

Deep learning with Hopscotch

1. Title Page

Do you have students like mine? Here is one, at the very beginning of Grade 6.

For those who do not follow me online, here's what I did during my summer vacation. '

Many people did not even notice the eclipse of the sun, but with my FLIR infrared camera attached to my iPad, I took many pictures of the eclipse, without damaging my vision. I analyzed the solar corona during the eclipse and I tried to detect Jupiter, Mercury, Mars and Venus in addition to the Regulus star that were hidden by the sunlight. With the help of my friends online, I learned about the relationship between eclipse and the development of Einstein's theory of relativity. I then developed a mathematical model of Einstein's theory by coding with Hopscotch. I shared my work on social media and I discovered other inspiring examples.

1b.

We can notice the motivation of the student who is fascinated by space since the 3rd grade. His passion for space motivates him to continue to develop, at home, his mathematical skills, by developing models by coding with Hopscotch. With the support of parents, he consults the public library, applications on the iPad, and goes to astronomy sessions organized by amateurs and university professors. We also notice the online science culture. This is a radical change from what happens regularly in the classroom. (1:45)

2. The relevance of deep learning

Programming with Hopscotch is very much related to mathematics. This allows us to compare the work of 3 students according to the thinking criteria of the provincial mathematics program. According to our mathematics program, our students must use the skills of planning, information processing, critical thinking and creative thinking with great efficiency. It is required by the math program.

The worksheet allows the student to understand the problem, make a plan to solve and model the solutions, but the activity itself does not allow students to show critical and creative thinking.

With isolated programming, the student can understand the problem, make a plan, elaborate model to solve the problem, and form a conclusion. The student uses critical thinking.

Did you know that David St-Jacques, the next Canadian astronaut to visit the space shuttle? He is also an astrophysicist! With deep learning, the student goes beyond all thought expectations. He has a glimpse of the work of astrophysicists, in addition to having a glimpse of what David St-Jacques had to do to become an astronaut. Deep learning allows the realization of an elaborate, critical and creative plan to show fractions using the code. The student's understanding is situated in an example of real life, in a field that fascinates and inspires the student and that could open doors for him in a specialty in high demand. He builds new knowledge.

Mathematics is only the beginning of deep learning. (1: 40)

3. The look of deep learning

The student in difficulty does not take regular school seriously. He needs a particularly powerful force to attract him to sustained and rewarding efforts. What gives meaning to the life of a struggling student? It may be a strong sense of identity around a purpose or a passion. When the student chooses a meaning to his life or a passion, in a good environment, he will be able to surpass himself.

At a light year, we can see the stars in a place where the light has taken a year to reach us. We see them as they were a year ago.

With the Hubble telescope, we could take a picture of a galaxy at 13.4 billion years, 400 million years after the Big Bang. With the expansion of the universe, this galaxy is now 32 billion light-years away from us.

Recently, Twitter showed me a report from RDI about the discovery of the very first stars formed in the universe with a brand new technology. At 100 million years after the Big Bang, in the first light after the big bang, he was able to detect a small decrease in the radio spectrum, showing the presence of a star.

4. The challenge

We all have students doing well. Our Challenge: can we create an environment where each of our students, even those who are struggling, can make a difference in our society? Can we mobilize the strengths, motivation, ideas that drive our students to excel?

One wonders what is the relationship between the STAR TREK film and the curriculum that one has to teach. We want to encourage students to choose Jim T. Kirk's growth mindset to explore their surroundings, use science and critical thinking to break the irrational, use science to improve their society, to build peace.

Captain Kirk's opponent, Krall, has a fixed mindset. He does everything to lengthen his life. He goes as far as to destroy other civilizations, to accomplish his goal. Krall, lost in space, did not know how to adapt and kept an intense hatred for his civilization.

The Challenge of Deep Learning: Can we inspire all of our Captain Kralls to change their mindset in order to make a meaningful difference in our society? (1: 20)

5. Reimagining learning

We need a new learning process. The teacher and the book are no longer the only sources of information and interaction during learning. There is a whole community, a multitude of sources of inspiration.

Hopscotch was designed by Samantha John and Jocelyn Leavitt that you see here in the photo. The app has won several international awards for its design. Jocelyn is now working to give you a lot of ideas on how to use Hopscotch with the whole curriculum. It's not just about learning to code, but about applying it in math, science, history, and languages.

5a. You do not know how to code? No problem. Hopscotch offers several videos for students, explaining step by step the basis of programming. There is a video for your weakest student to the most advanced.

5b. The application is easy to use. To code, it is only a matter of dragging blocks that we organize in a logical way about subjects that fascinate us.

Student creations can be shared with the Hopscotch community.

5c. Every programmer can watch, follow, love and learn from the programs of others.

5d. There is an increasing number of programs already written to inspire students to continue their learning.

5e. Hopscotch also provides feedback on all programs that are published. Hopscotch analyzes the programs published by the student and offer ideas to improve the student's program, to improve his programming techniques.

If you want to start a new project, Jocelyn is ready to communicate with you.

Combined with Twitter, radio, television, internet research, and the teacher, who also wants to make a difference, we provide a lot of tools for our students to thrive. (2: 00)

6. The character

We reserve one hour per week for programming: it's time for genius hour. During Genius Hour, we can challenge all our students to create something that they value and that interests them. Is this a reasonable solution considering your context? It's the same concept that Google uses with their employees. They have the autonomy to work on a fascinating project of their choice if they follow the vision of the corporation.

Students have the chance to develop their character and learn to learn, to show their perseverance during learning and a responsibility and integrity in the choice of ideas they choose to develop. Projects can then be shared with Hopscotch and social media.

One must learn to read and write in another way. Let's see an example: In your opinion, is it the code on the left or on the right that makes it possible to draw the hexagon?

The circle surrounds an artifact of the Voyager spacecraft while the hexagon shows the shape of a mirror segment of the future James Webb telescope. The James Webb telescope is scheduled to be launched in May 2020.

(1: 20)

7 - Civic Education

With civic education, we must open our minds, expand our horizons to the whole world. We need to develop compassion, empathy and interest in others. Can we consider finding our place in the universe to do this?

Each new image of the simulation is approximately 10 times larger than the image of the previous space object, placed in comparison.

We see the Earth that we know well, with all its immensity. The Earth is much smaller than the planet Jupiter, with a diameter of 12,742 km. Jupiter is much smaller than the exoplanet Tres-4 and the sun with its diameter of 1.39 million km. If we continue, we realize that the sun is much smaller than other stars including Aldebapan or KY Cygni with its diameter of 2.3 billion km. These stars are however much smaller next to the entire solar system, black holes, nebulae or our galaxy, the Milky Way with its diameter of 53 million trillion km. The Milky Way is much smaller than other galaxies, the Virgo supercluster, the local universe and the observable universe with its diameter of 880 billion trillion km.

What is the size of the universe? Why does the world exist? What is our place and function in this universe? How does the universe work? What forces are at the basis of our universe? How did it develop? Are we alone in this universe? These are multi-generational and multicultural questions that push scientists to understand the world in which we live. (2:15)

8- Collaboration

Do you have trouble with technology and math? Do you have any reluctance to innovate? I would like to encourage you because you never work alone with Hopscotch. The Hopscotch app offers extensive support to the student and the teacher. Gifted students in mathematics can write programs even beyond the teacher's comprehension, because the Hopscotch app provides the necessary support. The teacher ceases to be a transmitter of knowledge and becomes a facilitator of learning.

In this example, the picture comes from a host of the Royal Astronomical Society of Canada. The idea of creating artificial intelligence comes from Google's Siri system. The information about artificial intelligence comes from the site of the program Découverte of CBC. The artificial intelligence algorithm was written with Hopscotch commands and an iPhone. Hopscotch also allows you to recognize speech. So, instead of saying OK Google, for the phone to answer us, we will say OK Hopscotch and our Hopscotch program recognizes the sound of our voice and responds to us as explanatory text programmed by the student. We see in the image a galaxy that "eats" another galaxy. The AI makes comments in English or French, responding to the sound of the user's way.

A collaboration like that, I find it fascinating. Try to imagine the reaction of students who have successfully coded a project like this and their new motivation towards mathematics? (1:45)

9- Communication

Communication includes communication for various audiences.

Hopscotch allows students to write long texts with a medium they like. For a student who lacks motivation to write, the medium may be what makes all the difference.

Students can write letters, books, a newspaper article, design posters, develop a website, write interactive stories, and explain the program they wrote. The program may also be a response to a fictional text reading or documentary.

Here we see a website explaining the difference between rocks coming from Earth and meteorites, these rocks coming from space.

Websites are the basic resources of the internet. Websites also form the basis of online business.

There is the text, but the communication also includes the mathematical expression. The code allows learning for various types of learners. Programmers develop critical thinking, problem solving and mathematical communication in a visual and concrete way. They code to learn. For some, the code is so much fun, they learn math by playing. Code is another form of mathematical communication. (1:25)

10- Creativity

Creativity is about pursuing new ideas and solutions. Most people think that not many people can be creative, but in fact, everyone has enormous creative potential. The other misconception is that creativity is a little crazy, when in fact, most creative people are also informed, controlled and have a deep vision. There is an urgent need for creative and innovative people who know how to code and who know how the code fits the world of work and society.

For example, NASA is working with companies in several countries to develop their next projects. With introducing deep learning, you may allow your student to create the next Lunar Space Station, the next Martian mission or a brand new venture. (1:00)

12- Equity

Many students arrive in class not even ready to learn. They come from disadvantaged backgrounds through poverty,

alive in the terror of being a refugee,

after the Quebec massacre, in fear of their physical safety,

to live in the perception of not being welcome anywhere,

to be homeless,

neglected,

or lacking stimulation.

Many, even here in Canada, have the fixed mindset that science, mathematics and technology are not open to women. Very few women hold faculty positions at the University in this field. Yet women are as qualified as men.

Every teacher, without exception, will admit that she wants each of her students to succeed in mathematics; however, our attitudes sometimes hidden from ourselves, the stereotypes that we maintain towards certain students, have a contrary effect.

It is up to us to reduce these injustices and put in place deep learning for all. (1:45)

17- Promotion of powerful conversations

These examples that we see daily in the classroom change the way students think, feel and interact in the world. They are free to follow the thread of social media, but even more important, they can ask their own questions and find answers right away in the language of their choice on Wikipedia for example. Their research can then take them to YouTube, Radio-Canada, Netflix, TED talks or any other good conversation distributor.

Here, one wonders if life exists elsewhere than on the Earth and in what form.

The Curiosity mission verified the presence of water on Mars. The rover analyzed the geological composition of many places on the surface of Mars. The mission of Mars exploration is still going on. Will we be able to find life on Mars? Either microbe fossils or microbes still alive in the rock?

It will only be after the launch of the ExoMars mission in 2020 that we will be able to dig up to 2 meters deep on Mars to see if there are bacteria or traces of bacteria in the Martian basement. (1: 15)

18- Cultivate a deep learning culture

For deep learning to work, everyone must see themselves as a learner. Teachers as students. These are our questions, our investigations that teach what really matters. Our attitude, having a growth mindset is what will make all the difference. During learning, you develop personal goals, and you learn to evaluate yourself.

You could listen to a recent report on radio about Stephen Hawkins' life. He spent a large majority of his life studying black holes and sharing his knowledge with the general public despite a severe disability.

Black holes exist in the center of almost all galaxies. Our Milky Way contains a black hole, Sagittarius A, four million times the size of the sun. Around a black hole, gravity is so intense that space-time becomes infinitely curved and creates a gravity so intense that nothing escapes from it, not even light. However, Hawkins calculated the presence of radiation escaping black holes. This prediction must always be confirmed by observation. Here you see a simulation of the vibration around black holes. I wish all of my students had the courage and determination of Stephen Hawkins.

(1: 30)

26- The learning environment

The new learning environment includes physical space and virtual space. It is the environment, the ambient culture, which is the other teacher.

There are innovative ideas everywhere, for example in virtual discussions organized by TED. In one of the discussions, we can listen to Fei-Fei Li who discusses the vision of artificial intelligence that I transformed here into a Hopscotch program.

Artificial intelligence will be found in all areas, including space. The AI will be able to recognize space objects, including galaxies, in order to classify them. To do this, the AI must learn to see and interpret images. It's about supervised learning. Supervised learning is like showing a child a picture book. We show an image and we say it's a galaxy. Is there another image, is it a galaxy or not? After a few images, the IA realizes what a galaxy is. To be really useful, the AI must be able to recognize that what it sees is really a galaxy, and its characteristics. (1: 15)

27- The student asks questions

In our new environment, it becomes important for the student to ask his own questions. They do not passively receive the knowledge of teachers.

In this example, with the predictive learning of artificial intelligence, we learn to predict the future. We have to invent the rest of the image to predict things that are reasonable. We see here an impression of what would happen when a star of our galaxy explodes and becomes supernova. The intensity of the light would be such that it would be visible even during the day without any instrument. (0: 40)

47- Help humanity

I would like to conclude with a thought from astrophysicist Neil deGrasse Tyson. It reminds me of a strategy of emotional intelligence, to take a step back.

It reminds us that many people kill and are killed because they have a different conception of God, that others kill because of personal needs or political dogma. Faced with the extent of the universe, the multitude of galaxies, the possibility of meeting other intelligent life forms outside our planet and our very small size in this extended, we are forced to revise our perspectives, our identity and to become much more humble and even, taking into account our human nature, become aware of the deepest values and meanings by which we live. With a greater and deeper vision of our universe and our place in the universe, it becomes much easier to look beyond our immediate problems and circumstances in order to explore and think about solving the problems that we face. (1: 10)