MAKE THE Grade

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Interview **Dorothy Lepkowska**

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He was challenging Balls' comments – following the publication of this year's results, which showed yet another record crop of achievement – that claims of standards slipping were "complete and utter nonsense".

All the evidence suggests otherwise, Dr Pike says. "In the last 30 years we have moved from a system where 20 per cent of the cohort were doing O-levels and the remainder were doing a whole range of other qualifications, to one where everyone takes GCSEs," he says.

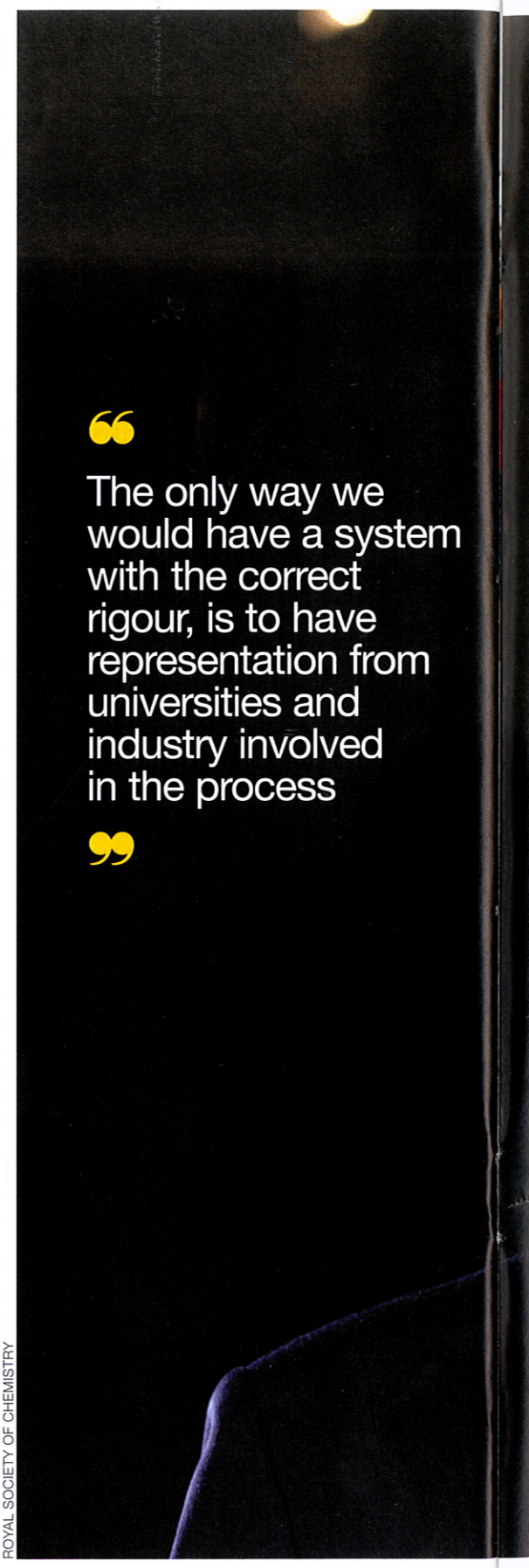
"Previously the examination system, and the diversity within it, was driven by universities. In the intervening years, we have moved to a system with a commercial approach and therefore, the process of assessing students has become much more market-oriented and examinations have become a business.

"Overlying this we have a regulator which until very recently was relatively weak, and league tables which accentuate the competitive ethos within the education system. It is hardly surprising, therefore, that we are now reaping the consequences."

The imbalance began, he believes, with the politicisation of education, most notably since 1997, under Labour governments. "When you proclaim that your government will be all about 'education, education, education' then you have to introduce metrics, and ways of measuring the success, or otherwise, of what you want to achieve.

"It has been like an arms race in reverse. The awarding bodies have had to make themselves more competitive, which in blunt terms means their exams have become easier."

Dr Pike is quite unequivocal in this belief and doesn't mince his words. He dares to voice his opinions openly. "We know that science qualifications have been made easier because some boards were told to lower the pass rates to bring them in line with others," he says. "More pre-teens are getting GCSEs and I know of a school where a quarter of the cohort gained 8 or 9 A*s. This would »



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ROYAL SOCIETY OF CHEMISTRY

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have been unheard of 20 to 30 years ago, even in the very best schools.

"We know that it has been possible in recent years to gain a grade C in GCSE chemistry with just 18 per cent, with some awarding bodies," he says.

"If you have a tough regulator you can stop this from happening, but left unchecked exams just became easier and easier, and thresholds lower and lower. For schools looking to boost their results and league table ranking, it becomes a feeding-frenzy for entry to easier examinations."

Limited knowledge

Dr Pike says examination questions are being made easier because less mathematical or scientific knowledge is now necessary to pass a science GCSE. Papers contain little, if any, maths, and candidates rarely need to show knowledge or the application of formulae. The Periodic Table is made available to candidates as part of the examination paper, so they don't even have to learn the chemical symbols of the elements.

It appears this lack of challenge is consistent across all subjects. Dr Pike cites one maths higher-tier paper where the question carrying the most marks – and therefore deemed to be the most demanding – asked students to calculate the area of a cube.

"Science is going the same way. There is now hardly any maths in chemistry GCSE. Candidates are asked to answer using narrative and by giving their opinion, rather than showing what they know."

The concerns are not new, but Dr Pike claims no-one is listening to the evidence. A report published by the RSC in 2008, *The Five-Decade Challenge: A wake-up call for UK science education?* found a lack of scientifically-based questions in GCSEs and suggested that the awarding bodies were showing evidence of non-compliance with the regulatory framework for examinations.

WORD ON THE STREET: DR PIKE WANTS TO INSPIRE THE YOUNG

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"We found there were not enough questions about how science works, which is blatant non-compliance," Dr Pike says. "Easy questions carried a disproportionately high number of marks, which failed to differentiate the most able candidates. A high number of points were being awarded for answering what can only be described as undemanding questions."

The report, which featured comparisons in styles of science examination questions over 40 years, found that questions that appeared in O-level papers in 1985, were now part of A-level courses.

"One of the problems is that there is a lack of transparency in the education system. In the past, everyone could see what questions candidates had to answer as soon as they left the examination hall because they could take the paper with them, as the answers were written in a separate booklet. Now candidates write the answers on the exam paper, which must be handed in."

Dr Pike has in his possession a series of sample exam papers in both general science and the separate sciences being developed for 2013 from a variety of awarding bodies that have recently been rejected by Ofqual.

One of the higher-tier questions in GCSE chemistry examines the use of biofuels and carries eight marks – the most points of any question on the paper and therefore a high proportion of the final mark.

For six of the eight marks, candidates are asked to: "Discuss the advantages and disadvantages of using biofuels instead of petrol for cars."

"A 16 year-old can answer this question from reading a newspaper, watching a documentary or using their common sense," Dr Pike says. "There is no analysis here, only narrative, and the question is based on opinion.

"In fact, there are few opportunities to use mathematics or chemical equations in the paper, and where these occur, there are prompts."

Restricted thinking

Dr Pike is concerned that students' thinking and learning are being restricted.

"Virtually the whole paper can be answered from a text book produced by the awarding body, and the answers they are seeking are consistent with what is in the books. It means that students offering an additional or alternative perspective may not be awarded any marks for this, even if they are scientifically correct. They can achieve the marks purely by waffling."

Ofqual's rejection of all 36 sample papers is a triumph for Dr Pike. Early this year, the regulator retrospectively declared the 2009 Science GCSEs to be lacking rigour and repeated this assertion in August with the

How Ofqual monitors standards

Dennis Opposs is director of standards at regulatory body Ofqual. He explains the organisation's role in maintaining standards.

"If qualifications do not meet our standards, we do not accept them into the regulated system. This is crucial to ensure that learners, teachers, employers and universities have the independent regulator's stamp of approval, as assurance that qualifications are rigorous, demanding and fair," he says.

"We monitor across awarding organisations to ensure the standard is the same across the different specifications, and if we become aware that standards are being compromised, we would investigate this thoroughly and require corrective action on the part of the awarding organisations as we did with GCSE science. This in-depth monitoring is a key aspect of our work.

"We made it clear in 2009, and again earlier this year, that work was needed to improve GCSE science. Specific problems identified included the lack of challenge and demand in some question papers, the quality of work at grades A and C in some exams, and the high weighting given to objective tests in some specifications. Immediate action was taken in 2009 to start addressing these issues for the existing specifications and work continued this summer.

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"Ofqual has been revitalised with the comment from [chief executive] Isabel Nisbet that this year's examinations fell short of what was expected," Dr Pike said. "Perhaps we are finally being listened to."

He stops short of suggesting that universities need to resume control of the examinations system as they did 30 years ago, but certainly believes that they, together with business and industry, need to be part of the process of developing and assessing qualifications.

"The only way we would have a system with the correct rigour is to have representation from universities and industry involved in the process," he said. "There also need to be greater sanctions on awarding bodies that don't comply with regulations, including bans of up to five years where appropriate.

"In schools, there should be a de-coupling of assessment of schools from assessment of individuals. At the moment the two are combined because of league tables, but they don't show the true picture of how well a school is achieving.

He says that rigorous reflection is required. "You would have to consider whether you want the existing system to continue or do you want to revert back to quotas where only a proportion of students gain an A and there are thresholds for each grade? Does the examination system exist to measure the effectiveness of government education policies, or for the self-satisfaction of students and parents? Or is it intended to produce a cohort of young people who are skilled in what is needed by society?

"We seem to have lost sight of what the examination system is for and have created a discrepancy between what pupils are learning and the needs of society."

Deficiencies

Dr Pike claims that the deficiencies in GCSE teaching are being passed on to A-level and those are, in turn, evident in universities, which increasingly have to run remedial courses in maths for scientists, or in science itself, to enable students to access degree courses confidently and with the appropriate level of knowledge.

"The national budget for education is in the region of £60 billion a year, much of which is being spent in the secondary sector, but it seems to me not very efficiently, if our young people are leaving without the knowledge to make the progression in levels. It means that in universities, a disproportionate amount of time and money is being spent to address those inefficiencies.

"The need for the introduction of the A* grade at A-level by implication suggests that there is a problem, but there is a lack of willingness to address it. They could have differentiated by re-jigging the grade boundaries, but there is a lack of willingness to do so.

> "We seem to have lost sight of what the examination system is for, and have created a discrepancy between what pupils are learning and the needs of society"

"Some young people are succeeding in spite of the system, but we are now seeing a polarisation where 90 per cent of young people are dropping science post-16. Of the self-selecting 10 per cent who continue, about half go on to do it at university."

Dr Pike believes that the imbalanced system has led to self-perpetuating problems in recruiting good scientists and in promoting quality teaching.

"If you have a dumbed-down GCSE then you will not attract the graduates in the science professions that you need. Good graduates will not want to teach 16 year-olds the surface area of a cube," he says.

"We have another problem in schools in that the number of teachers with a good science background in primary school is very small and few are conversant with science at all. Yet this is the age at which children are at their most enthusiastic and want to learn.

"Then they start secondary school where in the first two or three years they may not be taught by a subject specialist. Most physics and chemistry specialists in secondary schools don't teach those subjects until GCSE, but the disaffection with science starts much earlier. Pupils are not being inspired in the early stages of secondary school, when biology graduates tend to take on the teaching of chemistry and physics."

Dr Pike sees science in schools under threat from multiple factors, ranging from curriculum design to the layout of the labs.

"Too many teachers continue to subscribe to the mythology of health and safety. Science experiments can be carried out perfectly safely but often labs are not set out in the right way. There is a disconnect between the builders of new schools and the needs of science, so we see the electricity and water sources are at opposite ends of the room, and too few fume cupboards being installed.

"Teachers are being constrained by the rigours of the curriculum and the emphasis on literacy and numeracy.

"So the message is that whatever you try to do to rectify the dumbing down of science it will be painful. But it has to be done."

The indicator of the state of science teaching and learning in the UK, and indeed in the Western world generally, is that next year China is expected to overtake the USA in the number of chemistry papers published in quality journals. "This will be the first time this has happened and shows that we are being left behind," Dr Pike adds. "It is extremely worrying."

However, he remains positive and as he can see the wider debate about standards gaining pace, he is optimistic for the future.

"We have been banging on about standards for many years and my feeling is that, particularly with Ofqual's recent comment, we are finally starting to win.

"I often receive what I can only describe as hate mail from teachers and MPs after I make statements about the lack of rigour in examinations, but the majority of letters and emails are positive. It shows that people know these are serious problems that need to be addressed." ■

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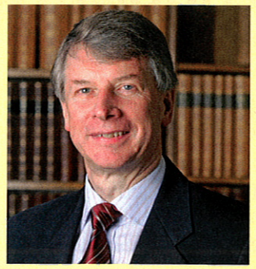
Dr Richard Pike: A life in science



Richard Pike was appointed chief executive of the Royal Society of Chemistry in February 2006.

He graduated from Cambridge University in 1971, obtaining both a First Class Honours degree and Doctorate in Engineering.

Dr Pike had a 25-year career with BP, where he held a number of senior technical and commercial roles in the UK and overseas, including president of BP Chemicals, in Japan.

After leaving Japan, Dr Pike became director-general of the Institution of Mechanical Engineering.

Dr Pike is a Chartered Scientist and Chartered Engineer and Fellow of five learned bodies in addition to the RSC, including the Institute of Physics and the Institution of Mechanical Engineers.

He is a Freeman of the City of London and has authored many papers in the fields of science, engineering, education, energy and climate change.