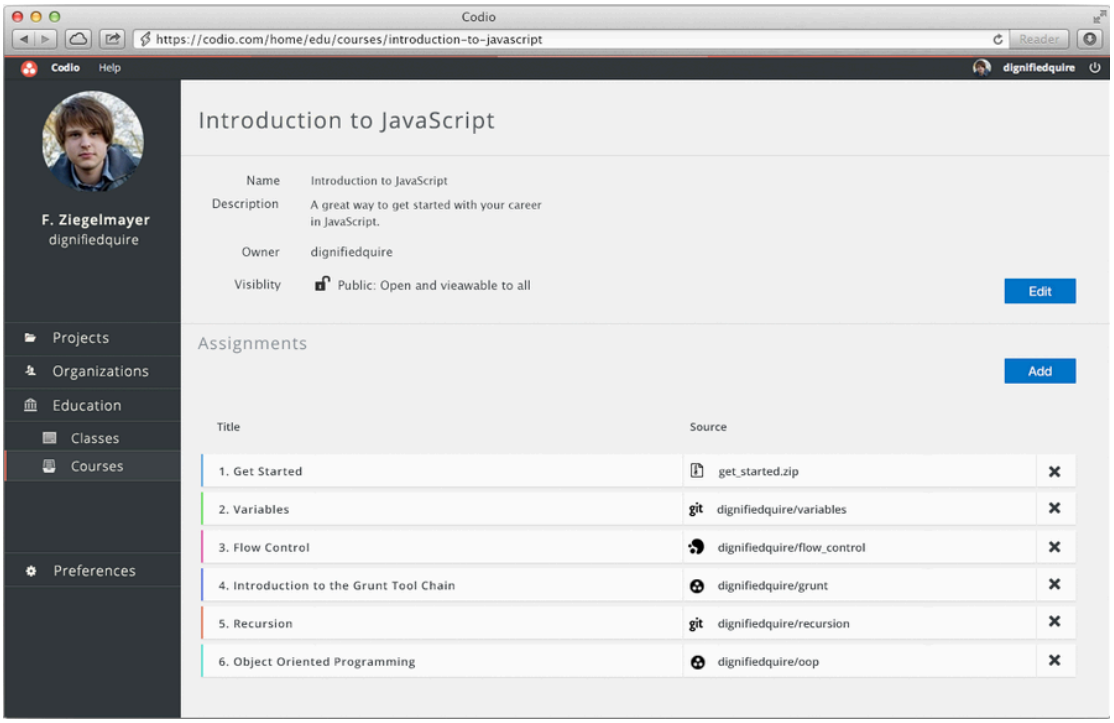
Teacher/Student administration

The ideal scenario for a teacher is an IDE integrated with a full set of administrative features. Codio is the only platform today that offers a professional grade IDE that is easy enough for beginners and also tackles the tedious administrative issues faced by teachers head on.

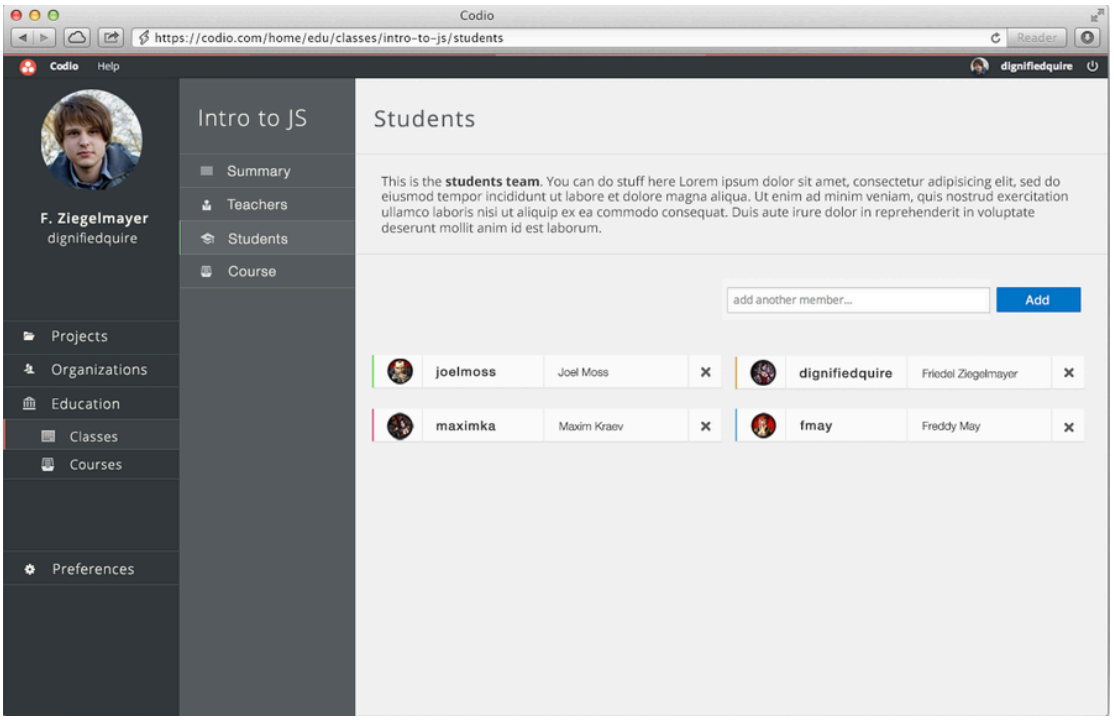
Codio combines its Web IDE with integrated student, class and course administration features to remove the majority of the pain experienced by teachers.

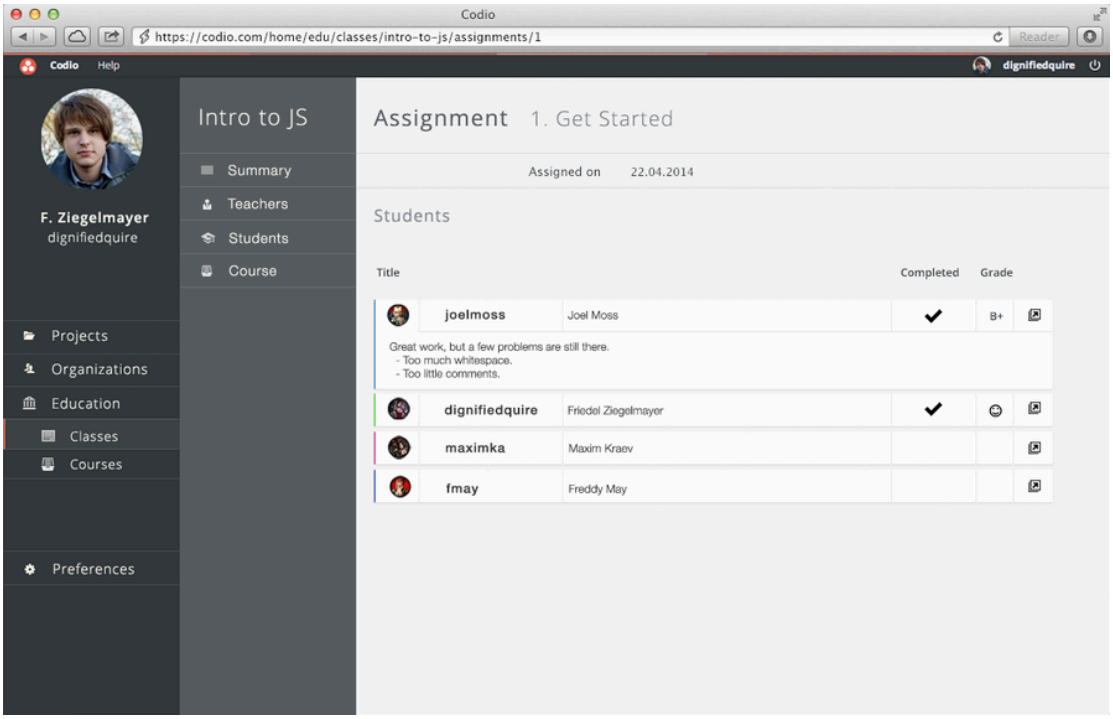
Course & Module Management – a teacher can create a Course and within it any number of Modules. These can then be made available either within your Organization or made public to help our crowdsourced teaching content initiative.



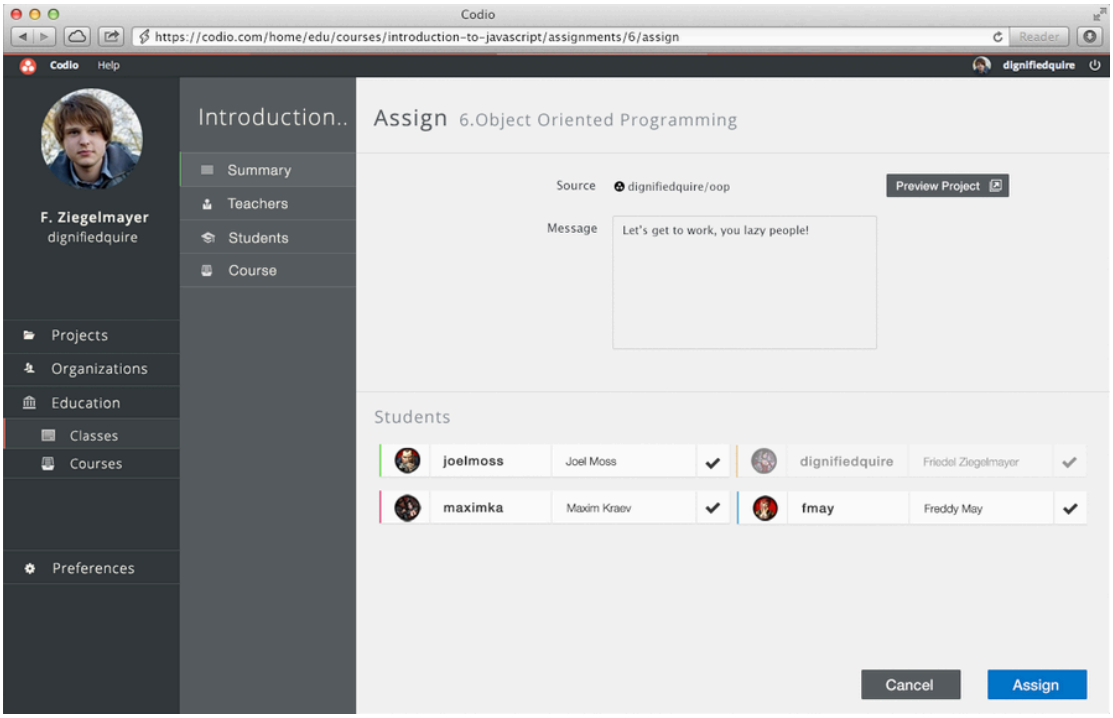


Class Management – you can create Classes of students in Codio. You can then assign a Course, with its Modules, to the Class.

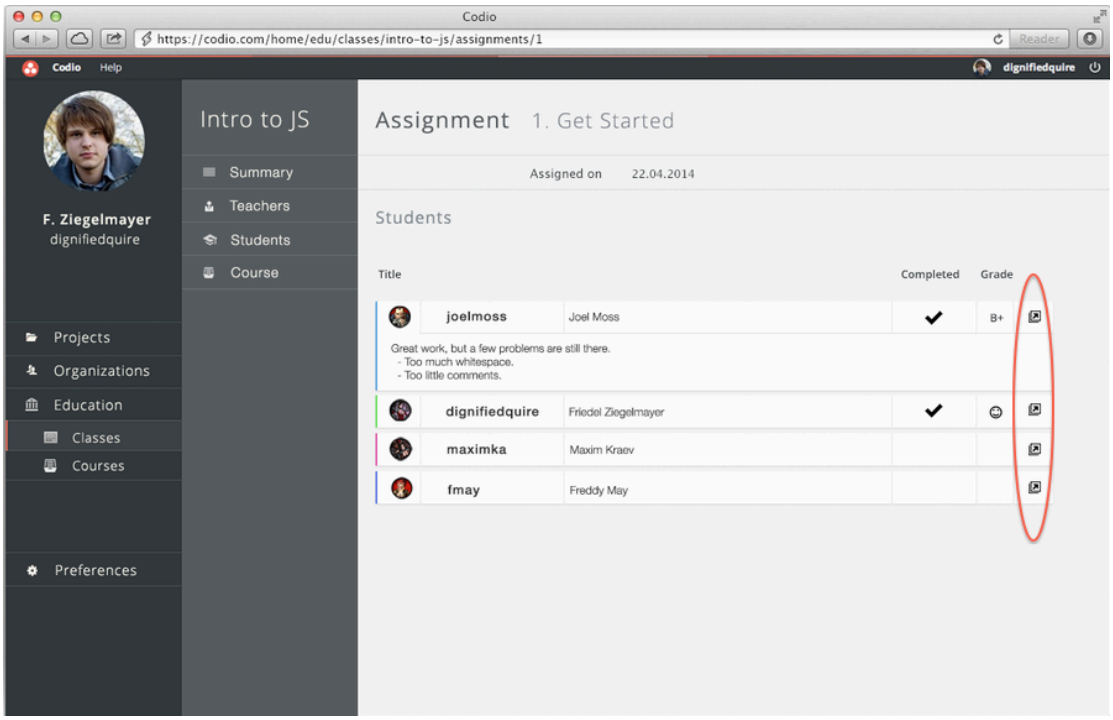


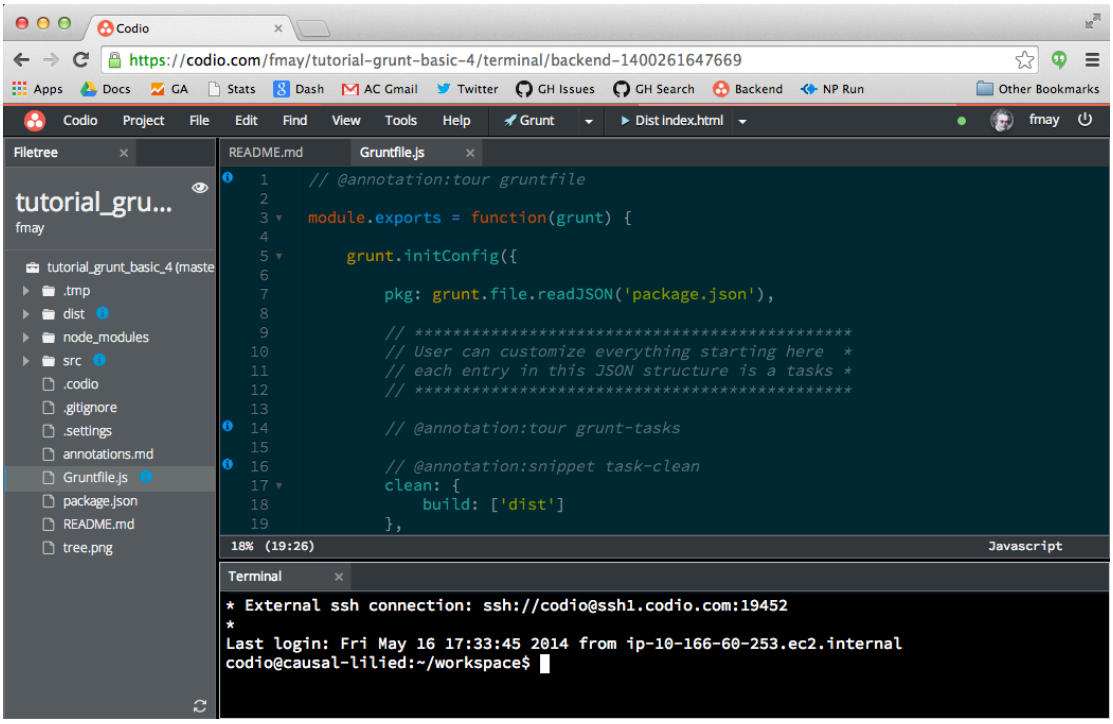


Assignment Notification – from the Class management screens, a teacher can assign a Course Module to a student or the entire class with a single click.

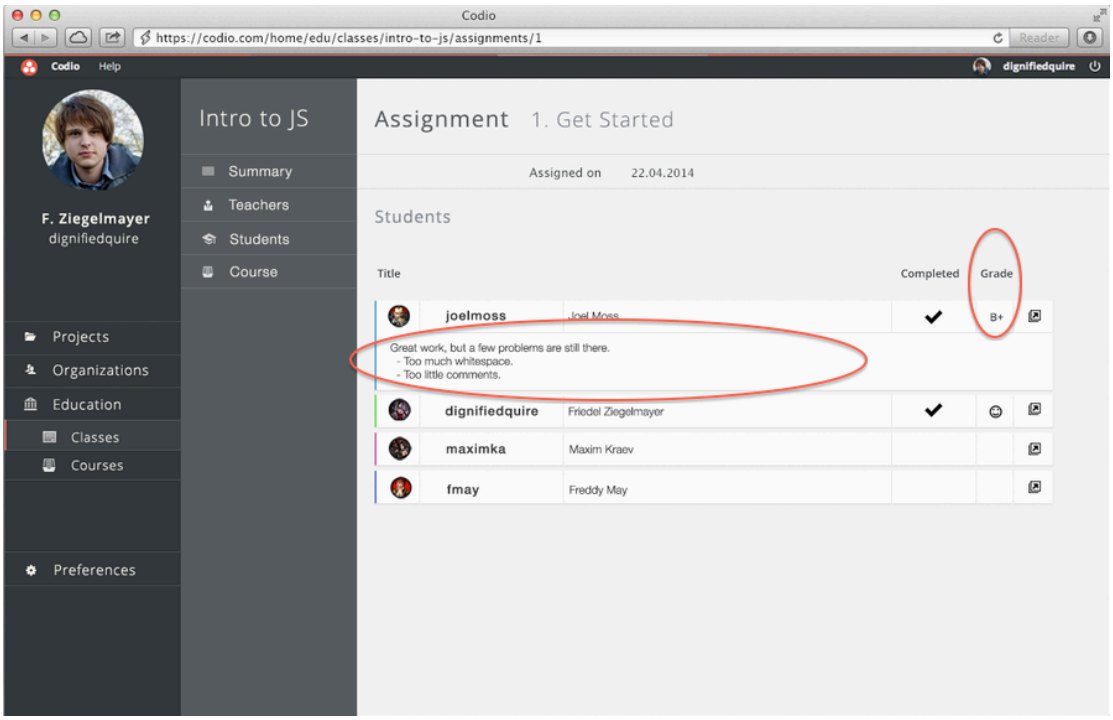


Instant access to Student code - using the Class management screens, the teacher can instantly access a student's code with a single click.





Grading/Marking – students can indicate when they have completed a module at which point the teacher is notified and can also see the status within the Class management features. They can then assign grades/marks along with detailed comments for each student.



Roadmap

We will soon be adding messaging and collaboration features that are all contained within the one integrated environment. Students can request help from teachers and teachers can see these requests and respond from within the Class Management features. Google Docs style collaboration will also be offered shortly so a teacher can help a student with code in real time.

Other General Issues

Besides the administrative and practical challenges faced by teachers, there are many other challenges the Codio helps to address.

Which programming language to use

There are a plethora of programming languages that teachers and courses may prefer. Other than HTML, CSS and Javascript there are many back-end programming languages that a teachers or course might prescribe. There is no such thing as the ‘best’ language. It is, will and should remain a simple preference of each teacher. Almost all programming concepts apply across all language boundaries, from Javascript, Java, Python to Haskell, Ocaml, Scala and many others.

At Codio, we believe that the teachers should be free to produce teaching content that they believe in most strongly and that this will lead to the best outcome for students.

Codio is completely language, database and components agnostic making it the ideal platform for any teaching configuration. A global, crowdsourced approach should also give teachers looking for suitable course material a big head start.

How to teach the teachers

This is perhaps one of the most serious challenges faced by governments and teachers. There are many teachers and schools that feel they do not have the necessary skills to teach programming. Waiting for teachers to be fully trained is not an option. Teachers of traditional subjects find a fully developer system in place to prepare them for their profession. This is not the case for coding and so a very different approach is needed.

Crowdsourced content provides a first rate solution to this problem. We have already mentioned how a lot can be learnt from the Open Source world. A web based platform allows teachers all over the world to create, use or even improve other people's content. Experienced teachers can contribute back to and improve existing Courses, exactly as happens with systems like GitHub in the Open Source world.

Inexperienced teachers can use these teaching materials to teach themselves before they start to teach their students. Kids need a lot less formal teaching or rote learning than you might expect, thereby reducing the burden on the novice teacher.

Programming can be a thoroughly enjoyable journey of self-discovery whether for a student or a teacher.

The problem with Codecademy and Khan Academy

Platforms such as Codecademy and Khan Academy are truly excellent for the complete beginner and they do a superb job of introducing novices to the basics of programming.

These systems, however, take students only a short distance from the absolute beginner stage. Very soon, the integrated consoles of these systems are insufficient and kids and students need to work with a proper Integrated Development Environment (IDE). Real world coding projects require the student to work with multiple files and different tools and libraries.

Slum Teaching

As a slight digression, we strongly recommend you watch some of the TED talks given by Sugata Mitra. This ones addresses the issues of how kids can

learn with only the most minimal formal guidance, provided the basic tools and content are available.

http://www.ted.com/talks/sugata_mitra_the_child_driven_education

It talks about the concepts of learning in very small groups, typically groups of four, and allowing kids to teach themselves as much as possible. Self-teaching is, in fact, the way that professional developers work. Even the most advanced professional developer is constantly learning by researching solutions to problems on the internet. Only very occasionally to they learn by going on formal courses.

Embracing this also means that teachers do not feel they have to have a deep mastery of their subject and teach everything face-to-face as they might teach mathematics. Teachers can act more as shepherds while all the time learning themselves where necessary.

Contacting Us

If you would like to get in contact with us to discuss any aspects of our education endeavors including partnering with us, integrating with Codio APIs, content creation etc. then please email fmay@codio.com.