Specialist primary science teaching in Northern Ireland

Summary: *Evidence shows that the subject knowledge of primary science teachers has a positive impact on pupil attainment, yet in Northern Ireland there is likely to be a shortage of teachers with this knowledge. The lack of science detail in the primary curriculum is also a concern, particularly given the lack of science expertise amongst teachers. A good science education is extremely important for the economy and for the development of a scientifically literate society and it is therefore crucial Stormont takes action to address this issue.*

Science Education benefits the Northern Ireland economy

The petroleum, polymer, chemical and pharmaceutical industries are strategically important to Northern Ireland and contributed in the order of £553m to its economy in 2008. They account for 12.6% of Northern Ireland's manufacturing GVA (Gross Value Added).[1]

These industries rely on a strong pipeline of workers with science skills. However, in 2008 21% of NI firms in the sectors highlighted above stated that they had internal skills gaps.[2]

It is important that young people are given the opportunity to take advantage of opportunities in these industries, and to also help drive scientific growth in Northern Ireland. Evidence shows that the science pipeline is shrinking – the 2009 NI STEM review report highlighted that not enough people choose to study STEM subjects at secondary school, college or university to provide a good "pipeline" for the jobs market. [3]

In addition, Northern Ireland ranks behind other countries when it comes to science education. The 2011 TIMSS survey reported that whilst pupils in Northern Ireland were among the top performers in the English speaking world for Maths (6th out of 45) and reading (5th out of 45), they were outperformed by 17 other countries in Science.

Without focused attention on improving science education it will be difficult for results to improve and for the needs of the STEM pipeline to be met.

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[1] COGENT factsheet on Northern Ireland (2011) http://www.cogent-ssc.com/research/Publications/factsheets/Northern_Ireland.pdf
[2] COGENT factsheet on Northern Ireland (2011) http://www.cogent-ssc.com/research/Publications/factsheets/Northern_Ireland.pdf
[3] Report of the STEM Review (2009) http://www.delni.gov.uk/report_of_the_stem_review.pdf

Attitudes to science

Research from across Europe shows that pupils' achievement in science is strongly influenced by how interested they are in the subject. The same research shows that a major determinant of student interest is the quality of teaching.[4]

This is particularly important at primary school level. A number of studies show that attitudes towards science become fixed at primary school age, and relying on good science education beginning at secondary school is likely to be too little, too late.[5]

In Northern Ireland this is particularly important – as science is no longer compulsory at GCSE, there is a shorter timeframe in which to inspire interest in the subject and encourage further study. The NI All-Party Group on Science and Technology has also expressed concerns regarding this, highlighting how this timeframe differs in the rest of the UK, where it is compulsory for pupils to continue studying science post-14.

In order to improve science results and engagement with science in Northern Ireland, effort should therefore be made to improve primary science education, and in particular to ensure that teachers are able teach the subject in an inspiring way.

Specialist science teachers are part of the solution

Given the importance of primary science education in shaping long term attitudes to science, it is crucial that primary teachers are confident in teaching science and have a good understanding of the subject.

The Sutton Trust recently found that the most effective teachers have a deep knowledge of the subjects they teach, and when teachers' knowledge falls below a certain level it is a significant impediment to students' learning, whilst the National Audit Office has argued that teaching is of better quality where primary science teachers hold qualifications in the subjects they teach.[6]

However, only a very small number of primary school teachers in Northern Ireland have a science background. An answer to a Written Assembly Question found that only 122 primary school teachers in Northern Ireland hold a degree qualification in which the main specialism is a science subject.[7] There are 839 primary (including preparatory grammar) schools and 8049 primary teachers in Northern Ireland. This means that science graduates only make up 1.5% of the primary

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[4] Science Education in Europe: Critical Reflections (Nuffield Foundation, 2008) http://www.nuffieldfoundation.org/sites/default/files/Sci_Ed_in_Europe_Report_Final.pdf

[5] Aspires project report (Kings College London, 2013) http://www.kcl.ac.uk/sspp/departments/education/research/aspires/ASPIRES-final-report-December-2013.pdf

[6] The Case for Change (DfE, 2010) https://www.education.gov.uk/publications/standard/publicationDetail/Page1/DFE-00564-2010 and Educating the next generation of scientists (National Audit Office, November 2010) https://www.nao.org.uk/report/edu

[7] Answer to Written Assembly Question tabled by Robin Swann MLA: http://aims.niassembly.gov.uk/terms/PrintResults.aspx?se=&so=Ascending&tb=&per=&sp=&fd=&td=&cb1=&cb2=&it1=97544&itn1=Teachers&it2=&itn2=&it3=&itn3=&pid=4&pm=&pg=2&tn=1&ito2=&ito3=&ks=&st=1&pi=0&m=0&mn=All%20Questions

teaching workforce.[8] Data is not collected, however, on whether primary teachers have an A Level in a science subject.

The NI STEM review found that "many primary teachers may lack the knowledge, skills and confidence to deliver a science and technology programme which develops progressively the children's skills and knowledge". Teachers who may have insecure scientific knowledge are tasked with teaching children whose natural curiosity may take them into unfamiliar concepts and lead them to ask challenging questions. Additionally, the 2011 TIMSS survey found that in Northern Ireland teaching time for year 6 pupils was 15% below the global average.

But what do we mean by science specialist? A primary science specialist is, in our view, a primary school teacher who has at least an A Level in a science subject, and Qualified Teacher Status. We believe that, ideally, there should be at least one of these specialists in every school, acting as the science subject leader. This role would not require them to teach all the science lessons in the school, but would instead require them to support other primary teachers to teach science.

We acknowledge that for small primary schools the above may not be possible. For these types of schools, we would encourage the formation of clusters where one science specialist is shared by a group of small schools. Again, this specialist would not teach all science lessons, but would provide support and advice for teachers across the cluster.

Changes to the Northern Ireland curriculum

Recent changes to the curriculum may have made it particularly difficult for primary school teachers to teach science. The "World Around Us" curriculum does not treat science as a separate subject with associated statutory requirements, which has led some to fear that teachers will reduce the amount of science taught if they do not feel confident with the subject area, or are under time pressure.[9] Studies have also indicated that teachers who lack confidence teaching a particular subject may decide to "teach as little of the subject area as [they] can get away with".[10]

The lack of detail and guidance around science teaching is particularly concerning given the small number of science specialists teaching in primary schools. It is possible that teachers who do not have a science background would lack confidence and interest in developing ways to teach the subject.

Solutions

It is therefore important to increase the supply of primary school teachers with a science background, whilst also helping existing primary school teachers to teach science effectively.

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[8] Figures from NI Department of Education data, available here: http://www.deni.gov.uk/index/facts-and-figures-new/education-statistics/32_statistics_and_research-numbersofschoolsandpupils_pg/32_statistics_and_research-northernirelandsummarydata_pg.htm and here: http://www.deni.gov.uk/index/facts-and-figures-new/education-statistics/32_statistics_on_education_teacher_numbers_pg.htm

[9] Is Science Lost in the World Around Us?(A. Johnson, 2013)

[10] NI Assembly, Research and Information Service Briefing Paper : Science in the Review Curriculum (James Steward, 2014)

a) Increasing the supply

Stormont should consider introducing schemes to incentivise those with a science degree or science A Level to enter primary school teaching. Potential incentives could be financial, such as bursaries and scholarships for teacher training, or pay increases. A targeted communications campaign promoting the profession to subject specialists could also be useful, particularly in universities and careers fairs.

b) Supporting existing teachers

It is important to ensure that existing primary teachers – the majority of whom do not have a science degree or A Level – receive support in teaching science. The 2011 TIMSS survey found that in Northern Ireland only just over half of primary teachers felt "very well prepared" to teach science whereas the equivalent figure for maths was 91%.

With the demise of subject advisers in education boards and the small availability of science specific CPD, primary teachers currently have few places to turn to for support.

In relation to the new curriculum in particular, whilst Government aims of flexible teaching are understandable, the current lack of guidance for science teaching is particularly difficult for many teachers given their lack of confidence and understanding of the subject.

More detailed guidance for the science curriculum would therefore be beneficial for these teachers, as would access to CPD.

Recommendations

To give students in Northern Ireland a world-class science and chemistry education, Stormont should undertake a number of measures to increase the supply of science specialist teachers, and to support existing teachers.

Recommendation 1: *Stormont must ensure that by 2020 every primary school should have access to at least one science specialist teacher. This teacher should act as a "subject leader" within the school, supporting other teachers with their science lessons, with time given to allow the subject to be effectively led. In the case of small schools, they should be able to access one specialist from within a cluster of schools.*

Recommendation 2: *Stormont should introduce incentives to increase the numbers of science graduates, and those with science A Levels, entering primary school teaching. These could be financial incentives, or a promotional campaign.*

Recommendation 3: *Stormont should increase provision of science specific Continuing Professional Development (CPD) courses for primary school teachers.*

Recommendation 4: *Primary schools and governing bodies should consider the subject knowledge of their staff, and ensure that sufficient time and funding is allocated for subject specific CPD.*

Recommendation 5: *CPD should be provided on teaching science within wider contexts, which would be particularly useful for the "World Around Us" curriculum. This would help make the connections between 'topics' and science.*

Recommendation 6: *A statutory baseline for the science curriculum should be developed for primary school teachers. In addition to this, a curriculum review needs to take place in order to ensure the importance of science in the curriculum is adequately recognised.*

Recommendation 7: *Stormont needs to build up an accurate picture of the deployment of science specialists teaching in primary schools. It should therefore collect and assess data on the subject-based qualifications (including A Level and other qualifications), training and deployment of primary science teaching staff across Northern Ireland.*

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