

Villanova College is bringing science to life Outdoor Bike Lab integrates STEM into the Grade 8 Science and Math classes

By Wallace Pidgeon

Who knew science and math could be so much fun?

And be brought to life with practical experience outside the classroom? The Grade 8 science and math students at Villanova College's Middle School do.

Seventeen Grade 8 students left the classroom of the King City school recently, shared their bikes and participated in an outdoor bike lab. And this was no ordinary bike ride.

It was an in-the-field research and data collection exercise. This is this kind of practical and real life experience that at Villanova College is part of the learning culture.

Teachers Gianpiero De Rose and Qb Mascaremhas are Villanova's one-two punch, committed to bringing math and science to life by integrating the STEM pathway curriculum into various outside the classroom learning experiences.

STEM represents the disciplines of Science, Technology, Engineering and Mathematics, combined into one. With real life experience, it creates a 'cool' factor that inspires the learning of these budding engineers, mathematicians and scientists.

'Engaging kids in active learning,' explained Mascaremhas, Villanova's Upper School math and physics teacher. 'The STEM program is based on that idea to try and get students to engage more in math and science using technology and practical applications.'

Mascaremhas brings more than a decade's worth of practical engineering experience from industry.

'The basis of STEM is predominantly laying the foundation of how it will benefit the students whether they have aspirations to become engineers, scientists, astro-physicists or whatever it is,' he added. 'Making sure that they are engaged and that they don't lose out on science and the opportunity to do those sorts of things.'

The practical application of math and science is not lost on De Rose, who teaches Grade 7 and 8 science and math.

'Escaping the text book and trying to make this real world,' added De Rose, who is also the school's head football coach. 'Again, we are starting here at Villanova College. This is a Grade 8 class, in the hopes that we can inspire the kids who are interested in math and science so they don't get lost in the shuffle, because then they have an opportunity for them to enter the STEM stream when we send them to the Upper School.'

The outdoor bike lab is one of many practical labs that the students are exposed to. It seemed to be something very practical for 12 and 13 year olds to truly capture.

'We start the year off with our mechanisms unit; sort of the physics unit for our elementary curriculum. And we have just finished studying simple machines; wheels and axels, gears, incline planes,' he explained. 'So now, again, in trying to escape the text book, most kids have a bike, most kids have ridden a bike, they want to get the one that has 67 speeds on it, but they have no idea what they do or when they use them.'

The students are learning about gear ratios (most don't know 21 speeds mean 21 gear ratios) and learning how the combinations with the front and rear sprocket are related.

'This takes our prior knowledge filtered through the text book, and now we will get a real-world application that will hopefully engage the kids and bring science outside the classroom, bring education outside the classroom, because I think the more we do as teachers and the more students do, the better learning experience and not so much opening up their heads and filling it with information,' De Rose observed.

With the hope that none of the students think that math or science is 'boring,' the entire Villanova student experience is engaging and motivates students to learn.

Not surprising, the inspiration for an outdoor bike lab came to De Rose outside the classroom, on the annual field trip to Ottawa and Montreal two years ago. During a bike tour along the Rideau Canal, he realized that his students really didn't capture the whole premise around gear ratios and mechanical advantage.

His takeaway from then was to integrate the lesson of gear ratios into a fun and practical way to apply mechanical advantage for students to grasp in a real way.

The student teams ran six tests over three zones of data gathering across campus that will lead to the results.

Each student would ride a bike to capture their findings based on the following zones; first zone 'Rough Uphill and Rough Downhill, the second zone 'Straight Away Smooth and Straight Away Rough and the third zone 'Smooth Uphill and Smooth Downhill.

Siena Thalassinos and Antonio Peluso partnered up to test the thinking. But as they both understood it's more than just about riding a bike. It is a math and science experiment.

"A bike lab in science class is to see the differences in gears, the difficulties in riding on different surfaces, seeing if it's easier or harder to do," Siena explained.

"It's basically mechanical advantage," Antonio added. "We are trying to find what gear has more of a mechanical advantage in different terrains."

The exercise is about finding out if there is a gear relationship to the level of difficulty.

"We want to see different ratios of gears and how they work and if it makes it easier or harder on a lower gear," continued Siena. It may seem straight forward that it is harder to go up a hill and easier to go down a hill, but it has to be tested and verified.

"That's what we are thinking right now," said Antonio.

"That's what our hypothesis is, but the hypothesis is not always correct," added Siena.

And as they explained, that's why there is the bike lab to collect and test the data.

In class, De Rose has taught the students that mechanical advantage is designed most of the time to make things easier. If you lift something heavy, you employ a pulley or a lever and that machine is supposed to magnify your input force.

And outside the classroom, he hopes the bike lab will give them a greater understanding of mechanical advantage.

"The students will really notice this on the uphill and downhill test," he explained. "So what's the machine or gear doing for you when you go up the hill or down the hill?"

"If it's easier you would employ that going up the hill, if it's difficult you wouldn't use the gears," he added. "So you want to manipulate the machine to make it work for you. When you are riding your bike, those gears aren't there for show."

Once they were done the circuit, Siena and Antonio had collected enough data to begin assessing the hypothesis.

"We learned going uphill is harder than going downhill and rough is harder than smooth," explained Antonio.

This supports their initial hypothesis, however there was one interesting finding.

"We were surprised when I realized that rough is more difficult than it seems, especially when you are going far and uphill," explained Siena.

Antonio agreed. They both believed that the outdoor bike lab was going well and that they were on track to proving their hypothesis.

Next May, when the science and math class travels to Ottawa, they will truly see how the science and math are put it into practice on their bike tour around the Rideau Canal.



Villanova College students Antonio Peluso and Siena Thalassinos have been participating in the outdoor bike lab. Photo submitted