**PDIG 1411**
**Integrating Computational Thinking Into Science and Technology**
**Final Report**

This aim of this project was to develop resources and teacher capacity for integrating computational thinking into cycle 1 science and technology. In pursuit of this goal, we met as a teacher team on 4 separate occasions: once at LEARN to explore some of the possible tools available to support the development of computational thinking into the curriculum and three times at our school board to develop resources and activities that could support the integration of computational thinking into the classroom.

This project proceeded mostly as planned, with two exceptions:

1) A laboratory technician, Judith White, who has a keen interest in this topic joined us for two of our meetings. Judith provided excellent support in connecting some of our pedagogical goals with possibilities given the available equipment in labs.

2) Our project started later in the academic year than anticipated due to some time constraints.

During our first meeting at LEARN, we explored what was involved in computational thinking and experimented with different tools that we could use in science and technology classes. One of the challenges that we identified was being able to encourage and support this kind of "tinkering" in a class of 30 students in which time is limited and the demands of the curriculum high. This theme continued throughout our meetings and we acknowledge that our role may be to provide some opportunities to students to use computational thinking to a limited extent in class, which may then inspire larger projects out of class, or which may also provide the background for skills that students may choose to use in more open-ended projects later in their year or schooling.

During the subsequent meetings, the participants collaborated on different projects. These projects are described below:

**3-D printing**

Two of the the participants examined how 3-D printing could be used to develop aspects of computational thinking (e.g. breaking a problem into smaller parts) in conjunction with concepts and competencies of the science and technology program. We learned that using design for 3-D printing is rich in learning opportunities related to graphical language and the technological design process. However, in order to implement the use of 3-D printing in class, we had to take into account technical concerns, and pedagogical concerns such as how to develop skills for graphic design using TinkerCad with the students and how to maintain the focus on the learning, opposed to the production of a gadget. The participants ideas and experiences have been consolidated in the attached document intended to guide the use of 3D printing for learning in science & technology.

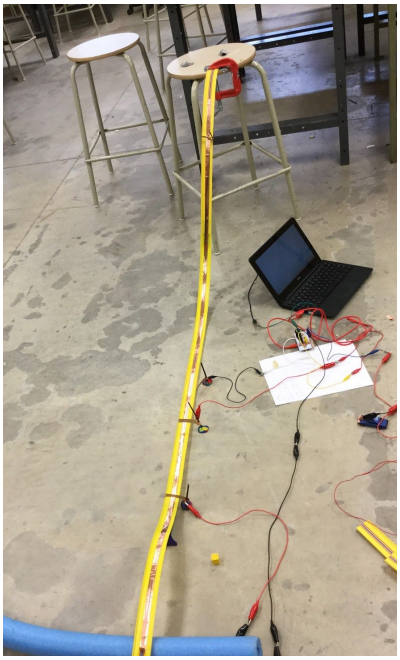
On the final day of the project, this team was joined by the other two participants of the group to develop a project that integrated 3-D printing with several concepts from science and technology. A project to design a prosthetic bird beak, adapted to the bird's environment, was chosen. These lessons have not been fully completed within the time frame of the project, but will continue to be developed and will be tested in the next academic year.

**Coding with Scratch: An interactive Dichotomous Key**

Two participants chose to integrate coding into science and technology by developing an activity during which students were required to use Scratch to design an interactive dichotomous key. In order to do so, the participants developed their own interactive dichotomous keys and then identified the skills and knowledge the students needed to accomplish the task. Lessons were then developed to guide students in developing the identified skills and knowledge. When developing these lessons, the participants were able to develop their own capacity in coding and computational thinking. Furthermore, issues regarding how much guidance students may require, and allowing opportunities for students to struggle, or to go further, as required was discussed. The links to the lessons are included at the end of this report.

**Coding and Using Sense Hats with Raspberry Pi**

For this part of the project, we thank Sam Altarac-Hoffman of SWLSB for his time and expertise in the exploration of using sensors. All participants expressed an interest in this aspect, recognized the potential of using sensors within their classrooms and had hoped to be able to build on the experiences of SWLSB to more easily integrate sensors into some of our teaching. However, we quickly discovered that we need to allow ourselves time develop our own comfort in using the equipment and being able to troubleshoot the problems that may arise. One of the participants worked with Sam to learn how to integrate the sensors into force and motion labs. This work involved identifying possible labs in which using the sensors would increase student learning and then designing ways in which to use the hardware. It was decided that within a school, a teacher could identify different times throughout cycle 1 and cycle 2 that students could have access to these sensors, allowing students to build their own capacity of how the tools can be used.



The included picture shows some of the experimentation during this aspect of the project.

This project allowed us to develop our capacity to integrate computational thinking into the cycle 1 science & technology classrooms and to seriously reflect on when it would be appropriate to do so. Given the time required to build teacher capacity and to address the technical requirements of the equipment used, we are yet to use some of the activities in class. However, the activities are ready for use in the 2018-19 academic year. Classroom testing will allow us to refine the activities and reflect on how it might be possible to further develop computational thinking with the students.

We believe that the resources we have developed thus far can be used by other teachers to support using coding and 3D printing in the science & technology classrooms. We also recognize that building capacity within schools is especially important and appreciate the opportunity that the funding for this project provided us to do so. We recommend that other teachers planning to pursue similar goals need to allocate enough time to build their own capacity. We plan on continuing to use the developed activities and to share our experiences with our colleagues. Once field tested, the activities will be shared more formally.

**Links to Resources:**

Guide to 3D printing
Interactive Dichotomous Key: Coding with Scratch

We would like to thank Chris Colley and Christine Truesdale at LEARN for their support during this project.