



# Daring to Create Digital Resources

Maryse Mongeau

**For more than two years, Computer Science Technology teacher Maryse Mongeau has been working on the creation of didactic materials to teach the programming of connected objects. She undertook this project because of the lack of quality resources for teaching these new elements of the curriculum. *Pédagogie collégiale* offers a look at the process of creating digital resources in collaboration with the Centre collégial de matériel didactique (CCDMD).**

During the implementation of our new Computer Science Technology program, updated by the ministère de l'Enseignement supérieur [Ministry of Higher Education, Ed.] (MES) in the last few years, I had the impetus to take over the new course developing the new competency "Develop applications for connected objects." These are everyday objects—for example, a thermostat, a watch, a navigation system, a smart card—enhanced with the help of IT and an Internet connection. For me, this meant going back to school to train for this specialization. In computer science, professional development (PD) is expected to be frequent, since new things come along very quickly. Thus, I completed a PD program, in English, at the University

of California, Irvine (UCI) during the 2019-2020 academic year to prepare myself to teach the new course in the fall of 2020.

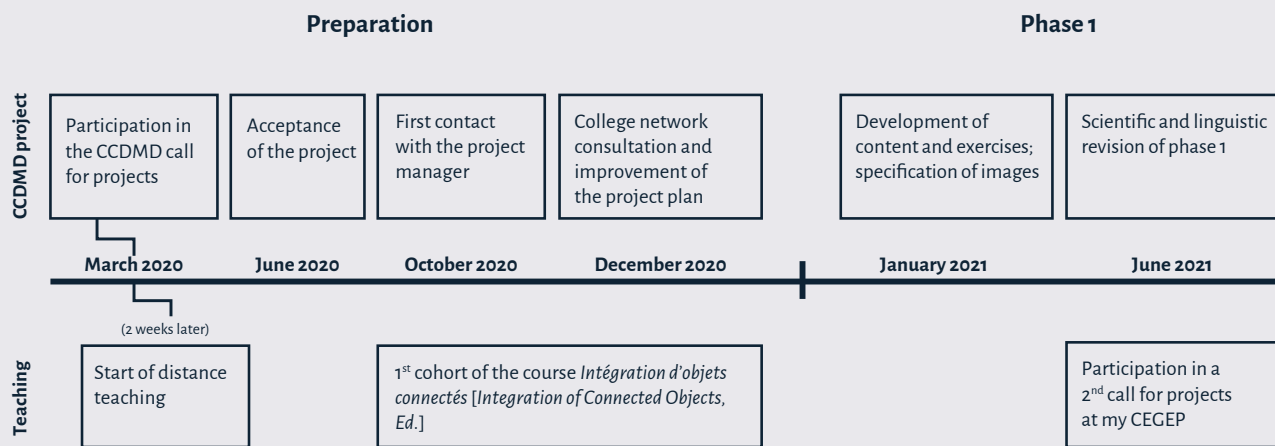
After my PD, I searched for didactic resources to teach these new contents, here, and I quickly realized that there was a gap. I didn't find anything comprehensive enough, let alone in French. Wanting to feed two birds with one scone—and if I were to design my own material anyway—I thought it would be a good idea to create quality material and share it with other CEGEPs in the network. My pedagogical counsellor informed me of the CCDMD's call for projects<sup>1</sup> and helped me develop a plan to participate. This plan was going to take me out of my

comfort zone but gave me a better chance of getting the project accepted. I would not only develop lecture notes and exercises, but I would also create video content; a first for me. Thus, in March 2020, I submitted a proposal for a two-year project. The reason I am writing this article today is that my project was indeed selected and that, together with the CCDMD team, we have produced a turnkey resource website for teaching programming of connected objects. We have worked hard over the past two years and have gone through different stages, as shown in **Figure 1**.

<sup>1</sup> Readers interested in learning more about this annual call and about the CCDMD can consult the article entitled "30 Years of Ideas, Resources and Learning" on page 61 of this issue.

Figure 1

## Timeline of the development of the CCDMD project in parallel with teaching computer science



The preparatory phase in the fall of 2020 allowed for consultation within the college network to improve the project plan and broaden its scope. Then, the winter of 2021 was devoted to the first phase of the project, i.e., writing the theoretical content, exercises, quizzes, and projects, as well as specifying the images. In the fall of 2021, the second phase of the project was an opportunity to test the initial content with students and then improve it. During the 2021-2022 academic year, we also proceeded to finalize the illustrations and create the instructional videos. Finally, website integration began in the summer of 2022, so I was able to test the materials with a cohort in the fall 2022 session, and as you read this article, the platform [in French, Ed.] has just been made available,<sup>2</sup> based

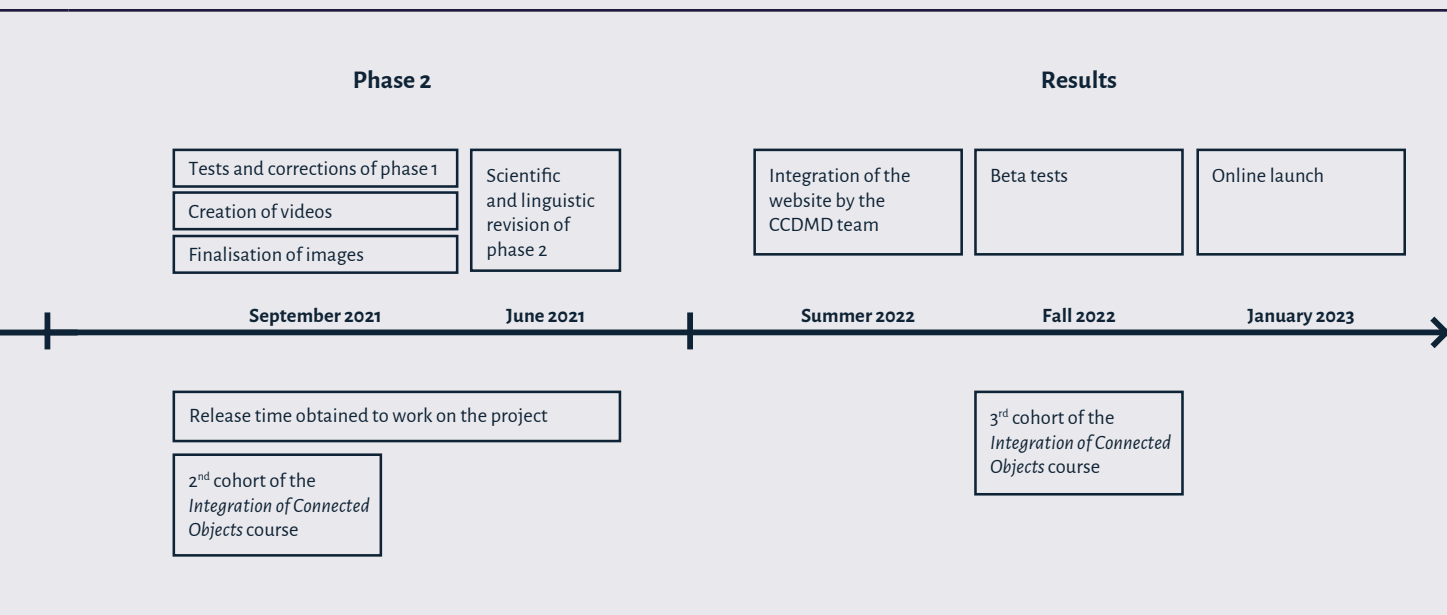
on the principles of free and open access, to all teachers and students.

### An eventful start

Connected objects mean electronic equipment. Therefore, I took the necessary steps for my department to get the hardware required to teach this new course. We acquired a few Raspberry Pi's (nano-computers designed to support computer science learning) and kits with prototyping boards, wires, resistors, LEDs, and buttons. But, due to the pandemic, in the fall of 2020, I had to teach my first *Integration of Connected Objects* course at a distance. To my surprise, this was as much a multidimensional challenge as it was a blessing.

We started the course using simulators and then loaned the Raspberry Pi units to students. Distance learning allowed me to get used to the camera and practise for a year by giving synchronous lectures, recording them and making them available to my students. Since these were live videos recorded with minimal preparation, it was accepted that they were far from perfect. In order to create professional looking videos for my project, I quickly realized that I would need the support of a professional video production team. By partnering with the CCDMD, I was

<sup>2</sup> To consult the [French-language, Ed.] digital resources for teaching connected object programming [objects.ccdmd.qcca].



able to get guidance, funding, release time and a whole team, including a project manager, a web integrator, a web designer, a graphic designer, a photographer and a videographer, not to mention the editors and other consultants without whom the project would never have been as complete as it was.

### One step at a time, as a connected team

Once the project submitted to the CCDMD in March 2020, I had to seek out contacts and connections. In addition to getting support from my department and college administration, I also had to certify the usefulness of the project with the backing of teaching staff in my discipline from

other colleges. Furthermore, I had the support of other organizations, such as the Fab Lab and the college centre for the transfer of technology (CCTT) at my college, the Cégep de l'Outaouais. Once my proposal was accepted, peers from other CEGEPs and professionals

in the field were solicited in the fall of 2020 to improve my initial plan by eliminating superfluous content and adding other useful elements in the courses targeted by the project and offered in other CEGEPs, in order to increase the scope of the project.

**Wanting to feed two birds with one scone—and if I were to design my own material anyway—I thought it would be a good idea to create quality material and share it with other CEGEPs in the network.**

Armed with the improved and validated plan, and supported by a project manager, I spent the winter 2021 session writing the textbook content. I had already accumulated a considerable amount of lecture notes and exercises, as I had just taught the targeted course for the first time in the fall. I put it all together and added the additional content chosen for the project. As I was writing, I also went looking for images to illustrate some of the concepts. Some were free of rights, but many had to be created. My mandate was to specify what the illustrations had to depict. I identified the figures that the graphic designer was to create and the photos that the photographer was to produce. Meanwhile, the web designer had time to choose colours and prepare mock-ups, which I could appreciate and validate.

After writing the additional content that I had not taught, the quizzes, and the projects, all materials were submitted for scientific and linguistic revision in June 2021, and I made the necessary corrections and adjustments. At this point, I had to accept that time no longer allowed me to add all the new material that had been suggested to me, so I sorted through it to focus on the essentials.

Wanting to have more time to devote to the project, I checked to see if it was possible to obtain release time from my teaching duties rather than an additional salary from my contracts with the CCDMD. My project manager confirmed that this was possible and that the CCDMD would pay my CEGEP to compensate for my release time to some extent. I also participated in a new internal call for projects to obtain release time of one day per week as well as



Source: Peter Stumpf/Unsplash

additional funding for the purchase of equipment that I needed for the continuation of my undertaking.

### The challenge of video

In the fall of 2021, a first version of the didactic material created was made available to a few computer science teachers from other CEGEPs who had already shown their interest in using the material developed. Some were even awaiting it impatiently!

For my part, I finally got a half day a week of release time throughout the 2021-2022 year to work on my project. Therefore, in addition to using the materials created thus far with my second cohort, I worked on the production of the accompanying videos. Being back in the classroom, this time face-to-face, I recorded some of the videos live while giving demonstrations to my students. I had two types of videos to prepare: those showing me handling equipment and others presenting configurations and programming on the computer screen.

I took the time to explain my process to the students, promising them that they would also have access to the videos. Indeed, having taught remotely the previous year, I knew the value of these recordings to them. This made it easy to get silence in the classroom whenever I started recording a portion of the course. Sometimes I would intentionally pause clearly to answer questions and then announce the end of the recording to signal to the group that noise and verbal exchanges were once again allowed.

Much of the video content for the project came from recordings made directly in the classroom, after proper cutting and editing. As with the written content, I had additional videos to prepare for the project beyond those made in the fall. Thus, I continued my video production through the winter 2022 session to cover all of the selected content.

In the spring of 2022, I booked the CEGEP's recording studio, and the CCDMD video production team and I spent two intensive days shooting all the required equipment manipulations. During these two days, the photographer was also on hand to take professional shots of the equipment. For me, who was still not entirely comfortable in front of the camera, these were the most stressful days, but I was also excited about the challenge. At the end of a day of shooting, I was exhausted, but I also felt a great sense of accomplishment.

During the last weeks of the winter session, in June 2022, I was mainly involved in validating the images and illustrations made by the photographer and the graphic designer as well as the video content as it was

being edited. Then, the integration team of the CCDMD worked on the website during the summer.

## A positive outcome

I was finally able to test the near-final product in the classroom in the fall of 2022 with a new group of students. It was then that I experienced the satisfaction of seeing them work autonomously with the instructional materials and really experienced the flipped classroom and its benefits for the first time. In fact, I hardly had any theory to present since everything was already written and well structured. The same goes for the demonstrations I usually do in class: they were no longer necessary since the students had access to the videos of the course. I was therefore able to optimize the time in class by devoting it to helping the students with their exercises, answering their questions, assisting them in connecting the electronics of the connected objects, helping them with debugging and leading group discussions. In turn, the students used the website to read the content and watch the videos. Their feedback was also very positive. For example, one student wrote to me:

"This is a great idea, I like being able to find the vast majority of my class notes on one site instead of having to open several different files. It's also more pleasant to read than Word documents."

Another explained:

"Whether it's the content of the site, the choice of colours, the depth of the fields in the navigation bar or the quality of the videos and images,

the entire layout of the site's elements facilitates the cognitive load of users."

Others said that the website is a "very good resource for the course," that it is "well detailed and easy to use," and that it is "very useful and organized."

In addition, the vast majority say that all the elements of the website helped them learn the theory, practise and self-assess. They added that the elements that helped them the most were the videos and the exercise series.

Today, as I look back, I am proud of the work I have done. I could say that it was demanding, but I can also see it as an opportunity to surpass myself. Having already used the material over time with three student cohorts now, I can say that the result is up to par, useful and relevant.

Indeed, the objectives of the project have been met. The resources developed and used by the students allow them to develop the targeted competency. All theoretical concepts were illustrated. Materials have been created for a variety of activities, such as quizzes and lab exercises. The readings, illustrations and videos allow for a flipped classroom approach. All the resources facilitate practical and theoretical learning. The quizzes give learners the opportunity to self-assess. Finally, everything is organized in such a way as to cover all the content necessary for the development of the competency, from theory to exercises to evaluation, which is also supported by projects that come with an evaluation grid. Furthermore, the project's accessibility supports students' autonomy, and the diversity of the content covered promotes the

development of their versatility, while contributing to the development of transversal competencies.

To complete a project of this magnitude, I was fortunate to benefit from adequate supervision. I also put a lot of time into it. You have to be passionate about it, but with a team, it's feasible. An important element was to define the project well, and then to accept to stick to the chosen framework.

### Substantial resources

I was able to test the finished product with my latest student cohort at the Cégep de l'Outaouais; some colleagues from other CEGEPs, who supported me, were also able to experiment with some of the material, and the feedback has been positive.

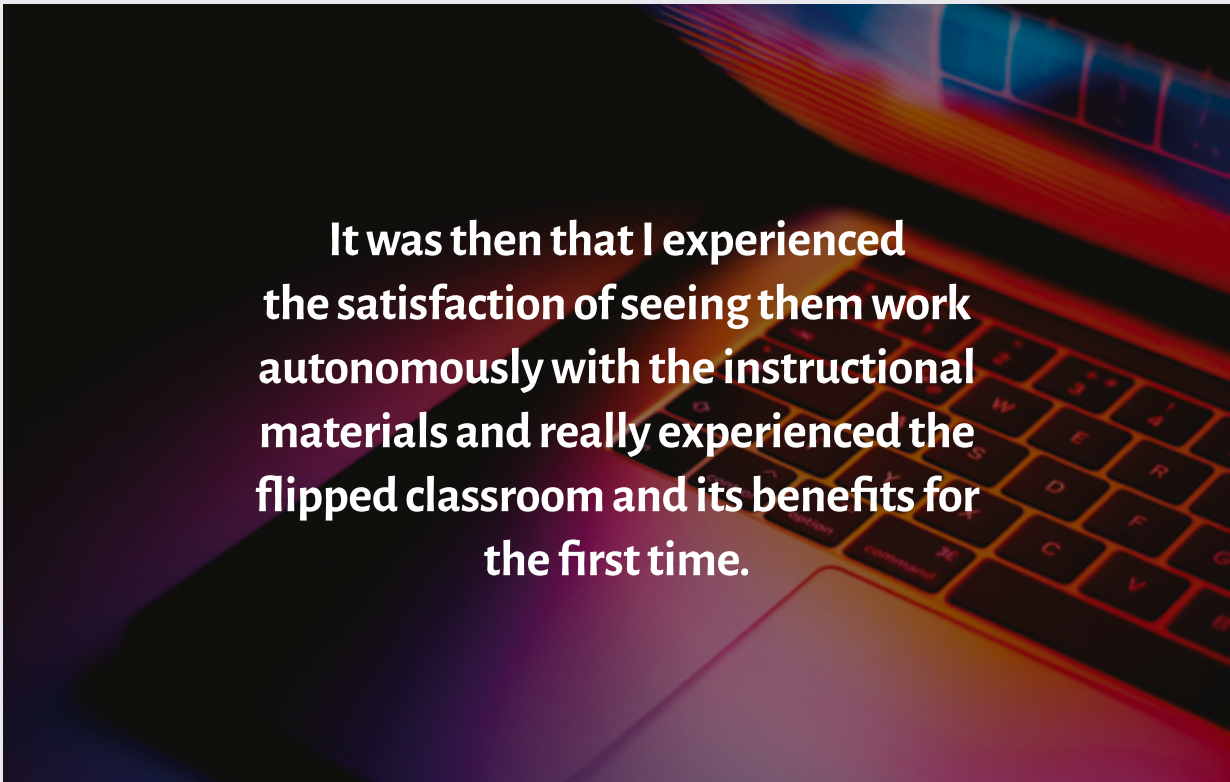
The website contains practically a turnkey course! It contains all the didactic and pedagogical resources to teach the programming of connected objects: readings, images, videos, exercises, quizzes and projects. The main contents covered are: the definition of the concept of a connected object, Arduino and Raspberry Pi development boards, connecting and programming sensors and actuators, programming Arduino and Raspberry Pi as clients or data servers, security of connected objects, and programming client applications using connected objects to monitor and control them in Python and for Android.

The website is so rich that it contains more sections than necessary to fill the course I teach at the Cégep de l'Outaouais. However, I know that other CEGEPs have chosen to dedicate

more hours to this competency. Others will also approach it from a different angle, with different prototyping kits, languages and software. I tried to integrate as many of these elements as possible to make the website complete and usable by as many people as possible. Everyone is free to select the relevant parts for their courses.

### Sharing the path

At first, I thought I was only writing this article to present the resources developed and to share them with as many people as possible. However, I realized that in addition to the resources, I also had a story to share: that of the creation of didactic material adapted to college teaching. It is therefore with this experience in mind that I am writing these lines and I encourage



**It was then that I experienced the satisfaction of seeing them work autonomously with the instructional materials and really experienced the flipped classroom and its benefits for the first time.**

anyone who has the ambition to invest themselves in such a project. I hope that my story will have inspired you. Initially, the project seemed daunting and challenging, but being guided through the process by pedagogical counsellors and the CCDMD team made the whole process smooth and enjoyable, and the adventure was broken down into manageable steps. Today, I hope to see more resources flourish, for computer science education in particular, and other disciplines where there is a need. —



**Maryse Mongeau** has a bachelor's degree in Computer Science from the Université du Québec en Outaouais and a master's degree in College Pedagogy from the Université de Sherbrooke. In addition, she specialized in connected object programming at UC Irvine in 2020. After working as an analyst-tester and a lab assistant, she now teaches college students, youths and adults, as well as private students, and does IT consulting.

maryse.mongeau@cegepoutaouais.qc.ca

**Subject matter experts and tutors wanted**  
**Work on our projects at a distance!**

**Subject matter experts: Take part in the development or review of educational material**  
Discover this role, the profile we are seeking and how to propose your services at [cegepadistance.ca/submexperts](https://cegepadistance.ca/submexperts).

**Tutors: Support and supervise students**  
Discover this role, the profile we are seeking and how to propose your services at [cegepadistance.ca/tutoring](https://cegepadistance.ca/tutoring).

**Francophone subject matter experts and tutors**  
Visit the *Carrières* section of our French website at [cegepadistance.ca/emplois](https://cegepadistance.ca/emplois).

**Management, professional and support staff positions**  
**Choose a career at Cégep à distance!**

Consult the latest career opportunities and apply online at: [cegepadistance.ca/opportunities](https://cegepadistance.ca/opportunities).