

1. Use infrared to stimulate thought and scientific innovation

Hi.

I was listening to a talk by Thierry Karsenti on YouTube and he said we have a plague in class. Technology is used, but students are passive. They use technology to distract themselves but not significantly to work in the classroom. Dr. Karsenti offers 17 ideas to overcome this passivity in class.

My name is Diane. I am a French immersion teacher in Mississauga, Ontario. I'd like to show you some ideas that we can use with the strategies we already know, to use infrared to stimulate thought and scientific innovation. (0: 55)

2 (Chair)

Can you imagine all the questions that came to mind when I saw an alien sitting on my chair with an infrared camera? I could not believe my eyes! You can see it, sitting there in white. What is happening?

It's a challenge for all learners. I have seen some books written by university professors about infrared but I have not seen any for the primary and secondary level. With infrared, you have no choice. You must explore and experiment to understand.

The image? Your eye can perceive visible light at wavelengths between 400 and 750 nanometers, so from purple to red. Beyond the red, in the electromagnetic spectrum, there is the infrared, with wavelengths of 750 nm to 1 mm. Our eyes cannot perceive this light but we can feel its heat. The infrared camera measures the temperature on the surface of objects by the amount of radiation emitted. It's like detecting heat, with a thermometer. What do we see here? It is the heat left by someone who sat on the chair for a while, and left.

Ask your students to do a meaningful task. Ask them to write a book about infrared related to a subject that fascinates them by using Wattpad for example.

(1: 30)

3 (Eye)

In our classes, we have very advanced students sitting next to students in very great difficulty. We also have students from different cultures and a wide variety of backgrounds. To reach each student, we differentiate our pedagogy. We can customize our pedagogy. We can give a different level of work to each student. Each group of different level or interest can be given a different job. Tasks can be given that the student chooses himself. One can give the choice of tool to perform a job.

To do a scientific or historical research, infrared is one of the tools at our disposal to differentiate teaching. For the 4th year, it's ideal.

It was in 1021, in the medieval world, that Ibn al-Haytham in Iraq, demonstrated with his camera the size of a room that can be seen through the rays of light that enters our eyes. With such a large camera, Sir William Herschel, in 1800, postulated the existence of light rays invisible to the naked eye.

The infrared camera makes it possible to create artifacts that a student can incorporate into his work, allowing a deeper understanding. (1: 15)

4 (Explosion)

Homework has a positive impact on students who own an infrared camera. Their homework is transformed into games. In a few minutes a day, they can have fun discovering the properties of light and the usefulness of infrared. The student will share her pictures and explanations with the whole class.

For example, there was an explosion in a shopping mall right next to one of our schools. The school had to close for two days to secure the premises. The police eliminated all criminal causes of the explosion. Firefighters had to find the gas leaks that fueled the fire. You see the gas leak with the yellow arrow and the fire with the red arrow. Then we had to make sure that the structure of the surrounding buildings was still intact, this is the white arrow. All this can be done using infrared. When I went to take these photos, on the Sunday of the explosion, I saw some of my students, accompanied by their parents, who took the same pictures before going swimming. Back in class, everyone was talking about this explosion, a personal reality of their lives. It is the students who took the photos, who lead the discussion.

Is it a good job according to you?

(1:00)

5 (iPad)

Today's FLIR infrared camera is tiny and can be attached to your iPad.

I do, among other things, 40 minutes of stationary cycling, in winter. This is the time I give myself to do other types of homework in infrared. I watch videos on my iPad. I noticed at least twenty films, and shows on Netflix and also, many videos containing different examples of infrared application. You can also read articles received with Google alert. It gives a lot of ideas.

By following the ISTE standards, the infrared camera allows the student to take an active role in learning the technology. He can learn to use it responsibly and develop critical knowledge. It allows us to work on the Redefinition of SAMR model because it allows us to create new tasks previously inconceivable. Our students will be able to develop innovative ideas based on their explorations. (1:00)

6 (Padlet)

Back in school, in collaboration with Padlet, from the very beginning, it is possible to make innovation, and work on the redefinition of the SAMR model. Reading and writing is completely transformed.

Padlet allows each student to collaborate and share on a single digital wall, what he thinks using text, images, voice, or film.

If you have shy or introverted students, infrared photography is an ideal way to help them speak.

By using infrared photos or videos, we make the student's thinking visible. Visual interaction provides a tool for students to express themselves and understand another point of view. Infrared allows a scientific angle to discuss the news critically.

With your suggestions for projects, such as those here, on our habitat concerns, you inspire students to participate responsibly in the digital world and contribute positively to the protection of the environment. (1: 10)

7- photo + plastic

What kind of thinking do you want to develop in your students? A movie like stalking in Boston puts you in situation. The film adds motivation. There are people here who have seen stalking in Boston? This is the movie that chronicles the events of the criminal explosion that killed several athletes in the Boston Marathon.

We can develop the scientific thought behind the events of the film. Helicopter officers seek to find criminals using their infrared camera. We see here a person completely hidden behind an opaque plastic wall, as in the film. Without the infrared camera, it is impossible to see the person. If we only watch the film, cognitively, we add a fact to what we know. With the camera in our hand, we do the experiment and we can see all the materials, the conditions, and the distance that make the infrared vision possible. (1:15)

8- explosion

We can develop thought in all subjects. What links can you make between the text, (the movie) and your own experience? There was a house blast on my street in Mississauga that caused a lot of damage. ... What preconceived ideas do you want to challenge? Rich people are all emotionally stable while immigrants are all emotionally disturbed? ... What changes of attitude of thought or action are suggested by the film? The conventional school has major shortcomings for the cognitive, social and emotional well being of many of our students. (0: 45)

9- (high-rise)

We can give a global dimension to the digital world by discussing problems affecting the whole planet such as global warming and its solutions. What are the best solutions? Which financing, which investments will be the most important? There are already thermographs in Ontario that use infrared to evaluate the energy efficiency of homes and buildings. Is there wasted energy in the heating and cooling of our buildings? Should we renovate the insulation? Are we following the Canadian standards for maintenance?

(0: 40)

10- (Infrastructures)

In reading, texts are not just books. There are graphs, maps, photos and trips to Alberta with Inside Education. To be able to use the camera, you have to learn to read the text of the image. Insurance companies use thermography with infrared to prevent property damage. You can inspect the surrounding wildlife, electrical circuits, buildings, fire extinguishers.

Here we see a place where the pipeline runs across Canada from Fort McMurray to Montreal. It's in Mississauga right next to a brand new express bus line that runs through the city to get to the Toronto subway. Imagine the responsibility of the inspector who must read the infrared images to ensure the proper functioning of the infrastructure.

Infrared can be used to check all sensitive infrastructures in order to detect cracks, breaks, structural problems, any leakage of gas or oil in order to avoid accidents which often have considerable costs and effects. The image shows us a proof that the equipment is working well. (1: 10)

11- (solar panels)

Thierry Karsenti has also identified 10 skills so that young people today can master the world of tomorrow. Here are a few.

In addition to having the ability to read the image effectively, students must have the ability to search information effectively with technology. So books and magazines give great ideas but these ideas need to be validated, elaborated, and pursued using the internet. There are several avenues to solve the problem of climate change, including solar energy.

Students must have the ability to solve problems effectively, with technologies. So, with the infrared, we inspect the solar panels to identify specific locations where the solar panel would be defective.

Students must have the ability to be critical in the use of technology. So, I'm going to ask you: What are the questions you ask yourself when thinking about the ideas I'm presenting to you, while taking into account the answers and comments of others? (1: 15)

12- (snake)

Fewer women than men choose STEM (Science, Technology, Engineering and Math). Many women who have pursued STIMs have indicated that their interest has developed in elementary school through school activities. The preference for a discipline would develop according to the stereotypes associated with it. Biology is more popular among girls while physics is more popular among boys. We have a role to play in changing attitudes to these stereotypes.

The contributions of women must be highlighted. Did you know that it was a woman, Janine Benyus, who popularized the new branch of science, biomimicry? With biomimicry, technology is inspired by the processes of nature to find ideas for innovation. The infrared camera comes from biomimicry. She imitates nature, like the serpent. In order to capture prey, the snake uses its eyes and nostrils with detectors to locate warm-blooded prey. (1: 15)

13- (Half moon)

There are many sources of inspiration. We can draw inspiration from a word, a sentence, a film, a reporter. For those who dream of exploring space, we can start by observing the moon.

In a half moon, visible light shows us only a half circle, part of the moon. In the same picture, the infrared can also see the hidden side of the half moon. The hidden face of the moon has a colder temperature than the visible face of the moon. It is easily seen in infrared.

Whether you want to visit the moon, Mars or exoplanets like TRAPPIST-1, infrared is essential for good vision.

There is the new Spirou instrument for the Canada-France-Hawaii telescope, which was developed in collaboration with the University of Montreal. Spirou is about the size of an iPad. It uses an infrared camera that is cooled to -200 degrees Celsius and is stabilized to one thousandth of a degree. Cryogenics removes ambient thermal pollution. So when the camera detects nanometric variations, it means that we have found an exoplanet.

The process of questioning the space is not only related to STIMs. Deep learning is a process that opens much larger doors. It makes one wonder that it is our place in this complex and scary world in which we live. (1:25)

14- (Algae)

French immersion is a truly oral program. We need to learn to communicate. We need to understand what a person is saying to us, in addition to being able to express themselves so that another person can understand us. This does not prevent the use of technology. Radio Canada programs can be used as a source of information for discussion using our best oral communication strategies. A Découverte show was really inspiring.

We were discussing green petroleum. It is made from algae. It is made by extracting biomass from algae, while removing CO₂ from the atmosphere. It offers a beneficial effect for the environment. Green petroleum helps our planet, in addition to being as good as fossil petroleum. By pushing our research a little more, we can realize that the infrared allows to analyze the viscosity of the algae and the temperature in the photo-bioreactor. (1: 05)

15- (knees)

FLIR offers infrared conference at Niagara Falls ou online videos. I learned that infrared is used in many medical applications. Infrared is used clinically to evaluate the health of a patient. It is possible to see early signs of all kinds of inflammation, arthritis, cancer, congestions of the lungs, even an imbalance of sugar in the blood. The infrared camera acts as a whole body thermometer. The infrared camera is also very useful in sports medicine. Here we see very clearly the extent of inflammation of an athlete's knee. If you cannot buy a high-end camera, you can rent it for a while. (0: 40)

(0: 40)

16- Video

We can create infrared videos. Students are very engaged during their creation. It is very difficult to distract them during all this creative work. The student, star of this video, is a brand new Syrian refugee student with many emotional difficulties caused by his memories of the Syrian war. When they arrive, these immigrants do not speak the language of instruction at all, but after 3 years in our school board, they are completely adapted and integrated into their new environment.

In the newspaper Le Devoir, I read the comment of a professor from Laval University who said, and I quote:

"Francophone students born in Quebec do not do as well as immigrants who did not even speak French when they arrived here. It's fascinating "

(1: 10)

17- (SSI)

We can think that there is no mathematics in taking infrared photos. It is far from reality. Here we see the International Space Station, taken at sea level. It maintains an orbit at an altitude between 330 and 435 km. It also rotates the Earth every 90 minutes.

To take the picture, I use the application STAR WALK which tells me what time and where in the sky passes the space station. I must be able to recognize it among all the objects that we find in the sky. You will only have a few seconds to photograph it. The knowledge of the percentage of humidity in the sky allows us to choose the days where the photo will be the prettiest.

As it passed, the astronauts were sleeping indoors because they followed the GMT schedule, London time in England. (0: 55)

18- (Lake)

Infrared technology is also found inside satellites that orbit the earth. It allows to take the temperature of oceans and air masses to predict our daily temperature and our bad weather. Here we see the changes in air temperature just before a storm on Lake Ontario.

Infrared satellites can detect temperature differences up to 6 meters below the ground. It also found some of the pyramids buried in Egypt. (0: 35)

19- (Eclipse)

Meetings with the teacher, either in class or online with Twitter, are essential to direct attention to important events and knowledge. With a good professional learning network, you will be able to know the events and the situations that allow a better learning. You can also discuss samples of infrared photos, in class or online. These samples of photos that are discussed show evidence of learning.

Here is the eclipse of the sun last summer. The moon covers the sun at 70%. During the eclipse, scientists collected data on the solar corona. It is known that solar flares can damage transformers in power grids. During the discussion, we need to find areas for improvement. 70% is not enough. It will take a picture with a total solar eclipse, 100%. The next total eclipse of the sun will be in 2024. Visible from Montreal. (1: 10)

20- (Nebula)

As a teacher, we must not forget the role of the student. You can have fascinating content but it is the student who makes the decisions about their learning. They choose what they want to learn. If the student gives up, the learning ends.

If you do not have an infrared camera, NASA offers you lots of free images on the internet.

The appearance of the universe in infrared is very different from the universe seen with visible light. Here we see the Carina Nebula taken by the Hubble Space Telescope. Nebulae play a key role in star formation. They form in large dense clouds, mixed with grains of dust. (0: 45)

21- (Fire)

For many years, the Peel School Board has been encouraging employees and students to be innovative and leaders in the use of technology. One of the approaches put in place is to allow students to bring their own electronic device, the BYOD. A large number of students, especially those most in difficulty, already have an electronic device. They were distracted by technology. By suggesting tools, students can be creative in the classroom and can pursue their projects at home with their own device. Instead of being distracted by their phone, we can stimulate their curiosity, inspire them to be more engaged in the classroom.

With its own apparatus, the classroom is no longer limited by the four walls of the classroom in the school. Our class is the whole world. Here we see a simulation of the cosmos. In a conservation center, the host prepares a fire as the Amerindians did. With the infrared camera, we make the link with the space. Cosmic clouds are completely opaque to visible light. In the infrared, on the contrary, they are very bright cosmic regions. It's a bit like a start of fire in straw. It is opaque to visible light and bright in infrared. (1:25)

22 - (Black hole)

Innovation Minister Navdeep Bains has promised a budget to teach children and teachers how to code. This can be done during genius hour.

So, one hour a week, we challenge all our students to create something that they value and that interests them. 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 their corporation. Is this a reasonable solution considering your context?

Here is an example of a slightly complicated 6th grade innovation. We use an infrared photo and programming with the Hopscotch application.

NASA's James Webb telescope will be launched in may 2020 to replace the aging Hubble Space Telescope. Before using the James Webb telescope, we will have to review the astrophysical literature, formulate questions and predict what we expect to discover and confirm our expectations with this new space telescope. The student does the same thing as astrophysicists. The student created a simulation of a black hole that will see the future James Webb telescope.

You can check the Hopscotch application to read the code of this program, in addition to all the other Hopscotch programs I wrote using infrared photos.

Seeing what students are capable of doing during engineering time, we must pay attention to digital passivity in education.

(0: 55)

23 - (Diane and Pierre)

What does a scientist look like? Ibn al-Haytham discovered huge cameras. Pierre makes small ones. My brother, Pierre Boulanger, the chief engineer, who led the development project for the FLIR infrared camera. He could not come here today, so I went to his home in Santa Barbara, California to take this picture. We grew up here in Montreal.

(0: 20)