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Jurong Pioneer Junior College's head of department for curricular development and innovation Edwin Lim using a mobile phone spectrometer, which measures light wavelengths. With him (from far left) are students Narahda Lim and Haw Jin Yu; Professor Thirumalai Venky Venkatesan, director of the National University of Singapore's Nanoscience and Nanotechnology Initiative (NUSNNI); Dr Hariom Jani, a research fellow at NUSNNI; and NUS student Aarushi Khandelwal. ST PHOTO: KHALID BABA

Show-and-tell way to explain abstract science concepts

Experimental set-ups developed by NUS team – at fraction of the typical cost – used by JCs to teach physics

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Education Correspondent

A local team has found a way to make abstract concepts in quantum mechanics and nuclear physics more "real" at a low cost for junior college (JC) students.

In the past three years, a professor and a research fellow from the National University of Singapore (NUS) have come up with the experimental set-ups, with the support of the Education Ministry (MOE).

For instance, a commercial cloud chamber – used to observe radioactive particles – could cost several thousand dollars on the market, but the team managed to produce a similar set-up at less than $300.

It is one of four demonstrations that the team has made at a fraction of their typical costs, using locally sourced materials and different vendors.

The devices were piloted with students and teachers from three JCs – National, Jurong Pioneer and Yishun Innova – and distributed in October to another 14 JCs.

Dr Hariom Jani, a research fellow at NUS' Nanoscience and Nanotechnology Initiative, a research institute, said: "We wanted to do something for modern physics, which doesn't have sufficient demos."

The idea, he said, was to identify complex topics in the physics syllabus that could be made more exciting, and brainstorm prototypes for students to visualise such concepts.

The other three demonstrations are a Geiger counter which measures the level of radioactivity, a quantum eraser kit which shows that light has wave-like and particle-like behaviour, and a mobile phone spectrometer which measures wavelengths of light that are viewed as different colours, depending on the gas they are emitted from.

Professor Thirumalai Venky Venkatesan, director of the Nanoscience and Nanotechnology Initiative, said: "Getting more students into science and engineering in Singapore is now a challenge because the brightest students end up going into medicine, business or law.

"The reason why people go into sciences is because of the excitement it generates... They participate in an experiment, a teacher shows them an amazing concept and that grips their attention."

In that manner, Prof Venky and Dr Jani's project hopes to spark an interest in science among JC students. It was awarded a grant by the MOE Academies Fund, which supports research and development work in teaching practices.

The team behind the project also worked with staff from MOE's curriculum planning and development division, and organised a full-day workshop for teachers and lab technicians to understand how to use the tools.

A set of online demonstrations including videos and quizzes was also developed for MOE's Student Learning Space, an online platform for students to access more materials.

Mr Edwin Lim, Jurong Pioneer JC's head of department for curricular development and innovation, said the JC has woven in the demonstrations as part of its lessons, starting this year.

"The students know the concepts in theory but we try to make the subject real for them. The set-ups help to make physics less abstract and more in the real world," he said.

Second-year Jurong Pioneer JC student Narahda Lim, 18, said: "The experiments help to deepen my understanding of topics and make lessons more interesting, instead of just listening to our teacher talking and taking notes."

Her classmate Haw Jin Yu, also 18, said: "We have a lot of fun conducting the experiments in the lab. I prefer to learn with hands-on practice."

Both students, who hope to pursue engineering, computing or science in university, said they are drawn to physics because of its real-life relevance.

Said Narahda: "When your body tilts a certain way when you're driving up a circular ramp in a carpark, why a ball bounces lower each time – these phenomena intrigue me."

REAL-WORLD RELEVANCE

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MR EDWIN LIM, Jurong Pioneer Junior College's head of department for curricular development and innovation.

DEEPER UNDERSTANDING

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NARAHDA LIM, 18, a second-year student at Jurong Pioneer JC.

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