

## 'Feminised' physics a formula for failure, says Michelle Simmons



Professor Michelle Simmons yesterday after delivering a 2017 Australia Day address. Picture: James Croucher

One of the nation's leading scientists has attacked attempts to "feminise" the high school physics curriculum by replacing maths formulas with essays as a "disaster" which has left students unprepared for university.

Renowned quantum physicist Michelle Simmons used an Australia Day address in Sydney yesterday to warn against the dumbing down of high school science and urged authorities to "set the bar high" for students to encourage them to excel.

Professor Simmons's criticism of the science curriculum has been supported by teaching experts who told *The Australian* yesterday that university physics courses were being altered to compensate for students leaving high school with limited maths skills.

And the NSW Education Standards Authority will introduce a new science curriculum to take effect from next year, which will reintroduce a focus on maths and reverse the introduction of sociology and history into the discipline.

"One of the few things that horrified me when I arrived in Australia (in 1999) was to discover that, several years ago the high school physics curriculum was "feminised", Professor Simmons told a high-profile audience at Sydney's Conservatorium of Music.

"In other words, to make it more appealing to girls, our curriculum's designers substituted formulae with essays! What a disaster," she said.

Professor Simmons obtained a physics PhD in her native Britain but chose to work in Australia in 1999 because it offered "a culture of academic freedom, openness to ideas, and an amazing willingness to pursue goals that are ambitious". She gained Australian citizenship in 2007 and now heads a team considered the world leader in the "space race of the computing era" — the quest to develop a quantum computer.

Professor Simmons said she was still seeing the long-term impact of the curriculum changes in students arriving at the University of NSW, where she leads the Centre for Quantum Computation and Communication Technology. "From the students coming (to university) I see little evidence that (the changes have) made any difference and indeed I see many students complaining that the physics curriculum has left them ill-equipped for university."

Professor Simmons used the example of final-year students being asked to write essays about the environmental impact of a nuclear power plant, rather than using maths to describe the physics of how the power was generated. "Physics is about looking at equations, it's deriving things, it's understanding things from a mathematical viewpoint as well as a descriptive viewpoint," she said. "An example I've heard of is to describe how a nuclear power plant works and its impact on the environment, and I do really think that within that you need to have some equations which would get them to address the physical structure of how energy is

transferred, so you have that critical thinking that physics normally demands.”

Professor Simmons said there was “a big cost” in trying to make learning easier for students because “when we reduce the quality of education that anyone receives, we reduce the expectations we have of them”.

“If we want young people to be the best they can be at anything we must set the bar high and tell them we expect them to jump over it,” she said. “My strong belief is that we need to be teaching all students — both girls and boys — to have high expectations of themselves.”

She warned that characterising Australia as “the lucky country” was “a mistake because it does not acknowledge the hard work that people have done to be successful and it encourages us to shy away from difficult challenges”.

Professor Simmons’s broadside won the support of the NSW Education Standards Authority — the former Board of Studies — which said new science courses to be introduced from next year “address the exact concerns” she had expressed. A spokesman said the new physics and chemistry courses, which would be examined at HSC level from 2019, “have a greater focus on mathematical applications as a way to describe the concepts and a strong emphasis on practical investigations”.

“There has been a reduction in the history/sociology-based content and an emphasis on practical investigations,” the spokesman said. “The philosophy underlying all science courses is to learn through practical engagement.”

He said an extensive consultation process had seen the move “overwhelmingly endorsed by science teachers” and there would also now be a five-year review process “ensuring syllabuses remain relevant and current”.

Australian Mathematical Sciences Institute director Geoff Prince also backed her comments. “The penetration of maths into science has been inadequate for a very long time,” he said. Physics should be “loaded with maths”.

“I don’t think physics has ever in Australia been as mathematical as it needs to be,” Professor Prince said. “We are absolutely creating a problem for maths itself when kids ask why are we studying it (maths) and they think the only outcome will be that they can become a maths teacher.

“The fact is maths has twice as many boys studying it as girls; that’s the problem we’ve got to address. And schools not offering maths with calculus is really closing the doors to studying science.”

Mark Butler, head of science at Gosford High School on the NSW central coast and a principal writer of the National Physics Curriculum, said he had been told by university advisory boards over the past 15 years that students were coming to physics courses underprepared.

“Several universities, including Newcastle University and the University of NSW, have even changed their first year courses to teach what would have previously been high school level physics,” Dr Butler said.

“They’ve had to soften it and slow down production because the kids aren’t ready for the level of mathematics. A lot of kids come through the current HSC physics course doing quite well but not being very good at mathematics, which is quite odd.”

Dr Butler, who has taught at Gosford High for 20 years, said he was excited the NSW HSC syllabus was finally being changed to decrease the reference to sociology and history.

“Our social science courses aren’t forced to study physics so I’m not sure why physics teachers are forced to study sociology,” he said. “When I cross a bridge I’d much rather know the engineer knew the equations rather than the sociology and history of bridge building.”

He also said he’d seen a decrease in the number of girls taking the course in the first five years of the syllabus being introduced.

“The number of females taking physics went downwards after the changes to the new syllabus in 1999-2000. It actually decreased. When I talk to female physics students, they have the same concerns as the boys about all the sociology and history in the course, they’d rather be doing science.”