Educational games with Hopscotch

Orlando

Difficult and sensitive situations arise in the media on a daily basis that have repercussions in the classroom. At the time of writing this presentation, mass shootings in a gay bar in the United States occurred by a man of Afghan descent. This is the worst attack on American citizens by a single terrorist. Every life is precious and no Muslim would approve of such an act of terrorism. It is possible to discuss these important and sensitive issues in order to identify and frame the two opposite sides of the dilemma with critical discussion strategies or emotional intelligence strategies. The consolidation of our inquiry that is integrated with the most curriculum expectations, including mathematics, ends with an educational game created with Hopscotch. Here we see a representative explosion of what took place. We also see the play of the mirror designed to promote attitudes of tolerance and understanding of the other. We see a pink hand, representing homosexuals, and an identical brown hand that is automatically drawn on the other side of the mirror, which represents the other. They are a mirror of each other. We realize that they share many points, causes and objectives.

Need-an-app

You may have seen it on television, a house exploded in our community of Mississauga. 72 addresses have been affected. Our students exchanged text messages when it happened. Several residents were evacuated and sent to temporary shelters. It did not take long to find the motivation to remix a Hopscotch game in order to calm our nerves and help others, who play the game, to calm down as well. The strategy is designed to release negative energy and promote a sense of well-being. The game tells the story of what happened from the perspective of a child. We discussed what could have caused the explosion, such as gas leaks or perhaps a dump under the house. Last January, the police investigation indicated that it was a double suicide by people with names like Diane and Robert.

IA jokes

You can code jokes from artificial intelligence with Hopscotch. Like what do you get when you mixed an optics with an object? .... An idea. OR As in the show DARK MATTER, the artificial intelligence of the lady robot told the man: I can feel your pheromones.

#HOUR OF CODE

Prime Minister Justin Trudeau wants to ensure that Canada's education system meets the challenges of the future, that Canada can play an important role in the world. He is leading the Hour of Code movement in Canada. The work opportunities for future engineers, for students who know how to code, are enormous.

Mathematics for Engineers

Here are CODE.org statistics. In the area of mathematics, science and technology, 60% of the jobs available are jobs for people who know how to code. And if you look at the number of graduates in mathematics, science and technology, only 2% have the necessary training to be able to work in this field. Of the qualified persons, only 27% are women. Also, most parents want their children to learn to code, but only 1 in 4 principals offer programming at their school. How can we teach mathematics to inspire future engineers?

Computational Thinking

ISTE's new technological standards include computational thinking, but what is it? For example, we want to create a security system to prevent the explosion of another house in our neighborhood. Engineers use a variety of tools to develop their systems and work with several products on the market (hardware and software) to develop innovative solutions. We need to identify what is available and what is needed for the problem in hand. We use Hopscotch with the iPhone or the iPad to develop our prototype. We will also use the FLIR infrared camera which allows us to see in the dark. Equipped with our tools, we take pictures of the area of interest, using a visible light camera and a FLIR camera. The infrared image allows us to see all the necessary information. We can see if anyone or an animal is present on the site. We can see structural problems, and damage. We can identify if there is gas buildup and if leaks are present. We could see if a fire broke out even before the eyes could.

In our prototype, we will code the buttons that change the security system between the visible light camera and the infrared camera. The security system is handled with the code. We will divide the system into 4 objects. An object is the image of visible light. The second object is the infrared image. When you press the first button, you can see the use of the visible light cameras and the second button allows you to switch to infrared. The code tells the iPad what to do. The program is written gradually, and tested to see if it works properly. When errors occur, the code must be corrected and retested until the prototype is completed.

Interview with Diane

Since most teachers have never worked as an engineer, how can they inspire students to go into this field? Following the initiative of Tony Wagner, we can find out by talking to engineers, and asking them what aspect of their education has had a positive impact on them.

Personally, I worked as a software engineer before entering the teaching profession in a second career. My engineering job consisted largely of reading the code that the other engineers had written, making sure that the code worked well, that there were no mistakes, that the code met the expectations prescribed by the minister. I found that there were many parallels with my work as an engineer and my work as a teacher.

Interview with Pierre

My little brother Pierre, who is the technology director at FLIR, does not remember what he did to learn mathematics. He remembers being introduced to programming in high school. At about 14, he did not have much to do during the summer, so he decided to look at my notes from the computer course I had taken in high school. In addition, our father bought a magazine that showed how a few computer programs worked. Pierre studied the magazine in detail and began reading the code of the computer magazine. After reading the code, he had a good understanding of the logic behind the code. Pierre spent his weekends coding.

At university, he was ready to become a computer engineer. In his programming class, he was among the 3 students out of 200 who passed the course. The other engineering students had all failed. If a student decides to pursue engineering or computer science at university without having coded before, he will face a lot of difficulty.

Interview with Samuel

Samuel is my nephew. His father, Pierre, encouraged him to code at home. He would give him allowances to code everything he wanted at home. Samuel learned to code by himself, using professional languages. At 17, while still in high school, Samuel began working at FLIR. He is now in his second year at University in Computer Science. As a hobby, he developed an application called 1stContact. The application gives a unique QR code for each phone number. When you meet someone, you scan their QR code and get their phone number. Samuel loves programming.

Interview with Haneef

Haneef is my son. He is the technology director of a start-up company. He was part of the team that developed the Wattpad application. Wattpad is the world's largest community of readers and writers. Haneef learned computer science from me from primary school. We used LOGO, HyperCard, and Visual Basic. In grade 10, he had no barriers in front of him at school to take computer science classes. He knew the value of programming. He decided to attend high school programming courses and, as he coded for fun, he succeeded, at the top of his class. At university he was also at the head of his class. I asked him what he thought of mathematical manipulatives, he remembers that it was something he had burned in an unapproved scientific experiment. Although they might have been useful at some point, except for the LEGOs, math manipulatives did not interest him.

Interview with Ismael

Ismael is my youngest son. He was an artistic child. He loved to play music. He spent hours composing and playing his own music. Ismael was rather undecided as to what he wanted to do in his future. He heard from his friend at school and his brother that computer science seemed interesting. With a little encouragement, he attended high school computer classes. He wanted to do something where he could solve problems and be creative. Computer science meets the two requirements he had. Ismael is in the 2nd year of the computer science program at the University.

Equity

Is learning to code only for rich white men? The statistics seem to show that as a society, we think so. Educational institutions are increasingly working to include programming in their schools. There is a shortage of people of color and women in computer science while they are also able to work there. It is a question of fairness.

There are now more black men in prison in the United States than there were slaves in the United States. They learn to code in prison. Would it be better to include them in school before going to jail?

Maybe the Malala of your class could become the person who will invent the next Google search engine. The needs of each of our students must be met. Including Hopscotch in the classroom offers exactly that. It gives all learners, including those who have traditionally been excluded, the opportunity to succeed.

Mathematics are everywhere

Ideas for education are not limited to the classroom. Students can get ideas from everywhere: from web videos, television, social media, TED conferences, field trips, museum tours, or in movies. Ideas are everywhere, available 24/7. We can encourage our students to be attentive and use all the ideas they have access to for their school projects.

On their own, students conduct inquiries about topics that matter to them and create innovative solutions based on real life. They work at the Redefinition level of the SAMR model.

Maths behind programming

The books of Marian Small Math by Image and Good Questions offer a good basis for problems to teach mathematics in a differentiated way. It advocates the use of visuals to differentiate teaching and to understand mathematical concepts in depth. Using an application like Hopscotch, we will also have fun while developing high-level processes behind mathematics: problem solving, thinking, reasoning, making connections, representation, communication, selecting tools, and appropriate technological strategies. The processes behind mathematics are what is most important in order to write the code.

Empathic

Have you heard that all teachers are in the 20th century, while all our students are in the 21st century? There is a discrepancy between what is taught at school and what students will need in the future.

Empathic teachers think about their classroom from the student's point of view, drawing on their interests. Hopscotch does not overload the teacher, he cooperates with the teacher and students. It helps the teacher to flip their classroom by providing videos, discussing them in a discussion forum, and giving a wide range of curriculum-based model programs where students can learn to code and are able to create Programs based on their interests.

Solve problems and take risks

Students are not limited to computational thinking. They can explore many ideas, problems and solutions during programming. For example, companies that promote the use of fractured natural gas maintain that their practices are safe. Students will remember 10% of what they read, but 90% of what they do. By "making" the code, we are better able to meet the needs of students.

Professional Learning Network

Being able to network with others is fundamental to innovation. Hopscotch creates an environment where ideas can be shared. Outstanding programs are always shared by the Hopscotch community. Students can look at programs written by other people, they can also remix them, use them as a basis to create something new. Programs written by students can be shared with the Hopscotch community. After sharing, the student receives other Hopscotch program ideas. Hopscotch provides an **assessment as learning** and also the motivation to create something new.

Observer

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Creators

Everyone can use technology and consume information, but not everyone can create new ideas. With Hopscotch, each program is an act of creation. Teachers encourage a culture of creation. With their own device at home, instead of playing violent video games, students can play or create a video game with a higher purpose from a very young age. A different culture is being created. After hearing horrendous news such as the fire that forced the evacuation of the entire city of Fort McMurray, Alberta, students, even Syrian refugees can immediately design an advertisement to help citizens.

Resistant

The transition from a class of the 20th century to a class of the 21st century is not easy. Is it easier to do what we do year after year? If students feel alienated in the classroom, they will behave badly. If they are actively involved in their learning, they will be motivated to lead their own learning and to help. There is a learning curve to this change. On the left is a beginner program. A yellow line and right a much more advanced program, a website with a pretty spectacular bison image initiated by the natives in order to reclaim their land.

Reflexive

My students have consistently achieved excellent exam results in the department, so I was not afraid to try something new. The use of Hopscotch during the Genius Hour was very successful. For one hour a week, during Genius Hour, students receive an iPad and the opportunity to create something new that they consider important. This is 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' creativity can be assessed. For example: ideas are combined in an original and surprising way, to solve a problem, to address a subject of litigation, or to do something new.

Mathematical discourse

In her book, Math Expressions, Cathy Marks Krpan, gives other criteria that can be used to evaluate students' mathematical discourse.

Success (1): The student can analyze, interpret, and summarize a variety of texts from a different mathematical context such as media, books, problems in words.

Students read and explain their understanding by speaking to the teacher, writing or using a technological tool. I wrote this Hopscotch program after reading a good book on nanotechnology, the science of the infinitely small. This is a 3D printer. In medicine, 3D printers are used to regenerate the skin and can be used in the future to regenerate whole organs, such as the kidneys or bones, from stem cells.

Success (2): Students are able to rely on what others contribute to mathematical discussions.

Did you know that there is a whole world undetectable to the human eye? The National Geographic film "The Mysteries of the Invisible World" provides an excellent example. By using all types of technological tools, we can see the world in a new way. With a little research, we can contribute to the mathematical discussion, adding that the infrared camera can detect infrared light emitted by each object or person.

The movie Mysteries of the Invisible World, also discusses that space flight is extremely expensive. Scientists believe there is a way to reduce the cost of space exploration by using nanotechnology. We are now able to create very strong structures using a single carbon sheet, a large sheet that can be wrapped in a tube. This discovery won the Nobel Prize in Physics in 2010. The film examines how these very strong structures could be used to create space elevators.

These space lifts will also need innovative mathematical thinking to build them. We can start saving money by imagining solutions. We can build a Hopscotch model of a space lift for space exploration.

Success (3): Students are able to paraphrase or explain what others are saying.

In the private sector, billionaire Yuri Milner is launching a $ 100 million research project to prove an interstellar travel concept using a small satellite powered by a laser sail. The craft, which can be held between two fingers, sets sail to Alpha Centauri. Milner plans to send not only one, but hundreds, even thousands of these tiny crafts into space for exploration.

Success (4): Students are able to change their ideas, listening to others.

Should we focus on investment in space exploration when many people on Earth do not have the necessities of life? It seems that there is not enough money to spend to build the infrastructure needed to help children in Africa who do not have access to safe drinking water. Even in Canada, there are communities that do not have access to safe drinking water, thereby violating our human rights code.

Nanotechnology could be used to help. The low-cost filtering straws of $ 20 per unit of nanofiber-coated water bottles at $ 40 per unit can be used to filter water in areas where infrastructure is still needed. Nanofibers not only remove the pollutant from water, they remove bacteria and viruses from water. With clean water, we can save millions of dollars on health care costs.

Success (5): Students are able to provide useful impressions to others.

If science is not interesting, perhaps the creation of a science fiction film could be? Creating movies requires not only a good story, but also a huge digital work behind the scenes. Is it worth it? For example, the Star Wars title at the beginning of the movie is displayed at a large size and rises while the letters become smaller. This is a creative way of displaying the title in a movie. This simple act of creation is part of what George Lucas has included in his Star Wars movies. He sold his franchise to Disney for $ 4 billion.

Success (6): Students use appropriate mathematical vocabulary.

Being able to express mathematical ideas using appropriate mathematical vocabulary can also be coded. For example, what does a nanometer look like compared to other known quantities? A carbon nanoparticle is about 130 million times smaller than orange and an orange are about 130 million times smaller than the planet Earth. The Earth is 12,756 kilometers in diameter. An orange is about 10 centimeters in diameter, while a carbon nanoparticle is 0.7 nanometers in diameter.

Success (7): Students can ask effective questions to stimulate reflection from others.

One question comes to mind. Is only nanoscale technology important this year? Actually no. Nanotechnology already exists in nature. We can think of the gecko feet with their nanoscale hairs that allow them to stick to the ceiling. Can we use the wisdom of nature in our future conceptions? In fact, there is a whole science behind the observation of nature. This is biomimicry. Scientists have observed the hair of the gecko to create a new band that can be used in hospitals to replace sutures during surgery. What else can be done with nanotechnology? Perhaps we could create nanobots to clean the ocean of polluting particles.

Success (8): Students are able to describe models or diagrams and how they represent mathematical ideas.

While world leaders agreed at the Paris conference, we need to invest in solutions to solve global warming. By using nanotechnology, the size and efficiency of solar panels are very small. We can model the solar panel by coding with Hopscotch.

Hopscotch can also be used to create diagrams of all types representing mathematical ideas. For example, we can see visually that two thirds of the planet Earth are covered with water while 97% of the water of the whole planet Earth is salty.

Games activating computational thinking

Dr. Romero of Université Laval also shows in her critical thinking model how the computer science of programming is related to the skills of the 21st century.

Students can create their own ideas, programs and games to promote an ideal like peace and sustainability and share their creation with the world. Students can emulate as early as 8 years what the most innovative entrepreneur does as a job. In the specific context of programming, the student not only learns to code, but to create innovative ideas with the code.

Starry Sky Game

The goal of the game is to create the night sky of your city as seen from the International Space Station at the touch of a finger. We create a black background and gray lines showing the light in the area. The yellow dots indicate the area where the light is most intense in the city of Montreal. As the students touch the screen, a yellowish light appears at his fingertips.

Oil Drilling Game

This game provides an understanding of the in situ technology used to extract bitumen from the oil sands. The goal of the game is to install the steam and bitumen pipes that are used to extract the oil. We press on the squares to draw the pipe, 10 pixels at a time and we press on the arrows to change the angle with which the pipe is being drilled. We have to make sure the hose is properly installed and goes to the right place, otherwise the oil extraction will not work.

Expert System Game

In this game, we create an expert system. The system contains knowledge on critical subjects such as photobioreactors using microalgae to create biofuels. Reacting to a loud noise, like the voice of a student, the expert system provides information about his area of expertise. This expert system is about creating sustainable green oil. Algae can produce biofuels very quickly, using waste such as CO2 in areas that are unsuitable for life or agriculture. The creation of seaweed-based oil reduces the amount of CO2 in the atmosphere while its biofuel has the same quality as traditional oil. As in searches using voice recognition, Hopscotch can detect sounds outside the iPad.

Target Wind Game

We can produce renewable electricity from the wind; However, the wind turbines will only turn when the wind is present, touching its blades. In this game, we must adjust the height of the blades with the knobs so that the blades touch the wind. If the blade touches the wind, it will turn and get points, otherwise no electricity is produced and we gain no points.

Sustainable Vehicle Design Challenge

In order to reduce our carbon footprint, we can use more sustainable sources of energy. We can also design a more sustainable transportation. MIT published the research of some scientists who were able to create solid and light materials through nanotechnology that could be used to build aircraft, saving an enormous amount of fuel. The material is so light that it can be placed on a flower without disturbing the flower.

The other example is a game where we designed a solar airplane like the Solar Impulse 2 that traveled all over the world with the only power of sunlight. The aircraft moves through the screen following the movement and inclination of the iPad or iPhone.

Biometrics game

To improve security at Canada's borders, this spring, we will install facial recognition technology at major Canadian airports, starting with Ottawa Airport. This technology is worrying people. The figure of the person presenting at the airport kiosk is compared to the photo on his passport. If the two are the same, we can cross the border, otherwise we must speak to the customs officer. This is what we are doing here, in a simplified version.

Virtual Reality Game

Researchers are using virtual reality games to treat bipolar disorder. When someone suffers from mental health problems, medications do not always work. Physicians are looking for alternative ways, using gaming technology to cure mental illness.

Ethical decisions

Google cars without drivers are controlled by algorithms. Driving tests indicate that the algorithms lead in a safer way than humans. Inevitably, the algorithms of cars will have to make ethical decisions in case of emergency. For example, the car is about to have an accident while driving on icy road conditions. The car's radar detects two groups of people in front of the car and must make a choice. Should the car strike a group of five elderly or should it strike a mother and her baby? As it is winter, the radar sensors are also partially covered with snow. The decision made by the car's algorithm will depend on the quality of the information gathered by the radar and the ethical decisions coded in the algorithm of the car.

Game of Peace

In a historic moment, the US President met with the Japanese Prime Minister and some survivors of the Hiroshima and Nagasaki nuclear attacks of the Second World War. This visit is a reminder of the danger of nuclear reactions, that a world without nuclear weapons is better, and that peace is precious. Here we draw the nuclear explosion that reminds us what can happen if we do not make an effort to be moral and work towards peace.

Climate change resolution game

Nuclear fusion is a viable solution to global warming. It releases enormous energy during the marriage of two atoms of hydrogen. The advantage of fusion instead of fission is that it produces very little waste. It is the same reaction that is found in the sun. Several groups of engineers around the world are working to manufacture nuclear reactors based on fission. A Quebec physicist, Daniel Laberge, innovates and embarks on a different technological direction. It uses the piston. Its reactor will have 200 pistons arranged around a sphere. Hydrogen plasma is injected into the center of a lead vortex. Pistons that strike once at every second will give a shock wave that will propagate to hydrogen plasma, making it 1000 times denser. With a higher density, hydrogen atoms will have a greater probability of colliding and merge. This technique has the advantage of being inexpensive compared to other fusion methods used by other engineers.

Moderation with other teachers

Moderation with other teachers is a process where teachers meet to evaluate student work based on predetermined success criteria. Teachers participating in moderation assess students' work in a more equitable and coherent way. If mathematics is not evaluated correctly, there is a question of ethics. We will use a section of the mathematics program. The topic shows the levels of thought.

Often, students are able to do mathematical calculations, but have no idea of the problems they solve. This section helps to evaluate higher levels of mathematical thinking.

Before the evaluation of the work, teachers would first place students' work in three categories: low, medium, high for discussion. We have on the left a page of the PolicePrep program. In the middle, we have a Hopscotch game, which was not coded by the student, which was used to describe fractions. To the right, we have a Hopscotch program, coded by the student.

In these examples, it is the teacher's design of activity that would allow a student to show higher levels of thought. The worksheet allows the student to understand the problem, make a plan to solve and model the solutions, but does not allow students to show critical thinking and creativity.

The second example does not include programming by the student. The student plays a game to show his understanding. The student can understand the problem, make a plan to solve the problem, make a model of the solution and form a conclusion. Students use critical and creative thinking to find the best points to model the fractions by touching the screen of their device. The student can demonstrate all expectations at level 3.

The third example allows the student to go beyond all expectations of thought by enabling the realization of an elaborate, critical and creative plan to show fractions by using the code in a real context. It all depends on the activity, but programming allows a student to develop his or her critical and creative thinking skills while allowing them to go beyond departmental level expectations.

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For more information on integrating Hopscotch into the classroom, you can always check out my book.