

Creating future scientists through fun and games



Schools use novel methods and real-life examples to revive waning interest in physics.

At the NUS High School of Mathematics and Science, Cheng Heng Yi, 18, tries to balance himself on a hovercraft suspended 2.5cm above the ground.

His classmates crowd around him, excited, waiting their turn.

This is not some outdoor adventure, but a common scene from physics classes at the school. Students spend half of their lesson time playing games which are used to explain abstract physics concepts in a fun and simple way.

The hovercraft experience, for instance, illustrates how frictionless motion works. Said principal Hang Kim Hoo: "You have to get them curious about the gadgets first, then they will pay attention and want to learn."

The games, part of a plan to revive students' interest in the subject, have paid off: physics enrollment in the school rose from 70 per cent to 90 per cent over the last four years.

It is one of the few schools here to buck the worrying trend of declining enrolment in physics, which is a prerequisite for designing new technologies in industries ranging from medicine to information technology.

In the last decade, physics enrolment in junior colleges has plunged from 80 per cent to 40 per cent.

Secondary schools The Straits Times interviewed also noted waning interest in physics, one of the oldest academic disciplines.

The impact, say experts, is not just academic. Without physics-trained engineers, Singapore could lag behind other countries in almost every industry.

Searching for a 'rock star'

Students who shun physics say the subject is too abstract, hard to score well in exams, and the career options are dull.

"It's very 'dry' and involves a lot of mathematics," said Stacy Shamini, 16, from Tanjong Katong Girls' School, who dropped the subject last year.

The trend is so worrying that physics teacher from secondary schools convened a one-day national conference in February, the first of its kind here. At the Physics Education Seminar, they exchanged practical tips for the classroom and how to inspire students to careers in the field.

But participants said there are factors beyond their control. Students were dropping the subject partly because it was no longer a requirement for engineering courses at the National University of Singapore (NUS) and Nanyang Technological University (NTU).

"It made things worse," said Mr Chow Chiu Wai, a physics teacher and director of education technology at Hwa Chong Institution.

But the universities seemed to suggest that it is a chicken-and-egg problem. Spokesmen for the universities said they had to revise the admission criteria because fewer students were taking the subject in junior colleges.

More are instead choosing to study chemistry, which is now seen as the subject that unlocks doors, a status physics once held, Mr Loi Guang You, head of science at River Valley High School. "Even medicine courses now require chemistry. Not biology, but chemistry," he said.

The physics scientist also has an image problem. Said Mr Loi: "Students know the money is in the banking and digital media industries."

Mr Foong Sew Bun, chief technology officer at computer giant IBM Singapore, sums it up: Physics needs a "rock star" to become "cool" again.

While the field has outstanding personalities such as Professor Stephen Hawking, they do not "connect" on the same level with teenagers like, say, Apple chief Steve Jobs, he pointed out.

Said Mr Foong: "Computer engineering has Steve Jobs. Finance has the wall street banker. Physics has no one."

'Without physics, there is nothing'

Waning interest in physics is not a phenomenon unique to Singapore. The United States, Britain and Russia have reported a similar trend.

But it could hit Singapore harder because of its potential impact on the Republic's competitive edge. Without physics-trained engineers, Singapore will lag behind new powerhouses like China in every industry, warned Professor Andrew Wee, dean of NUS' Science Faculty.

"We have to remember that all technology starts with new physics," he said. "Without physics, there is nothing." He cited this example: "If you want to create electronic devices, you need to understand electrons, which is part of physics."

"The next generation of medical devices relies on nanotechnology, which is also physics-based."

Experts said the decline in physics here has been slow enough to be manageable, but it has to be reversed soon. If not, even Singapore's security could be affected, said Professor Alfred Huan, head of the physics and applied physics division at NTU. He said: "You need physics to design weapons and defence systems, and we cannot keep relying on foreigners to do these jobs for us."

Renew passion in physics

To recapture the students' interest in the subject, schools here are letting go of decades-old practices.

At River Valley High, physics teachers have adopted a new Harvard University teaching style. Called Teaching For Understanding, it focuses more on how science concepts can be applied to real life.

For example: Instead of just giving students the equations for speed, teachers could use examples of car crashes to show how the speed of the vehicle affects the driver's chances of survival.

The fresh methods have given physics lessons a new buzz. At Yio Chu Kang Secondary, students learn about heat transfer by thinking of ways to keep a lunch-box warm until the recess period. It is part of a new French teaching style called *La Main A La Pate* – literally, "to get involved".

Miss Sin Puay San, a physics teacher at the school, said: "The students are as noisy as ever – but now they are talking about the lesson itself."

At Tampines Secondary School, which also uses real-life examples in its lessons, student Benjamin Neo said he now thinks about physics even when he is not in class. "I was a barbecue once and I started wrapping the aluminium foil around food to maximize the heat from the grill," said the 16-year-old.

"That made me realize physics is everywhere in the world."

The next quantum leap?

But getting students interested in the subject is only half the battle. Teachers said it is equally important that students can see themselves in physics-based careers.

Said Dr Hang of NUS High: "You can't expect students to work towards a future in physics if they don't know what that looks like."

At NUS High, any student can submit a proposal for a physics project. If selected, he or she is paired with an industry mentor, who can be from universities here, the national defence research institute DSO National Laboratories or the Agency for Science, Technology and Research (A*Star).

Another way to inspire students is to try and bring their experience in schools closer to the working world, said Miss Sin.

River Valley High, Yio Chu Kang Secondary, Tampines Secondary and Hwa Chong Institution are among schools that have invested in data logging devices used in laboratories. These are used to compile data over a period of time.

Said Mr Chow of Hwa Chong Institution: "If you allow the students to feel like scientists, there's a higher chance they'll actually become scientists in the future."

But Prof Wee pointed out that the drive in schools needs to be matched by parents, universities and by the industry itself. Agencies such as the DSO National Laboratories and the A*Star, for instance, have introduced new contests and programmes like science camps.

Such efforts are starting to change the image of physics among students like NUS High's Joshua Lim. Last year, the 14-year-old was so inspired by his lessons that he tried building a Tesla coil, a circuit that produces different electric currents.

Four weeks later, he assembled a functioning coil that was taller than him. "We had to confiscate it because it was dangerous," said Dr Hang. "But we also gave him a small lab in the school and got him mentors from the industry."

Joshua said the experience has set him thinking about a career in physics. "For the first time, I can see myself doing this for work in future."



An NUS High student demonstrating a Van de Graff generator - which generates high voltage within its metal sphere - at an open house last month. PHOTO: NUS HIGH