



Llywodraeth Cymru
Welsh Government

Response to the Estyn thematic report on Science at Key Stage 3 and Key Stage 4

Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.



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Report title:

Science at Key Stage 3 and Key Stage 4.

Report details

Estyn was asked to review standards, provision and leadership in science at Key Stages 3 and 4, examining a range of factors including the quality of teaching and assessment, curriculum planning, staff development and curricular and extra-curricular learning experiences.

Summary of main findings

The key findings of the report are that:

Standards

Pupils make good progress in their knowledge and understanding of science in many of the science lessons observed in Key Stage 4, but only in about half of the science lessons in Key Stage 3. In a minority of lessons, progress is too slow. In these lessons, many pupils are too reliant on the teacher

In Key Stage 4, performance at level 2 in science has shown an upward trend from 2012 to 2015. Despite declining in 2016, science remains the highest-attaining core subject in Wales. Girls consistently perform better than boys in science. Pupils eligible for free school meals still do not perform as well as other pupils. The proportion of pupils who achieve the highest grades in Science GCSE has not improved over time.

In Key Stage 3, according to teacher assessment, there has been a year-on-year increase in the proportion of pupils attaining the expected level in science, since 2012. The proportion of pupils gaining the higher levels in science has also improved, although more able pupils eligible for free school meals do not do as well in science as their peers. Performance of boys has been lower than that of girls at each level every year since 2012.

The GCSE and teacher assessment outcomes contrast with the findings in PISA 2015. The average PISA scores for science in Wales have declined since 2006, a key factor being the deterioration in performance of the highest-achieving pupils. In PISA, there is no significant difference in the performance of boys and girls in science.

Provision

The quality of teaching has many strengths in many lessons in Key Stage 4, and in around a half of lessons in Key Stage 3. Many teachers, particularly in Key Stage 4, have strong subject knowledge and develop pupils' scientific knowledge and understanding well by planning a range of interesting activities. These teachers provide well-planned practical work, make good use of ICT to enhance teaching, and provide opportunities for pupils to develop their literacy and numeracy.

In a minority of lessons, particularly in Key Stage 3, expectations are low, and there is not sufficient planning to meet the needs of all pupils, particularly in supporting development of ICT skills.

Many teachers use assessment information from tests and examinations well to gain a clear picture of the strengths and weaknesses of individual pupils. Only a minority of teachers provide pupils with useful subject-specific comments to improve their work. Pupils respond positively to such feedback.

In general, enough time is allocated for teaching science, but this is tending to be reduced for GCSE Science in many schools, to accommodate other curriculum areas such as Welsh Baccalaureate. Most schools have reduced the number of pupils entered for vocational science courses significantly since 2015. Very few schools have yet reviewed their science curriculum in response to the *Successful Futures* report.

Most schools offer worthwhile extra-curricular science activities, but planning for expanding more able pupils is underdeveloped in science. There is a lack of opportunity for pupils to contribute to what and how they want to learn.

Leadership and management

In the schools visited, senior leaders generally have a broad vision for the school curriculum and what they want to achieve for their pupils. In science departments, leaders are less clear about the specific aims of the science curriculum. The recent changes to qualifications may have contributed to this, since science leaders are not yet familiar enough with the content or assessment requirements.

Lines of accountability for science departments are generally clear. However, because all qualifications are included in the level 2 measure for science, performance data is not specific enough to allow a department to compare itself effectively with similar schools. This has led to a lack of rigour in the performance management and evaluation of science departments in recent

years, especially when leaders are not using a range of evidence to evaluate the quality of teaching and leaders of science departments and are too dependent on using data.

A minority of schools visited took part in the latest round of PISA. Only a few analysed their school's own report on the test outcomes in detail so as to identify any weaknesses and plan to address them. Similarly, of the schools that did not take part in the PISA tests in 2015, very few have considered the content of the report for Wales or how it would impact on their work.

Most science teachers benefit from sound internal support from their school leaders and colleagues. However, the regional Consortia target their support on science departments that need to improve significantly, and there is insufficient subject-specific support for science in schools that are not underperforming.

Most lessons are taught by specialist science teachers. Generally, there is a lack of applicants for science posts and recruiting to Welsh-medium science departments is a particular problem. When science staff are absent, many schools employ non-specialist supply teachers to cover their lessons, especially in Key Stage 3. The number of post-graduate science teachers being trained has fallen short of national targets over several years.

Most science departments are well equipped. They have a suitable number of laboratories and an appropriate number of technicians to support the teaching. Science support staff receive appropriate training on health and safety issues. There is very little training or support available for technicians.

Recommendation 1

Schools should provide stimulating and challenging opportunities in science involving effective practical work to meet the needs of all pupils, including the more able.

Welsh Government Response: **Accept**

The Welsh Government is committed to ensuring that children and young people reach their full potential in education regardless of their background or circumstances. Our vision is for all of our children and young people to enjoy teaching and learning that inspires them to succeed, in an inclusive learning environment which respects and values cultural diversity. Our work to raise standards in the teaching and learning of science will be led through our new National Network for Excellence in Science and Technology (NNEST), which will work with lead schools, regional Education Consortia, higher education

and other key partners to ensure that science and technology professional learning is linked to the new curriculum.

In collaboration with the National Association for Able Children in Education (NACE) Cymru, we have produced resources to support More Able and Talented (MAT) learners - *Meeting the Challenge: Quality Standards in Education for More Able and Talented Pupils*. These resources were distributed to all schools and local authorities and provided advice on meeting the educational needs of MAT learners.

Development of the Quality Standards has enabled Welsh Government to put in place a consistent approach to meeting the needs of MAT learners as well as providing a mechanism for schools, authorities and the Welsh Government to monitor progress.

The Welsh Government and NACE Cymru has also developed a training pack to support schools in providing high-quality, stretching, learning experiences for MAT learners. It has been issued to all schools in Wales and is available on the Learning Wales website.

Recommendation 2

Schools should evaluate their curriculum for science in preparation for the new Area of Learning and Experience for Science and Technology.

Welsh Government Response: **Accept**

This is an area primarily for schools, however the Welsh Government is working in partnership with Pioneer Schools, Consortia and Estyn to develop the Science and Technology Area of Learning and Experience (AoLE). The Science and Technology AoLE will draw on physics, chemistry and biology, engineering, design technology (food, textiles, resistant materials), craft, design, graphics and, importantly, computer science. Work on the AoLE began in January.

Consortia will consider how schools are best supported as part of the national approach to professional learning, which includes the NNEST.

Recommendation 3

Schools should ensure departmental self-evaluation is robust and based on a range of evidence to evaluate subject-specific standards and the

quality of teaching.

Welsh Government Response: **Accept**

The new professional standards for teaching and leadership identify reflection as an important part of the pedagogy standard, and will support schools in this area. The standards contain descriptors of practice setting out expectations in relation to evaluation for practitioners at the end of Initial Teacher Education (ITE) and end of induction, at the level of sustained excellent practice.

From 1 September, newly qualified teachers (NQTs) undertaking induction will do so using the new standards. NQTs who began their induction before 1 September will continue to use the existing standards. The standards become mandatory on 1 September 2018 and teachers and leaders have until that time to explore the standards and adopt them at an appropriate time for them.

The final version of the standards and descriptors (following wide consultation) is being made available online. An interactive version of the model is being developed, and this will form an integral part of the professional learning passport (PLP). The PLP is hosted on the Education Workforce Council's website and is designed to support practitioners' career-long professional development in the pursuit of improved learner outcomes.

Recommendation 4

Schools should use feedback from the latest PISA report to inform planning for improvement.

Welsh Government Response: **Accept**

PISA assesses the knowledge, skills and readiness for adult life of pupils aged 15. Pupils are assessed on their competence to address real life challenges, including for science. Each cycle of PISA focuses on one of these three areas. The main focus for PISA 2015 was science, mathematics and reading were minor domains.

In order to better understand variation in Welsh pupil performance on PISA 2015 and to provide an indication of pupils PISA assessment skills, an additional analysis has been undertaken on the results, and will be disseminated system wide this autumn. This has covered specific item level analysis, including:

- Welsh pupil performance on PISA 2015 that identifies the proportion of skipped, not completed and partially completed items by pupils.
- commentary on the implications of findings in relation to subject

specific knowledge and skills, and a general assessment skills of Welsh pupils.

- Comparison of results of this 2015 item analysis to those conducted previously for Wales.

The findings will inform the work of Pioneer Schools in the development of the new curriculum, alongside the NNEST / consortia professional learning provision.

Recommendation 5

Schools should ensure that assessment helps pupils to know what they need to do to improve.

Welsh Government Response: **Accept**

The current National Curriculum subject orders for science set out that learners of all abilities should have access to appropriate assessment and accreditation. Guidance on this is set out in relevant Welsh Government curriculum documentation.

The Welsh Government is committed to ensuring that future arrangements give priority to using assessment as a means to inform better teaching and learning. Details of content and implementation of the new arrangements will be decided through dialogue with the education workforce, but the central focus of assessment in the future will be to ensure learners understand how they are performing and what they need to do next in order to progress.

There will be a renewed emphasis on Assessment for Learning as a natural and integral feature of learning and teaching, and a move away from gathering information about the performance of children and young people on a school-by-school basis for accountability purposes.

We have increased funding to support a programme of work to improve the quality of teacher assessment. The programme will build on the work of the assessment and progression Pioneer schools and make links with professional learning Pioneer schools to ensure synergy with Assessment for Learning activity. The programme will also include the formative use of tracking information within the classroom to modify practice and promote learning throughout the school, effective marking, planning, peer and self-assessment.

Recommendation 6

Local authorities and Consortia should provide more subject-specific support for science on improving teaching and assessment, and facilitate the sharing of good practice

Welsh Government Response: **Accept**

This will be a key area of activity for the National Network for Excellence in Science and Technology (NNEST), within which all 4 regional education Consortia in Wales are key drivers.

NNEST will work with Pioneer / lead schools to support evidence-based pedagogical development, for improved classroom practice, ensuring the teaching workforce has access to appropriate training, development and support. Through the Network, regional Consortia will work with universities and practitioners to develop and deliver an enhanced level of professional learning as part of education reforms.

As part of this approach, Pioneer Schools engaged in professional learning development will be working with curriculum design pioneers to develop the specific support. This includes support in the areas of Science and Design and Technology.

Schools should consider the support currently available, and their future needs, in the context of their School Development Plans. If provision for a specific need is not readily available in their local area, they should discuss the matter with their regional Consortium.

Recommendation 7

Local authorities and Consortia should provide more support for schools to evaluate their curriculum, and plan for the development of the Science and Technology Area of Learning and Experience, as well as the changes to qualifications in science.

Welsh Government Response: **Accept**

Welsh Government is working in partnership with Pioneer Schools, Consortia and Estyn to develop the Science and Technology Area of Learning and Experience (AoLE).

Consortia will wish to consider how schools are supported as part of the national approach to professional learning, which includes the NNEST.

Recommendation 8

Welsh Government should campaign to attract more science graduates into the teaching profession in Wales.

Welsh Government Response: **Accept**

To support a high-quality education workforce that is vibrant, engaged and committed to continuous learning for all, the Welsh Government is working towards getting Wales' Initial Teacher Education (ITE) offer right. The principle purpose of ITE reform is to improve the quality and consistency of ITE provision, introduce a new approach to ITE and ensure that all programmes meet high aspirations for world class ITE in Wales.

From initial teacher training into the classroom, and through career-long professional learning, our national approach focuses on ensuring and further developing a high-quality teaching profession and promoting Wales as a place to teach. The Education Workforce Council (EWC) has been empowered to accredit individual ITE programmes, through the establishment of the Teacher Education Accreditation Board. This will enable more specific consideration of how ITE programmes will raise the quality of ITE provision. In doing so, the Board will seek to ensure that any programme is demanding, credible and professionally appropriate.

Compared to overall graduate entry figures, ITE recruitment remains strong. The new rules for teacher training are a key part of our drive to attract the best talent to the profession. We continue to work closely with partners including regional consortia and teacher unions to attract more science graduates into teaching.

Publication details

The report was published on 20 September 2017, and may be accessed on the Estyn website: www.estyn.gov.wales/thematic-reports