

**SPEECH BY MR THARMAN SHANMUGARATNAM, MINISTER FOR EDUCATION & SECOND MINISTER FOR FINANCE, AT THE OPENING CEREMONY OF THE CONFERENCE IN HONOUR OF CN YANG'S 85<sup>TH</sup> BIRTHDAY ON WEDNESDAY, 31 OCTOBER 2007, AT 8.45 AM, AT THE SWISSOTEL MERCHANT COURT**

**Introduction**

1. First let me wish a warm welcome to Prof C N Yang as well as a very "Happy 85<sup>th</sup> Birthday". It is, as Prof Su Guaning has just mentioned, an honour for Singapore to host a Conference that pays tribute to Prof C N Yang's many contributions. And the contributions are indeed many. Quite apart from his contributions to the advancement of science, he has inspired many individuals to pursue a life of research, in the pursuit of excellence. He has in addition made very thoughtful contributions on education – on nurturing the best possible minds in science, and more generally, for society. I am not qualified to talk about his contributions in Physics so I will restrict my brief remarks to some observations on education, that draw in part on what I have seen previously of Prof Yang's comments.

**Foundations in developing Scientific Talent**

2. We have today a relatively strong education system in Singapore, and specifically when it comes to breeding scientific talent. We have a strong emphasis on Science and Mathematics that begins from young in our schools. And, so far at least, we have a large proportion of our students in universities and polytechnics pursuing the sciences or engineering. About 55% of university students and 70% of polytechnic students pursue the sciences or engineering.

3. We are also redoubling our efforts to develop a strong research infrastructure, especially in our universities. A very substantial increase in funding for research, all the way up the curve - downstream to upstream or basic research. Our universities will benefit from the substantial infusion of resources into research through the Academic Research Fund. The first Research Centre of Excellence within our universities that we're setting up as part of our new funding framework - the Centre for Quantum Technology - happens to be the field of Physics.

4. So I think the elements are in place –

- An interest in Science and Mathematics, which fortunately persists in Singapore, unlike some other places in the world;
- Well-trained teachers in all our schools, people who are themselves knowledgeable in Science and Mathematics;
- And a funding infrastructure that supports excellence in research, starting even with the schools and moving up and expanding at the universities and polytechnics.

### **Taking Intellectual Risk**

5. However, these elements alone are not sufficient to nurture excellence in research - not sufficient to groom minds that will create breakthroughs in knowledge. For that, what really matters is the culture of education. A culture that is reflected everyday in the classroom and the

lecture hall, and in what students do in their own time. How our students learn is more important than what the students learn.

6. The key I believe is to provide an environment that encourages our students to take more intellectual risk. In other words, to be willing to question, to tinker with things and to explore new approaches knowing full well that there is every chance that they will not succeed. Knowing full well that each new approach that you embark on has a good chance of not working out. This culture, or attitude towards learning and experimentation, has been the seed bed for the most successful research environments in the world.

7. It is not entirely absent in Singapore, or the rest of Asia. But is very much 'work in progress' in reforming our education systems, starting with our schools, and especially in our universities. Changing the culture of education to one which encourages students to take more intellectual risk.

8. It is important, more broadly, for us to become an innovation-driven society. In other words, not just for the purpose of grooming scientists or so to achieve big breakthroughs in knowledge, but for the grooming of a whole generation of individuals, whether we're working as analysts, or engineers or bankers, or entrepreneurs. We are past the "catch-up" phase - past the phase where we want to try to do as efficiently as possible, at lowest cost, what has already been done elsewhere. We are now in the phase where we need a whole generation of innovative minds, people who are constantly questioning and searching for something new, always trying to do something better, and

occasionally breaking new ground.

### **Evolving How We Teach and Learn**

9. It involves many shifts in education. It is not a “big bang”, not a large or sudden change, because we do take off from a strong education system in Singapore. And if you look across Asia, there are several other strong and robust education systems. But it involves moving forward, in meaningful shifts.

10. First, in the nature of examinations themselves, because they remain central to our systems. Examinations are still the simplest and fairest way of ensuring that the system remains meritocratic. Which school or university you get into, which department you get into, has to depend on merit. And examinations, unfortunately, are still the fairest, simplest and most transparent way of gauging of a student’s abilities, even if in an approximate way.

11. But we have to gently evolve the nature of our examinations, towards a system that tests students’ ability to think in a more open-ended context. In other words, thinking in a situation which a student has not fully predicted. This is after all what thinking ability is about. Which is why we always have some examination questions which are not easily predictable.

12. Next, we have to expand the menu of assessments beyond written examinations. We are experimenting with new types of curricula and assessment. That is why we have project work, or the various other types of assignments and assessments that our students in the Integrated Programme

schools are exposed to - research, presentations or projects in which they have to make something. Devising these new forms of curricula and assessment is extremely important. They are more authentic to what happens in real innovation processes, and to the skills that come into play in the real world.

13. This is also why we are developing new ways of identifying talent, besides measures of academic ability, within a system of meritocratic progression. New ways of assessing students based on their talents. And this is the tricky part because we have to do so in a way that remains fair, remains meritocratic and remains reasonably transparent. This, too, is an important reform in Asian education systems, which in some respects we have been able to move further along in Singapore, compared to the larger and more complex systems in Asia.

14. But the shift in education is at its heart not about exams and types of assessment, but about evolving a new culture of teaching and learning. Where the role of the teacher and the lecturer is to encourage students to question, to challenge, and to think originally. Thinking in original ways has to be the dominant motif of a university education in Singapore. That is how you should get an "A1"; not by reproducing as capably as possible what your lecturer thinks, or least of all what your lecturer has handed out in lecture notes.

15. I'm glad the culture in our universities is in fact evolving, and has

come far. The universities today are quite different from what they were even ten or twenty years ago. You cannot have a hierarchy that is based on seniority. We must remember that the American universities overtook the European universities because they respected only a hierarchy of ideas and of talent, not a hierarchy of seniority. That is how Prof C N Yang could get the Nobel Prize at the age of 35. Would it have been possible in Asia in his time? It would only have been possible in the United States. Not even in Europe in his time.

16. So that university culture is very important - of constantly spotting talent and rewarding it, and providing research funding for the best ideas, not the ideas proposed by the most senior professor or the dominant school of ideas. But it starts from young – from grade school or primary school – encouraging children to stand up and speak their minds; even if they may not say something that is always correct or even relevant. Take intellectual risk. It has to begin from young so that it becomes a habit and our children develop the habit of thinking originally as they grow up.

### **Rules Matter**

17. It is, I hasten to add, not simply a matter of abandoning all rules. Creativity has never been about the abandonment of rules. It is not about being free from all restrictions, whether in the Sciences or the Arts. Whichever field you look at, whichever paradigm you look at, there are certain basic precepts which guide creativity and allow it to flourish. Prof Su Guaning mentioned that Prof C N Yang will be talking about the Arts in a few days'

time, so maybe I will take an example from the Arts. Take, for instance, Cubism.

18. Cubism was a revolution in rules. In fact it totally changed the rules of Art that had operated since the Renaissance. Allowing you to look at three-dimensional objects from more than one perspective, from a few perspectives simultaneously, so that viewers feel they are almost walking around the subject. It was a fundamental change in rules. But Cubism has its own rules, its own complexity. It is a demanding discipline, a new paradigm with a new set of rules that generations of artists starting from a century ago have used to express their creativity.

19. Likewise, Chinese calligraphy. (Incidentally, Picasso himself, a leading exponent of Cubism, openly declared the influence of Chinese calligraphy on his own art.)

20. Chinese calligraphy is about rules as well as freedom within the rules. There are clear rules – the concentration of ink, the defined structure of the words. But there is also tremendous creativity that flourishes within the rules. If you look at China in the last 50 years, there have an explosion of new forms of calligraphy. But within each school - within the classical school, the modernists, the neo-classical school, or even the avant-garde school – there are rules. These are the precepts that allow the critics and fellow artists to say “Ah, that is a good piece of art!” Because it exercises creativity within certain precepts and laws – and that is the beauty of art.

## **Conclusion**

21. So let's keep moving in this direction - of promoting a culture of taking some intellectual risk, of questioning - a culture that underpins advancement in the Sciences, in the Arts, and in the ascendance of a society. We are getting there, but it is still work-in-progress. In fact, the most important, work-in-progress.

22. Let me in closing, congratulate NTU once again, and in particular its Institute of Advanced Studies, for organising this important event and bringing together a very unusual collection of outstanding scientists to share their insights with our students. I look forward to Prof Martin Perl's address immediately after this. To Prof Yang, I wish you good health and happiness and all the best in your future endeavours. 身体健康，身心愉快！