SCORE
SCIENCE COMMUNITY REPRESENTING EDUCATION

2010 SCORE CONFERENCE REPORT

AN INTERNATIONAL PERSPECTIVE ON SCIENCE EDUCATION

The 2010 SCORE annual conference was held on 26 February and brought together over 120 members of the science and science education community.

This year's annual conference was the first for SCORE and aimed to provide delegates with an international perspective on science education. Delegates heard from a wide range of international speakers and also had the opportunity to take part in a series of interactive workshops. This report offers an overview of the day and a summary of the key messages taken away from the workshops.

Sir Alan Wilson FRS chaired the conference.

ABOUT SCORE

SCORE is a partnership of six organisations, which aims to improve science education in UK schools and colleges by supporting the development and implementation of effective education policy and projects. The partnership is currently chaired by Professor Graham Hutchings FRS and comprises the Association for Science Education, Institute of Physics, Royal Society, Royal Society of Chemistry, Science Council and Society of Biology.

SCORE's priority areas over the next four years are: the curriculum, the schools and colleges workforce, the wider learning experience and qualifications and assessment.

KEYNOTE SPEAKER

Graham Ruddock
Deputy Head, Department for Research in Assessment and Measurement, National Foundation for Educational Research (NFER)

Graham Ruddock provided an overview of the findings and methodology of the NFER primary curriculum comparison study, commissioned by the then Department for Children, Schools and Families. The study compared the English primary curriculum, in relation to literacy, mathematics and science, to the eight highest performing countries, as identified by TIMSS[1].

Key findings of the report:

- The English primary science curriculum structure, with scientific enquiry at the heart, was not typical among high performing countries.
- It was difficult to establish a uniform picture of whether the English science curriculum was broader and harder than other curricula.
- The English primary mathematics curriculum had more similarities with high performing countries, in terms of content, time allocated to teaching and structure.
- There was no consensus on the time allocated to science in the primary curriculum but it generally tended to be lower than mathematics (3 hours per week).
- All the countries in the study avoided mandatory instructions on how to teach subjects.

Graham Ruddock explained that conducting a similar study for the English secondary science curriculum would be more complex. It would be more appropriate to consider a range of curriculum structures regardless of performance and analyse whether different curricula provide a better model for science as understood by that age group and by the different abilities within an age group.

[1] TIMSS - Trends in International Mathematics and Science Study

PANEL SESSION 1

The first panel session gave an opportunity for delegates to hear approaches to secondary science education in Finland, Hong Kong and the USA and its impact on students' attainment and attitude to science.

'Any change in the society affects the educational system and any change that you are trying to do in education, it is in the context of society and culture.'

Professor Hannu Salmi

Wai-Leung Kwong

Manager, Hong Kong PISA Centre, Chinese University of Hong Kong, China

Wai Leung Kwong discussed the strengths and weaknesses of the science education system in Hong Kong. In recent years, PISA[2] has rated Hong Kong among the top three performing countries in science education. PISA has also identified Hong Kong to have a comparatively low spread of attainment levels between students of different socio-economic backgrounds. Wai-Leung Kwong explained one possible reason for these results was perhaps due to the public funding invested in Hong Kong schools: all schools are likely to have the same resources in terms of teacher qualifications, teachers' pay and laboratory facilities. Of the weaknesses, studies suggest that students are not always encouraged to think creatively, with the science education system in Hong Kong adapting a more guided discovery approach.

Professor Hannu Salmi

Director of Research, University of Helsinki

Professor Salmi focussed on bridging the gap between the formal education and informal learning sectors. He argued that if greater connections were made between the two sectors it would have a positive impact on the attainment and recruitment figures of students studying STEM subjects. In Finland's experience, despite having high performance levels in PISA, students tend to have an average to negative attitude towards science. Professor Salmi noted that this is a common correlation among highly technically developed countries and that there is a concern in Finland that this will affect the readiness of students to follow a career in science. Professor Salmi stressed that the influence of informal learning sources on career choices should also not be ignored in science education.

Dr Rodger Bybee

Director Emeritus, Biological Sciences Curriculum Study (BSCS), United States of America

Rodger concluded the panel session with a USA perspective on science education. In comparison to Finland and Hong Kong, the USA has a relatively low performance in PISA. Rodger explained this was largely due to an incoherent education system, with a mixture of national and state policies and no clear ownership. In order to overcome this incoherence, 48 of the 50 states in the USA have agreed to adopt common core standards for science education. The USA has adapted a similar approach to the UK in terms of incorporating 21st Century skills in the context of laboratory activities, investigations, field trips and the curriculum. Rodger finished with a warning that what works well in one country may not work in another and international comparison studies should be reviewed carefully within the context of the country.

[2] PISA - Programme for International Student Assessment

PANEL SESSION 2

The second panel session focused on processes behind science curriculum development with perspectives from England, Scotland and Northern Ireland.

'You choose the right people to become teachers, you develop them into effective teachers who teach consistently well and you establish systems and targeted support to ensure that every student is able to benefit from excellent teaching and those three points I think put the curriculum in perspective.'

Professor Edgar Jenkins

Professor Edgar Jenkins

Research Professor Emeritus, University of Leeds

Professor Jenkins provided a brief introduction to science curriculum development beyond the UK. He reiterated that different education systems are culturally, socially and historically different and that mechanisms for effecting school science curriculum reform will be specific to that system. However, a common challenge facing many education systems is how to develop a science curriculum that best provides a science education appropriate for all students while meeting the needs of those who will become the scientists, engineers and technologists of the future.

Professor Jenkins then focused on the English science curriculum. He noted that in recent years the English Government has been the main driving force behind the science curriculum reform. He highlighted the global emphasis on the role of education in promoting economic growth and raised concern that numbers, rankings and target settings might drive school science education policy. He stressed that the TIMSS and PISA studies should reflect the outcomes of school science education not determine its goals.

Professor Jenkins raised specific issues that need to be addressed in the secondary science curriculum including:

- Accommodating the relationships between science, society and technology within school science curricula requires a redefinition of school science education.
- Narrowing the gap between the worst and best levels of performance in schools.
- Developing a greater understanding of students' interests and how and when they make career decisions.

'Generally what you find from TIMSS is that there tends to be a relationship between high performance and more negative attitudes in terms of enjoyment for students'

Graham Ruddock

PANEL SESSION 2

Dr Colette Murphy

Senior lecturer, School of Education, Queen's University Belfast

Dr Murphy described the Northern Ireland science curriculum in relation to a framework she has developed which links school science with 1) everyday experiences and the interests of students; 2) other learning; and 3) the wider world of science.

Dr Murphy also referred to the STEM Northern Ireland study and highlighted the following key findings:

- The need for greater support for science in the primary curriculum so that teachers without a science background have the confidence to teach the subject.
- The need for greater curricula coordination for STEM, particularly between primary and secondary level.
- A major decline in STEM subjects at A-level, particularly in physics.

In the revised Northern Ireland science curriculum, introduced in 2007, science is compulsory up to the age of 14. In some respects, Dr Murphy explained that the revised curriculum at key stage 3 does offer teachers more freedom and flexibility and supports the inclusion of the three framework links into lessons. There has also been evidence pupils enjoy science more at key stage 3 because of this less prescribed approach. However, Dr Murphy ended her talk with three emerging concerns: there are growing transitional issues between key stages 3 and 4, there remains a significant gap between the highest and lowest achievers in science and there is a lack of alternative key stage 4 qualifications to meet the needs of the more applied students.

Allyson Dobson

Team Leader – Science and Social Studies, Learning and Teaching Scotland and Professional Advisor to Scottish Government

Allyson Dobson gave an account of the new Curriculum for Excellence in Scotland which is expected to be introduced to all schools from August 2010. The national curriculum was reviewed in order to:

- Provide a broad based curriculum for 3 to 15 with specialisation in the senior phase;
- Provide a skills-based curriculum, including literacy and numeracy, that equips learners with the skills that are required for future uncertainty in the job market;
- Increase teacher professionalism and offer greater flexibility; and
- Reduce the extent to which assessment drives the curriculum and instead allow it to support the learning and teaching.

Allyson outlined the partnership approach to the development of the new curriculum, involving teachers, learned societies, the Scottish Government and local authorities. She also highlighted that in the Curriculum for Excellence both informal and formal education are recognised and that there is an entitlement for all young people to have a broad education which includes science to the age of 15. There is an emphasis on making connections across the curricula areas and entitlement for personal support including professional development for teachers. Allyson noted that the new curriculum does present some challenges, particularly with the new freedom given to teachers when a prescribed approach has been in place for so many years. She stressed that guidance is in place to support teachers through these changes.

'Call for assessment not to drive the curriculum, but for assessment to actually support the learning and teaching.'

Allyson Dobson

WORKSHOPS

Three parallel workshops were held in the afternoon and provided delegates with the opportunity to explore key issues on science education in an international context.

SCIENCE PROGRESSION INTO HIGHER EDUCATION (HE)

Revd. Dr. Richard Walton, from the Centre for Science Education, introduced the session with a presentation on the quality of science teachers across Europe and the effect this has on the uptake of science degrees. Another factor seen to affect HE science progression is the lack of career awareness and appropriate guidance and support. Nicola Hannam, of the Science Council, presented the key findings of the SCORE report *Choosing the right STEM degree course* which investigated the information available for prospective applicants. The report highlights the sheer volume and complexity of information available to young people and the urgent need to improve levels of communications between the main stakeholders involved: students, teachers, parents, admissions tutors, UCAS and career advisers.

Delegates discussed these issues and raised other areas for SCORE to consider in an international comparison study:

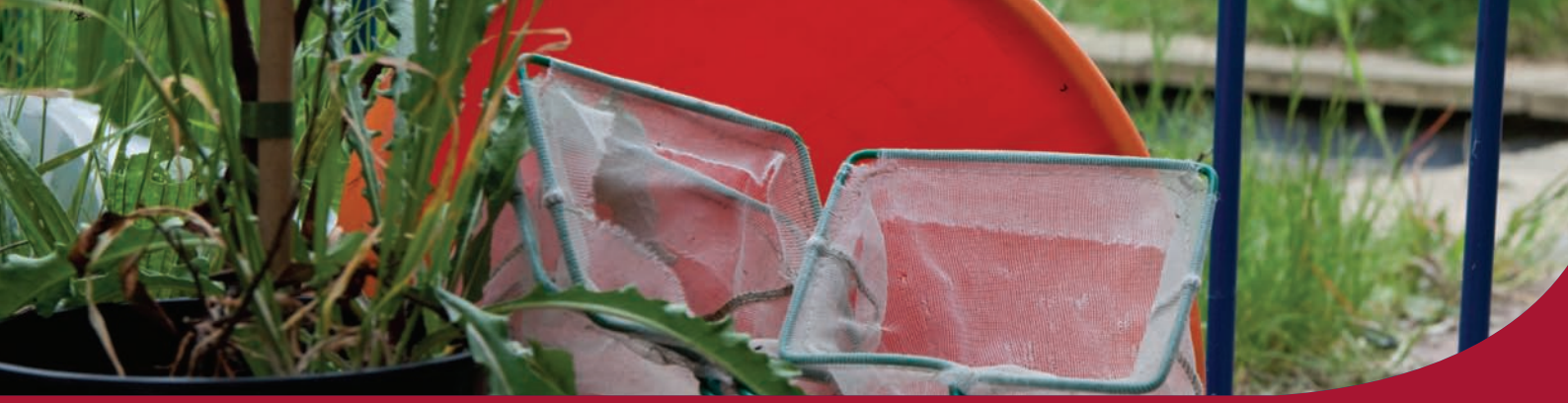
- Investigate the stage at which students specialise in subjects and the recovery options available to those who choose the wrong pathway.
- Research into how other countries balance the two conflicting agendas; science for all and science for progression.
- Review alternative options to higher education for STEM progression post-16.

PRACTICAL WORK IN SCIENCE

Professor Dillon from King's College London provided an introduction to the discussion. He argued that in some respects the UK is ahead of most countries for its developments in practical science activities, with its emphasis on investigative based science and its investment in CPD for teachers and technicians. The UK has also been involved in many successful projects which have been copied abroad (e.g. the Cognitive Acceleration Project (CASE)). Professor Dillon maintained that practical work is a crucial element of science education; it develops scientific knowledge and understanding, enhances the practical skills of an individual and develops an understanding of scientific enquiry.

Emerging from the session were key areas around effective practical work to explore internationally:

- Extent to which practical work in schools prepares pupils for employment and research into the skills competencies developed through practical science activity.
- Comparison of the assessment of practical work in different countries and how to ensure assessment is appropriate.
- Comparison of the resourcing of practical work e.g. time spent on practical activity, funds allocated to schools for practical work, technician time.



VOCATIONAL AND APPLIED QUALIFICATIONS

Professor Linda Clarke and Michaela Brockmann, from the University of Westminster, started the discussion with an insight into 4 areas of vocational qualifications offered in Europe and how they differ to those offered in the UK.

The research did not find commonalities between the case studies but there were some general observations. For example, on the continent vocational education very much involves employers and unions whereas the UK has a lack of integration between industry and education. The research also highlighted issues surrounding the professionalisation of vocational education and, in some cases, making it more academic at the expense of the skills required by employers.

In discussion there was general consensus that the term 'applied' referred to a style of learning and the term 'vocational' appeared to focus more on the outcomes of the qualification, i.e. employer focused and career related. Areas identified by delegates that would merit further exploration in an international context included:

- Research on the supply of technicians in different countries and the routes into similar science type vocational courses.
- Research into methods adopted by other countries to engage employers in the curriculum and qualifications development.
- Comparison of the further education colleges in the UK and their equivalent in other countries.

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The SCORE partnership, working together on science education: Association for Science Education; Institute of Physics; Royal Society; Royal Society of Chemistry; Science Council; and Society of Biology.