

Attitudes of Children and  
Parents to Key Stage 2  
Science Testing  
and Assessment

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# **Attitudes of Children and Parents to Key Stage 2 Science Testing and Assessment**

**Final report to the Wellcome Trust**

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## Abbreviations used in this Report

AfL	Assessment for learning
APP	Assessing pupils' progress
ARG	Assessment Reform Group
ASE	Association for Science Education
BERA	British Educational Research Association
CPD	Continuing professional development
CRAG	Children's research advisory group
CRC	Convention on the Rights of the Child
DCSF	Department for Children, Schools and Families
EYFS	Early Years Foundation Stage
ICT	Information and communications technology
ITE	Initial Teacher Education
KS2	Key Stage 2
KS3	Key Stage 3
LEAs	Local Education Authorities
OFSTED	Office for Standards in Education
QCA	Qualifications and Curriculum Authority
SATs	Standard Assessment Tests
SPSS	Statistical Package for the Social Sciences
STEM	Science, Technology, Engineering and Maths
TES	Times Educational Supplement
TLRP	Teaching and Learning Research Programme
UK	United Kingdom
UN	United Nations
UNCRC	United Nations Convention on the Rights of the Child

# **1. Executive Summary**

## **1.1 Purpose of the research**

The Wellcome Trust commissioned this research in January 2009 to provide information on parents' and pupils' views of testing and assessment in science at Key Stage 2 (year 6). Children in Key Stage 2 are aged between eight and 11 years old. We focused on assessment that took place in year 6. Field work took place between January and June 2009, and involved children from year 6 and year 7 (the latter group provided the longer-term perspective as they looked back to their experience the previous year) and their parents. The research follows on from a previous report focusing on the views of teachers (Collins, Reiss and Stobart, 2008) and responds to the UK Government's acknowledgement that "there is little information on parents' and pupils' views of testing and assessment" (House of Commons, 2008). The Trust, by commissioning this work, intends to provide a valuable opportunity to use research evidence to inform policy discussions and decisions, as well as informing any future work by the Trust related to assessment.

## **1.2 Aims**

This project aimed to explore the attitudes of children and parents to the different forms of Key Stage 2 (year 6) science assessment experienced by children in England and Wales in terms of fitness for purpose and the impact of assessment approaches on children and their families. The project seeks to recommend changes to assessment policy and practice, where appropriate, based on the findings of the study. More specifically the aims can be stated as:

- to consult with parents and pupils to provide a clear, evidence-based analysis of their experience of and attitudes towards testing and assessment of science at Key Stage 2 (year 6)
- to evaluate these experiences and attitudes in terms of fitness for purpose of the tests and their impact on children and families
- to recommend changes, where appropriate, to science assessment policy and practice based on findings from this study.

## **1.3 Methodology**

This research explored key issues for children and parents regarding assessment of science in primary schools, and their ideas for improving assessment. A literature review was performed to identify major issues and developments relating to primary science assessment.

The methodology adopted for working with the children was designed to ensure that the research process was compliant with international children's rights standards on children's participation. To this end, we recruited four children's research advisory groups (CRAGs) from schools in England and Wales. The CRAGs were introduced to the issues addressed by the project through capacity-building activities and actively assisted with and informed the research at all

stages. They provided a range of responses to issues so that other children completing an online survey could consider different perspectives. The advantages of using an online survey lie in its adaptability to a range of children's ages and abilities, its universal accessibility within schools, and that it can be made fun and engaging for the children taking part. CRAG children introduced the survey to those taking part via a video clip at the start of the questionnaire. A representative from the Wellcome Trust also informed the participants via a video clip about who was listening to their views and that the findings were being used to advise policy makers in England and Wales about future assessment policy. The four CRAGs worked together to interpret findings from the survey after its completion by 997 children.

The sample comprised 16 schools in England and Wales, four of which were 'project schools'. Four CRAGs - one from year 6 (KS2) and one from year 7 in England, and similarly in Wales - were recruited from the project schools to work with the research team at all stages throughout the project. There were eight children in each CRAG, representative of different gender, ability, social and ethnic groups in the project schools.

Parents of all children who completed the online survey were invited to complete a paper-based questionnaire. There were 245 respondents.

In addition, a stakeholder seminar was held towards the end of the project in which representatives of policy makers, curriculum developers, teacher unions, teachers and other stakeholders considered the findings relating to improving science assessment at KS2 (year 6) in terms of their desirability and feasibility for implementation in schools.

## **1.4 Key findings**

### Attitudes to KS2 (year 6) science and its assessment

1. Children's and parents' views of science assessment at KS2 (year 6) were largely positive.
2. Most KS2 children enjoyed science at school and most parents agreed that science should remain a core subject in primary school. There was, however, a statistically significant decline in interest in science observed as children moved from year 6 into year 7.
3. More than 90% (n=941) of children agreed that science assessment was useful. Nearly half of the children in English schools (44%) and a quarter of children (26%) in Welsh schools found that science assessment helped them enjoy science (n=935). More than half of the children in England (51%) and a third of the Welsh children said that science assessment made them want to learn more about science (n=947).
4. Children responded that they spent less time revising for science than for English or maths. Children from English schools said they spent more time than children in Wales on revision and less time than children in Wales on experiments and computer work.
5. The type of assessment children suggested as the most useful for finding out how well they were doing in science was non-SATs science tests (57% English children and 47% in Wales). Most children in England and Wales



were positive about the use of non-SATs tests to find out how well they were doing in science. More than a third (38%) of children in Welsh schools chose teacher-assessed science as the most useful for finding out how well they were doing, whereas a third of children in English schools (33%) selected doing SATs practice papers at home. Least popular was SATs practice papers done in school (selected as the most useful by 9% children in English and 11% children in Welsh schools), although more than half (53%) of the children in English schools and 14% in Welsh schools said they did SATs practice papers 'very often' in science lessons (n=928). Children who enjoyed science more and perceived they were better at science were more positive than those who did not enjoy it or felt they were not good at science about the usefulness of KS2 (year 6) science assessment.

6. Parents from Wales chose teacher assessment of children's work as the best way to assess them in science; parents from England chose SATs. This finding corresponds with the assessment approach used in the respective countries at the time (moderated teacher assessment in Wales and SATs in England<sup>1</sup>).
7. Despite children indicating overall positive attitudes towards science assessment at KS2, they reported that its impact on their friendships and home lives was largely negative. The effect was more pronounced in children from English schools. Parents were more positive than children about the impact of science assessment on children's home lives.

#### Abolition of KS2 (year 6) science SATs in England

8. The majority of children in English schools *did not* agree with the abolition of science SATs. Their reasons included a concern that they would not learn as much science, they would not know their levels in science, that SATs are a good preparation for secondary school and that science will become less important in school without SATs. Children who agreed with the abolition of science SATs cited reasons including reduced stress and pressure on children, better learning and teaching in science and more time for other things.
9. Parents of children in English schools were apprehensive about the abolition of science SATs, which had been announced in the month prior to their survey administration. Most Welsh parents agreed that children enjoy science more and learn more science without SATs and that the change from SATs for science assessment had been for the better (all SATs, including science, were abolished in Wales in 2004). They also felt that prior to 2004, SATs were a lot more 'low key' in terms of media coverage.

#### Improving KS2 (year 6) science assessment

10. Children's and parents' ideas for improving assessment were consistent with findings from research and inspection reports. All suggest that assessment should be designed to motivate science learning by employing a variety of approaches, (including non-SATs tests) which allow for choice and have a strong emphasis on investigative work.

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<sup>1</sup> Science SATs were abolished in England in May 2009, so the children from English schools sampled for this survey were among the last to sit the SATs tests.

11. The two most popular categories of children's ideas for improving assessment were: assessment of science investigations (including presentation of findings from their projects) and end-of-topic, as opposed to end-of-year, tests. Children's ideas for improving assessment fell into the following broad categories: 'games/fun/invention/enjoyment', 'tests', 'collaboration in terms of sharing and helping', 'marking non-test work', 'answering aloud' and 'children's choice'. Parents' ideas for improving assessment of science at KS2 (year 6) broadly matched those from children, although parents did not highlight a 'fun' element, oral assessment or pupil choice.
12. The methodology used to access children's perceptions and ideas empowered children to voice informed, considered and reflective views about science assessment at KS2 (year 6). Children valued the space to express their views, seeing a range of other children's opinions, being listened to and the assurance that their opinions will be passed on to Government policy makers in England and Wales.

## **1.5 Recommendations**

### **Policy makers**

1. Children should be consulted about decisions that are being made about their learning and assessment. They provide a legitimate, important perspective which can serve to improve policy and practice.
2. The Wellcome Trust should try to represent the voice of the children, as expressed in this report, in its dealings with policy makers in relation to KS2 science assessment.
3. English policy makers in England should also consult with Welsh colleagues in formulating policies and procedures for post-SATs science assessment. Welsh parents indicated that science learning and teaching have improved since SATs were abolished there in 2004.

### **Curriculum developers, advisers and teachers**

4. Science assessment at KS2 should be embedded in normal science class work and should include the use of end-of-topic, as opposed to end-of-year, testing. It should cover a range of sources of evidence from practical, oral and written work, and should focus on the understanding of science as opposed to knowledge recall.
5. KS2 science should be linked with children's everyday experience, their learning in other subject areas, and the world of great science achievements and wonders. Children should be excited by school science and assessment should increase their motivation to learn more.
6. Teachers need to be guided in relation to communicating with children about the impact of completing assessments on their friendships and home lives to ensure that the experience is as positive as is possible.

### **Researchers**

7. Ideas for assessment of science at KS2 presented by children, parents, other stakeholders and researchers in this study, particularly in relation to consulting with children and embedding assessment in normal classroom

practice, should form the focus of intervention studies. A rigorous evaluation of the effects of such interventions could be completed using a randomised controlled trial whereby children are randomly allocated to an intervention or control group and the resulting outcomes data compared.

8. Research using a children's rights approach should be pursued to explain the decrease in popularity of STEM subjects in early secondary school and suggest ways to reverse this trend.

## 2. Introduction and Literature Review

### 2.1 Introduction

This report presents children's and parents' views and ideas about science assessment at year 6, Key Stage 2 (KS2). An innovative methodology was employed in which children's research advisory groups (32 children: four groups of eight) contributed to all stages of the research, including the design, construction, piloting and evaluation of an online questionnaire for use with the main sample, as well as interpretation of findings from the survey.

Several recent reports and research studies (for example: Harlen, 2007; ASE, 2008; Wellcome Trust, 2008) which have either focused on or addressed issues relating to assessment of science at KS2 have highlighted concerns about the way science is assessed. The evidence from these studies came from teachers, head teachers, science teacher educators, government inspectors and researchers; some of the concerns are summarised below:

- Individual pupil performance in science at Key Stage 2 is also used to evaluate the performance of teachers, schools and Local Education Authorities (LEAs) and for monitoring national standards over time, despite such tests exhibiting low validity (Harlen, 2007).
- There is an over-emphasis on preparation for national tests at primary level, which has led to a negative effect on children's enjoyment of science. High-stakes testing causes more anxiety in the primary than the secondary sector, since the latter has more experience, leading to greater acceptance by parents and teachers. A number of major research projects have thrown doubt on the considerable rise in children's performance in science shown in the national test data (House of Commons, 2008).
- Current testing in science has had a detrimental impact on learning and teaching, particularly in the years when the tests take place (ASE, 2008).
- Recent research showed that a sample of secondary science teachers in England claimed to mistrust KS2 national test results for science, and also found that respondents to a survey in Wales suggested that the abolition of national testing had positive effects on the teaching of science in year 6 classes (Collins et al., 2008).
- The Office for Standards in Education report (Ofsted, 2008) showed that outcomes of tests and public examinations in science have not changed substantially over the last three years at primary level and that there is scope for improvement. The report suggested that teachers were mainly concerned with meeting narrow test and examination requirements, leading them to adopt methodologies which did not meet the needs of all pupils or promote independent learning.
- There is some evidence to suggest that the conceptual understanding of children has decreased to an alarming extent since the 1970s; one explanation for this could be that statutory assessments in science at Key Stage 2 could have restricted the rate of growth of children's scientific thought (Wellcome Trust, 2008).

This report adds to the evidence by focusing on children and parents as major stakeholders in addressing issues relating to science assessment at Key Stage 2. It sets out to explore children's and parents' perspectives and to see whether they add weight to the evidence cited above or, indeed, whether children themselves have an experience which is reflected somewhat differently from that implied in other studies. The report also looks at the influence, if any, of the introduction of assessment for learning (AfL) approaches on children's science assessment experience.

In a recent publication, Gordon Stobart, a member of the influential Assessment Reform Group (ARG), argued that assessment shapes how we see ourselves and how we learn (Stobart, 2008). Stobart showed how, in a test-driven culture, assessment can often undermine effective learning by encouraging shallow 'for-the-test' learning and by treating test results as an end in themselves. Stobart and other members of the ARG examined the purposes and consequences of assessment. Issues surrounding the purposes and consequences of assessment informed the work in the current study, which aimed to provide suggestions contributing to a way forward in providing an effective assessment strategy for science at KS2.

## **2.2 Background to the study**

A comprehensive literature review on research relating to statutory national testing and teacher assessment for summative purposes in science at Key Stage 2 was presented by Collins, Reiss and Stobart (2008) in their report to the Wellcome Trust on the effects of national testing in science at KS2 in England and Wales. The literature review presented here builds on that earlier work by drawing on more recent sources, and by focusing more specifically on those issues that relate to children's and parents' views of assessment. The main concern of the research in this report was to present the view of assessment currently expressed by children and parents, how that reflects the national testing context in both countries and what it means for deeper issues of what is valued in primary science education. Moreover, we consider the future scenario as national testing in science has now ceased for KS2 science in England.

The main thrust of the review by Collins et al. (2008) was on the impact of national testing on teachers and teaching. They focused on research findings that demonstrated how an assessment system involving national testing has had a detrimental effect on the quality of education, citing the work of the Assessment Reform Group (2002), Gipps (1994), Broadfoot and Black (2004) and Harlen (2007) in raising questions about the impact of testing on teaching and learning. For example, Broadfoot and Black (2004) highlighted tensions that teachers faced between formative assessment that aims to enhance the learning of the individual child and the pressure to produce improved results overall in the national tests. Collins et al. (2008) showed how the situation in science at KS2 has had a particularly dramatic impact on teaching, because of the nature of science education in primary schools pre-national curriculum. Prior to national testing in England and Wales, primary science was characterised by variation in content,

lack of consistency in teaching, learning and assessment, and the limited science experience of teachers. Collins et al. (2008) suggested that the introduction of national testing in science at KS2 resulted in a struggle for many primary school teachers to deal with high expectations of outcomes when they had limited confidence and resources.

Collins et al.'s (2008) review highlighted the culture of test preparation at KS2 which had developed as a result of the high-stakes nature of national testing. They pointed out that research shows there is little evidence to suggest that test preparation results in higher scores, though teachers believe this is not the case. They cited research by Johnston and McClune (2000), who found that high-stakes tests and the nature of test questions led teachers towards transmission teaching with an emphasis on factual knowledge, and by Sturman (2003), who showed that 'normal' science activities were being replaced by test preparation throughout Year 6. Collins et al.'s (2008) review also pointed out that national testing has inhibited the development of children's knowledge and understanding, in particular the development of inquiry skills. We take up this issue by drawing on Harlen's recent work (Harlen and Qualter, 2009), on teaching and assessing primary science to re-examine the relationship between summative assessment practices and learning. Our concern is for the views we find to be conducive for learning, and if not, what recommendations are needed.

Xiao (2006) researched the emotional impact of KS2 SATs on his peers. Xiao (2006) is a child researcher (aged 11) who considered the views of 69 children in year 6. Xiao (2006) concluded that the school a child attended had the greatest impact on children's emotions about KS2 SATs. Children in one school were a lot more negative than children in the other school. Xiao (2006) also concluded that negative feelings before the SATs can have a negative effect on test performance and confidence when doing the SATs.

The literature review by Collins et al. (2008) also raised the issue of the validity and reliability of national test outcomes and draws on the arguments of Black and Wiliam and others on the validity and reliability of national test data (e.g. Wiliam, 2001; Black and Wiliam, 2006). Wiliam's work on validity has highlighted the problems inherent in using national tests to make high-stakes determinations about students or teachers. He argued that such tests lack validity as they only assess a small proportion of the curriculum. Black and Wiliam (2006) demonstrated statistically how unreliable (hence of limited validity) national tests can be. They also pointed out that teachers may be unaware of the limited reliability of their own tests, hence their argument is for formative assessment by teachers over a period of time, where evidence is collected for guiding learning and where teachers can detect and support learning through interaction. More recently, Wiliam (2008) focused on issues of validity in examining the quality of decisions that can be made as a result of assessment. Wiliam (2008) made a case that validity should be viewed as a feature of the interpretation and use of assessment outcomes, not the tests themselves. He suggested that for legitimate decision making arising from assessment, assessment needs to have adequate reliability, address all-important aspects of constructs to be generalised and eliminate irrelevant factors. These issues are relevant to our research, as we

consider children's and parents' views and implications for the future emphasis of assessment in primary science.

In their study for the Wellcome Trust, Collins et al. (2008) explored the views of teachers in England and Wales on the strengths and weaknesses of current assessment arrangements, including the impact of changes to KS2 assessment in Wales since national testing for science ceased. As a result of their research Collins et al. (2008) found that ending high-stakes testing in Wales did not immediately lead to radical changes in teachers' practice. Where changes have occurred they related to the increased teaching of inquiry, a positive move, but teachers continued to use optional tests to reinforce their judgements. However, alongside this result, Collins et al. (2008) found that teachers in both countries lacked confidence in the accuracy of national tests to demonstrate attainment, with a view that teachers' assessment, suitably moderated, would be more dependable.

### **2.3 Focus on values**

The literature on assessment is wide-ranging and reflects different perspectives on key assessment issues such as method, purpose and outcomes. Authors can take quite different stances on these issues, or emphasise different aspects of childhood experience that are relevant to the assessment debate. Drummond (2008) focused on the choices available to assessment in relation to what is valued most in the education of children, that is, how we construct an understanding of what it is to be a child. What are valued as salient qualities determine what is offered in education and hence what is assessed. Drummond (2008) questioned the assumption that defining, labelling or measuring what a child can or cannot do can be a reliable predictor of what she or he will do next. The psychologist/ educationalist Lev Vygotsky (1896-1934) famously argued that testing of what children already know measures retrospectively and does not provide an effective indicator of future performance. He studied the problem-solving abilities of several children who had identical IQ test scores and found that some could complete problems with very little help whereas others could not perform the same task even when given maximum support (Vygotsky 1934/1987). Assumptions based on test scores can lead to limiting or damaging expectations, whereas assessment should focus on understanding what is going to inform our pedagogy. In her writing, Drummond (2008) offered alternative choices about learning that would not be appropriate to judge through simplistic quantification.

If we accept the stance expressed by Drummond (2008), where does that take us in the assessment debates within the United Kingdom? The lessons from Drummond's (2008) account for us as educators are that we should be clear, in a post-SATs era, about our views of what is valued about children and about learning, so that our assessment practices reflect these values. In our research we pose the question of what children's and parents' views of assessment are. Are these views expressed in terms of goals, or labels? What new choices would children and parents want?

To determine how assessment may reflect what is valued in teaching and learning, the recently published independent review of the primary curriculum written by Jim Rose (Rose, 2009) sought to answer two questions. Firstly, what should a broad and balanced curriculum contain to ensure that children receive a well-rounded education? Secondly, how should the curriculum change to meet children's different but developing abilities as they progress through the primary years? Key features of the new curriculum include recognition of subjects, a stronger focus on curriculum progression, literacy, numeracy, information and communication technologies (ICT) and language learning, and also a greater emphasis on personal development through a more integrated and simpler framework for schools. There is also more emphasis on continuity between the Early Years, Foundation Stage, primary and secondary Key Stages. In reviewing the aims of the primary curriculum, Rose (2009) pointed out that clarity on values and aims should be the starting point for determining the primary curriculum, and that these should be unifying for the whole of education. Such clarity of aims and values has been elusive in past versions of the national curriculum, but are highlighted more recently by the Every Child Matters agenda introduced by the Children's Act 2004, and reflected in the new secondary curriculum for England and Wales. Three main aims are that children should become:

- successful learners who enjoy learning, make progress and achieve
- confident individuals who are able to live safe, healthy and fulfilling lives
- responsible citizens who make a positive contribution to society.

Rose (2009) drew comparisons between the aims and values of curricula in different countries, including Scotland, Northern Ireland, Sweden, Denmark and New Zealand, to show the similarities in values now being reflected in many curricula aims. The review set out a design for the curriculum to meet these aims through the six areas of learning:

- understanding English, communication and languages
- mathematical understanding
- scientific and technological understanding
- historical, geographical and social understanding
- understanding physical development, health and wellbeing
- understanding the arts.

The subject details do not appear to be radically different from the existing curriculum, which, it could be argued, is a lost opportunity to really address a values-focused curriculum. Moreover, as Alexander (2009) argued, there is a need to clarify distinctions between knowledge, subject, discipline and skill and how these terms are used within the recommendations.

In reviewing transition and progression from the Early Years Foundation Stage (EYFS) and through Key Stages 1 to 3, Rose (2009) pointed out the work that has been done to set appropriate expectations of children's attainment and to frame level descriptors to help primary schools plan for children's progress. The role of assessment for learning (AfL) and assessing pupils' progress (APP) has now become established in England with the government's three-year AfL strategy that aims to ensure that children (and their parents) know how they are



doing, that teachers are equipped to make well-founded judgements and plans, and that schools have systems for managing and tracking progress. The promotion of APP is supported by a professional development programme, with APP materials to support primary science being piloted and finalised during 2009. It is intended that the APP should be widely in place across all year groups when the new curriculum is implemented in 2011. When fully developed, the APP should reduce teachers' reliance on testing as the main source of evidence for pupils' performance in relation to national standards<sup>2</sup>.

The Rose (2009) review also considered the views of parents on the curriculum, and through survey and focus groups, and found that parents supported the three aims (listed above). A consistent feature of parents' views was a balance between acquiring the basics (reading, writing and mathematics, and for 53% of parents, science) and personal development. In spite of the similarities in the details of the curriculum, the Rose report suggested that values will be at the heart of the new primary curriculum. If so, the forthcoming assessment review will need to reflect these values.

## 2.4 Fitness for purpose

In examining the relationship between assessment and learning, James (2008) posed the question of whether assessment and learning are 'in sync'. She examined the relationship between different views of learning that represent three generations of thinking about learning, that is, behaviourist, constructivist and socio-cultural, suggesting that assessment processes exist that reflect each view. James (2008) argued for more clarity in moving towards a more blended approach to assessment that is 'fit for purpose', and that can reflect all these views of learning.

In a recent article for the *Times Educational Supplement* (TES; James, 2009), James and the Assessment Reform Group have "thrown down the gauntlet to policy makers on how to make performance measures count". This article coincided with the publication of the Economic and Social Research Council's Teaching and Learning Research Programme (TLRP) commentary on assessment policy (Mansell, James and the Assessment Reform Group, 2009), co-authored by James. In the TES article James pointed out the difficulty many adults have in understanding assessment and what it can and cannot do. She highlighted three key misunderstandings:

- the assumption that test scores are completely accurate
- a short test can validly capture achievement of something multi-faceted
- tests can drive up standards.

James (2009) argued that the fitness for purpose of the assessment system needs to be re-evaluated. Fitness for purpose rests on "the extent to which formative assessment, summative assessment by teachers, tests and exams and accountability systems have the quality needed to engender confidence and support good teaching" (p. 23). The TRLP report (Mansell, James and the

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<sup>2</sup> For further information on APP, see:  
[nationalstrategies.standards.dcsf.gov.uk/primary/assessment/assessingpupilsprogressapp](http://nationalstrategies.standards.dcsf.gov.uk/primary/assessment/assessingpupilsprogressapp)

Assessment Reform Group, 2009) addressed the notion of quality in some detail, reiterating the technical difficulties associated with validity and reliability (Black and Wiliam, 2006) and spelling out the issues of quality in formative and summative assessment. The report also reinforced the message that quality is linked to the interpretation and use of assessment data (Wiliam, 2008), addressing the issue of quality in accountability, through asking “what do test data measure?” and “what are the consequences of publishing test data?” The central thrust of the report was to pose four challenges for policy makers:

- putting effective in-class assessment into practice system-wide
- enhancing confidence in tests and examinations
- justifying the costs of assessment
- avoiding micro-management.

The messages of the report are important in conveying to children and parents what assessment is for and how assessment outcomes can be interpreted.

## **2.5 Impact of testing on children's well-being**

There has been much discussion of the impact of external testing on children's well-being. Woodward (2003), in an article in the *Guardian*, suggested that the UK government was breaching the United Nations convention on children's rights by imposing a “targets and testing regime” in English schools that ignored children's needs. Woodward cited an interview with Katarina Tomasevski, special rapporteur on the right to education for the UN Commission on Human Rights, in which she argued that the then current system of tests at seven, 11, 14 and 16 for children in England was designed to “fulfil government objectives rather than meet the needs of the children”. In Wales, KS1 SATs taken by seven year olds were abolished in 2002, and KS2 and KS3 SATs were abolished in 2004. In England, assessment of children at age seven has been made more flexible and SATs at 14 were abolished in 2008. In 2009, science SATs at age 11 were abolished for children, although the 2009 cohort of 11 years olds still completed the science SATs.

The Testing and Assessment report of the House of Commons Children, Schools and Families Committee (2008) cited several sources of evidence suggesting that there was a negative impact of SATs testing on children. For example, children aged ten or 11 exhibited increased tension and stress when facing a week of examinations in which they are expected to demonstrate “the full extent of their learning from seven years of education” (p. 22). Other evidence cited suggested that testing is stressful for children, and that repeated testing can have a negative effect on children, leading to demotivation, reduced learning potential and lower educational outcomes (p. 55). Alexander (2009), in the Cambridge Review, was also critical of primary SATs, league tables, and national strategies – he suggested that children's creativity, curiosity and well-being is likely to suffer as a result of intense demands for accountability. An article published by the National Association of Head Teachers (NAHT, 2008) called *SATs: The Children's Voice* cited children's responses to their SATs tests. An example quote was: “My biggest challenge is SATs because they are very hard and you might get picked on or bullied if you get a bad score or even if you get a good score people will call

you names like nerd, geek and beano...” Child researcher Xiao (2006) carried out a small survey of year 6 children’s emotions of KS2 SATs (69 children) and reported that most appreciated the importance of the tests, whilst the impact on their emotions was more variable. The section of our report which deals with the impact of assessment on children’s friendships and home lives provides further evidence that SATs testing, even though many children were positively disposed to it in terms of its fitness for purpose, nevertheless had a negative impact on their well-being.

## **2.6 Providing evidence for learning**

Dudley and Swaffield (2008) drew on the Assessment Reform Group’s (ARG) definition of assessment for learning (AfL) as “the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go next and how they get there” (ARG, 2002). Dudley and Swaffield (2008) extended the notion of what counts as assessment data beyond numbers, figures etc., to include children’s oral responses and written work as evidence. They provided a range of ways in which schools can use assessment data to personalise learning and track children’s progress. In the same volume, Harlen (2008) outlined the purposes of formative and summative assessment and provided an example of how evidence can be used for both formative and summative purposes. The example, from science, begins from teachers’ goals, which relate to both understanding to be developed and also skills of investigation.

In the most recent edition of *The Teaching of Science in Primary Schools* (Harlen and Qualter, 2009), a text that is used extensively by qualified and student teachers, Harlen and Qualter redefined assessment for formative purposes as “assessment to help learning”. They clearly stressed the purposes of assessment and the use of evidence “combining various ways in which evidence is collected and the various ways of interpreting and reporting it creates different methods of assessment”. Having set out their definitions and reinforced the message about fitness for purpose, Harlen and Qualter (2009) devoted much of the book to practical advice on gathering information that provides evidence for learning in science. These included questioning, observing, using children’s writing and drawings, concept maps, concept cartoons and ‘eavesdropping’. They made the point that listening in can help teachers to find out how children are reasoning and using evidence, and how they use language in science. In addition to other methods of assessment for formative purposes, including types of feedback and children’s role in assessment, Harlen and Qualter (2009) devoted a chapter to summative assessment, called ‘summarising achievement’, drawing on the evidence of negative effects of testing (ARG, 2002; Harlen and Deakin-Crick, 2003). Harlen and Qualter (2009) reiterated the message that summative assessments can be used formatively, and provide examples of how special tasks can be embedded in normal work to provide evidence for learning in science.

If, as is anticipated, AfL and the APP are the future focus for assessment, then some teachers may need help in understanding and putting formative assessment into practice, finding ways of gathering information that provides

evidence for learning. Overall and Sangster (2006) provided teachers with an accessible and informative overview of how assessment works and how opportunities to assess can be created in every classroom. But the voice of children and parents could also provide a valuable perspective for policy makers and teachers to consider in designing and implementing effective assessment of science at KS2. Assessment policy and practice also influences and is influenced by children's attitudes to studying science in primary school. Our study considers children's perceptions of science and its assessment in school.

## **2.7 Children's attitudes to primary school science**

An important aim of primary science is to spark the interest of children in the sciences. Ideally, during science children should have opportunities to manipulate materials, ask questions, hypothesise, predict and test their predictions. They could express what they have learnt through drama, writing, talking and drawing and by using ICT. Unfortunately, the reality of primary science classrooms is often very different from this ideal. Whilst there is general agreement that considerable progress with primary science has been made since its introduction as a compulsory primary subject in the UK, there is concern that advances made in the early stages are in danger of being lost (Parliamentary Office for Science and Technology [POST], 2003). The POST (2003) briefing summarised these concerns as: declining pupil interest in science during the primary school years; the balance needed between teaching factual knowledge and the skills of scientific enquiry; the effects of the SATs tests (and equivalents) and the importance of teachers' scientific knowledge and confidence. The decline in liking for science is even stronger in KS3 than in KS2 (Donnelly, 2001; Braund and Driver, 2002). Their evidence shows *widespread repetition* of primary school science occurring at KS3.

Many children show a decline in interest and enthusiasm for science from a young age. A study by the Institute of Electrical Engineers (1994) showed a decline in the level of interest in science by children in England between the ages of ten and 14. Osborne, Driver and Simon (1998) found that positive attitudes towards school science appeared to peak at or before the age of 11 and decline thereafter by quite significant amounts, especially in girls. They revealed that science attitudes and interests are developed early in primary school and these are carried into secondary school and adulthood. Morrell and Lederman (1998) reported that many studies have shown very little, if any, relationship between overall attitudes to school and to science. They concluded from their own study carried out in the United States that attitudes to school were more positive than attitudes to science and that the difference became greater as the pupils got older.

The problem of declining interest in school science is international and many reasons have been put forward to explain it, including the transition between primary and post-primary schooling, the content-driven nature of the science curriculum, the perceived difficulty of school science, and ineffective science teaching, as well as home-related and social-related factors.

Murphy and Beggs (2003) carried out an extensive survey of primary children's attitudes to science and found that most of the older pupils (10-11 years) had

significantly *less* positive attitudes than younger ones (8-9 years) towards science enjoyment, even though the older pupils were more confident about their ability to do science. The effect of age on pupils' attitudes was far more significant than that of gender. Girls were, however, more positive about their enjoyment of science and were a lot more enthusiastic about how their science lessons impacted upon their environmental awareness and how they kept healthy. There were also a few significant differences in the topics liked by girls and boys – generally girls favoured topics in the life sciences and boys preferred physical science topics. In an attempt to improve children's experience of science in primary school, Murphy et al. (2004) reported that increasing the amount of practical, investigative work in science had a marked, positive effect on their enjoyment of science. They demonstrated a highly significant reduction in the effects of age and gender on children's attitudes to school science. Several studies have considered children's interest in and enjoyment of science before and after interventions which focus on investigative, practical elements of science. Mant et al. (2007) looked at the effect of increasing conceptual challenge in primary science lessons through use of discussion, experiments and investigations and encouraging children to think for themselves. Mant et al. (2007) then conducted 16 focus group interviews in the intervention schools. In every interview, children talked about how the lessons were better. In every interview children said this was because there were more experiments and investigations and in 11 interviews children said it was because they spent less time writing. Mant et al. (2007) reported a positive effect on children's learning through use of practical work and that children themselves had a clear sense of 'doing' helping 'learning'.

Preparation for national science tests in primary school could impact negatively on children's learning in science. Ponchaud (2001) reported that anxiety about performance in national tests sometimes leads to excessive routine test preparation in the final years of primary school. Children have reported the boring and repetitive nature of such preparation (Murphy and Beggs, 2003) and commented negatively on aspects of curriculum content which they found difficult, such as:

*"The flower - remembering parts, like ovule and ovary - I kept getting these terms mixed up" (11 year old girl)*

*"Forces - pushing, colliding, hard to understand where the force is acting from" (10 year old boy)*

*"Evaporation - I was confused by all the long words, like evaporation, condensation" (11 year old girl)*

Murphy et al. (2001) showed that even initial teacher training students, including those who experienced compulsory school science from the ages of 11-16 and some with post-16 science qualifications, could not correctly answer questions in some primary science topics in tests which had been written for 11 year olds. Science is frequently being taught as facts or as a 'body of knowledge' in the final two years of primary school. Teachers feel the need to prepare children for the tests by ensuring that they can recall the required content knowledge. Attention to constructivist theories of learning science and to scientific enquiry has all but diminished by this stage.

By the time children reach KS3, a further decline in positive attitude to science is evident in many children. The Northern Ireland Curriculum Cohort Study (carried out by Harland et al. for NFER, 2002) cited science as one of the subjects with the most fall-off in enjoyment during KS3. Donnelly (2001) tracked 84 individual pupils from primary to post-primary schools to determine whether their attitudes to science changed. Her evidence showed a decline from KS2 to KS3 (see Fig. 2.1).

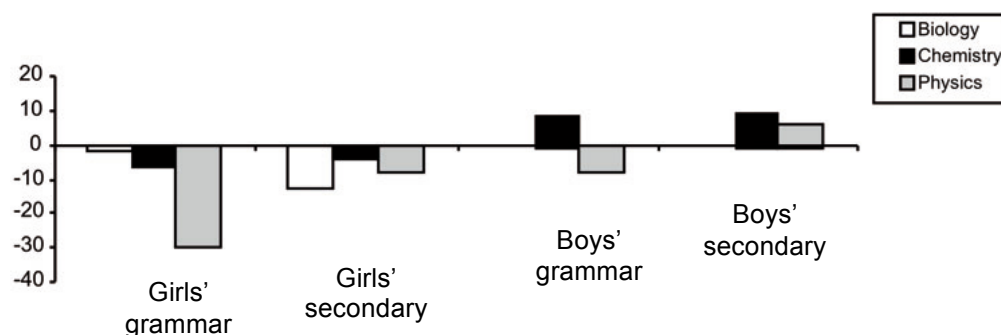
**Figure 2.1: Change in enjoyment of science from primary 7 to year 8**



Jarman et al.'s (1997) study, however, showed that whilst there was a decline in interest in science, there was a very high percentage of pupils who were either very interested or quite interested in science at the end of KS3; 98% described themselves as finding science either very interesting (31%) or quite interesting (67%). The number describing science as 'not interesting' was small, although it increased as the pupils progressed through KS4. Two types of questionnaire were administered in this study: a topic questionnaire and a questionnaire sourced from the (then) most recent APU survey. Both indicated at KS3 'interest' mean scores comfortably above the median. Again a decrease in interest scores was found as pupils progressed through KS4.

Gender and school type were shown to have a significant impact on attitudes to the separate sciences. Changes were most marked for physics topics. Fewer children liked physics topics in grammar schools than they did in primary - this was especially true of girls (Fig. 2). In secondary schools, more boys liked physics topics more than when they were in primary. There was a decline in girls' liking and an increase in boys' liking for chemistry topics in both secondary and grammar schools. The attitudes to biology changed least, except there was a decline in liking of biology from girls going to secondary schools.

**Figure 2.2: Overall percentage change in enjoyment of biology, chemistry and physics recorded by individual pupils as they progressed from primary to secondary**



This data supported earlier findings from Jarman (1997), in which some secondary teachers reported that their first-year pupils were less enthusiastic in class, and proportionately more of these responses came from science teachers in school catering for more able children. However, her study did not compare these children's attitudes at Key Stages 2 and 3. Jarman suggested that these are the pupils, presumably, who had made the most progress in primary science and for whom the risk of repetition was greatest.

Finally in this section, we cite more children's research. Brennan and Schofield (2006) investigated changes in children's preference for science between year 7 and year 8 (first two years of secondary school). Their sample comprised approximately 60 children and they reported an overall decline in positive attitudes to science between years 7 and 8, but not as much as national statistics might suggest.

The findings regarding attitudes to science in our report showed that there was a significant reduction in positive perception of science between children towards the end of final year primary and those at the end of first year in secondary school.

## 2.8 Summary

The literature presented in this chapter has summarised studies relating to the impact of assessment on teaching and learning, children's well-being, fitness for purpose, and the relationship between assessment and what is valued most in education. It also considered issues surrounding the validity and reliability of assessment methods and new initiatives that are being implemented in UK schools to provide evidence of learning (including assessment for learning [AfL] and assessing pupils' progress [APP]). Finally it summarised some of the key studies into children's attitudes to primary school science and the impact of assessment on how they view learning about science. Most of the evidence outlined in the literature comes from teachers, head teachers, science teacher educators, government inspectors and researchers. The work in this report adds to the evidence by focusing on children and parents as major stakeholders in addressing issues relating to science assessment at Key Stage 2.

### 3. Methodology

#### 3.1 Overview and rationale

This research explored the key issues for children and parents regarding assessment of science in primary schools and their ideas for improving assessment. A literature review was performed to identify major issues and developments relating to primary science assessment. The research accessed views and experiences of parents and children regarding science assessment at Key Stage 2 (year 6) and used methodologies designed specifically for each group. The aims of the proposed project were to: consult with parents and pupils to provide a clear, evidence-based analysis of their attitudes to testing and assessment of science at Key Stage 2 (year 6); evaluate these attitudes in terms of fitness for purpose of the tests and their impact on children and families; and recommend changes, where appropriate, to science assessment in England and Wales, based on findings from this study.

The key research questions were:

1. What are the key issues for (a) pupils and (b) parents regarding assessment of science at Key Stage 2?
2. What improvements in policy and practice might enhance the experience of science assessment at Key Stage 2 for pupils, teachers and parents?

The methodology involved three strands which, when taken together, provided a range of data collection and analyses, both quantitative and qualitative, which was used to address the research questions.

**Strand A: A literature review** of studies relating to assessment of science at Key Stage 2 provided a broad framework in which the project findings were discussed.

**Strand B: Surveys** of children and their parents were undertaken. The children's survey (Appendix 1) comprised an online questionnaire designed by the research team, which included children's research advisory groups (CRAGs) from England and Wales (see chapter 6 of this report for full details). Data from the survey included: sample characteristics, children's attitudes to and experience of school science and its assessment, and their ideas for improving assessment of science in primary school. The CRAG groups were involved in the interpretation of data from the online survey. The parents' questionnaire was paper-based (Appendix 2) and provided data on sample characteristics, parents' views on science and its assessment in primary school, and their ideas for its improvement.

**Strand C: A cross-sector seminar** took place in which initial research findings were discussed with stakeholders from across primary science education. Representatives from England and Wales attended. Delegates participated in discussion workshops in which they considered the children's ideas for improving KS2 science assessment from their various perspectives.



### 3.2 Literature review

The literature review was undertaken in order to provide a background and context for the work. A review of recent studies into assessment of science at KS2 provided a fuller picture of the issues to be investigated. Key research into children's attitudes to learning science highlighted primary children's responses to various aspects of school science learning which may have a bearing on their attitudes to assessment.

### 3.3 Samples and surveys

#### Children's survey and data analysis

The sample comprised responses from 997 children to an online survey which sought their comments and ideas relating to science and its assessment at KS2 (year 6). Children from year 6 (primary) who were currently undergoing KS2 science assessment and from year 7 (secondary), who reflected on the experience and its impact from the previous year, were targeted. A total of 32 children from four children's research advisory groups (CRAGs) co-designed the survey instrument with the project research team and, after its completion, the CRAG groups came together to interpret the findings (see chapter 5 for a full description of this process). The breakdown of the sample can be seen in Table 3.1 below.

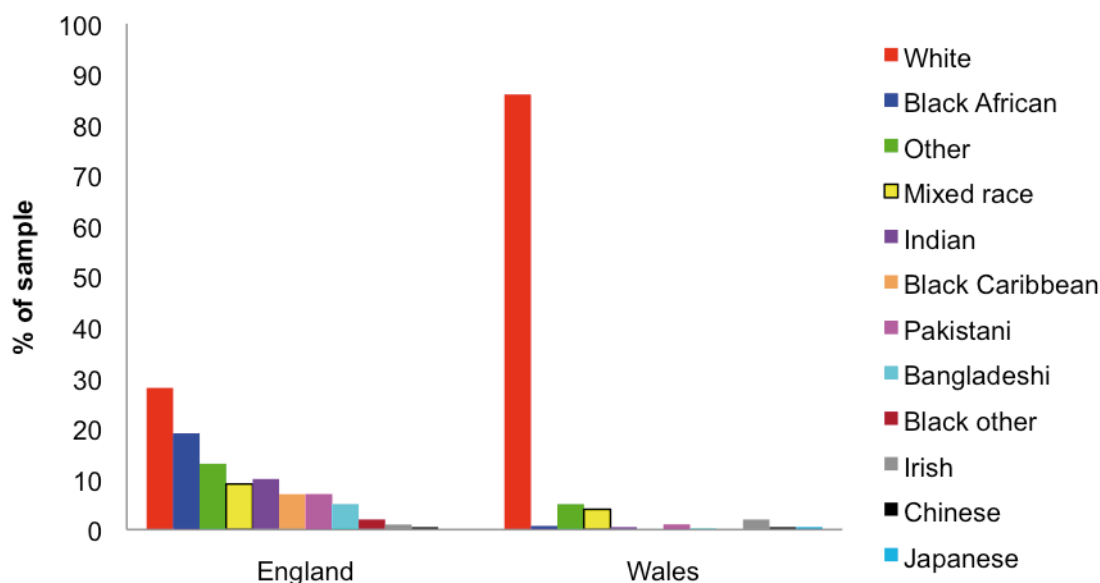
**Table 3.1: Sample characteristics of the children who completed the online survey (n=997)**

	Characteristic	Total sample (%)
<b>Country</b>	England	57%
	Wales	43%
<b>Gender</b>	Male	45%
	Female	55%
<b>School</b>	Primary	49%
	Secondary	51%

#### *Ethnic diversity*

There was a considerable difference between the English and Welsh samples in terms of the ethnic diversity. In Wales, 86% children recorded White as their ethnicity whereas in England, only 26% said they were White. The second largest group in English schools was Black African (see Figure 3.1).

**Figure 3.1: Percentage of children of different ethnicities in the English and Welsh samples (n=997)**



The wider diversity of ethnic groups in the English schools may have some impact on the findings. To investigate this further, t-tests were conducted to compare responses from children who indicated themselves as White with those who recorded other ethnicities (for the English and Welsh samples, separately). The data in Table 3.2 presents the t-test results from attitudinal items. It is important to note that there were significant differences for only *two attitudinal items*: enjoyment of science and views on abolition of science SATs.

**Table 3.2: T-test results for attitude items for responses English and Welsh children of different ethnicities**

Questionnaire item	Ethnicity	Percentage of responses	n	Significance of difference
<b>England</b>				
<b>Do science assessments in (primary) school help you enjoy science?</b>	White	yes=37%, not sure=37%, no=26%	149	p<0.05
	Other ethnicities	yes=56%, not sure=25%, no=19%	388	
<b>The Government has recently decided that there will be no more SATs in science. Do you think this is a good idea?</b>	White	yes=17%, not sure=22%, no=61%	149	p<0.05
	Other ethnicities	yes=27%, not sure=17%, no=56%	384	

### *Socioeconomic status*

All of the schools in England and Wales were categorised as either high-deprivation or low-deprivation schools based on the proportion of children receiving free school meals. This measure was used because it was the most readily available within the short timescale of the project (six months). The percentages of children receiving free school meals were broken them down into quintiles (0-4.8%, 4.9-8.5%, 8.6-13.8%, 13.9-24.1% and 24.2%+). Schools were classified as high-deprivation if more than 24.2% of the children were entitled to

free school meals, and low-deprivation if fewer than 24.2% of the children were entitled to free school meals. Of the nine schools in England, two were categorised as high-deprivation (151 respondents attended these schools) and seven were categorised as low-deprivation (379 respondents attended these schools). Of the seven schools in Wales, one was categorised as high-deprivation (31 respondents attended this school) and six were categorised as low-deprivation (395 respondents attended these schools). There was very little difference in the responses from children in schools designated as high- or low-deprivation. However, there was a small but significant difference observed in the responses from children in high-deprivation and low-deprivation schools in England to three items: enjoyment of science, usefulness of science assessment and whether or not science SATs should be abolished. More children in high-deprivation schools said they enjoyed science, found it useful and did not agree that science SATs should have been abolished (see Table 3.3).

**Table 3.3: Summary of differences between responses from children in high-deprivation and low-deprivation schools in England and Wales**

Questionnaire item	School deprivation	Percentage of responses	n	Significance of difference
<b>England</b>				
<b>Do you enjoy science lessons in school?</b>	Low	Yes= 41%, Not sure=36%, No=23%	379	p<0.05
	High	Yes=50%, Not sure=32%, No=18%	151	
<b>How useful do you think science assessments are for children?</b>	Low	Useful=76%, Not useful=24%	378	p<0.01
	High	Useful=87%, Not useful=13%	153	
<b>Abolition of SATs</b>	Low	Yes=27%, Not sure=21%, No=52%	375	p<0.01
	High	Yes=20%, Not sure=12%, No=68%	152	

These three items are similar to the items which drew significantly different responses from the ethnicity data above. Children in high-deprivation schools were more positive about enjoyment of science and usefulness of assessment and children of other ethnicities were more positive about how science assessment helped them to enjoy science. Significantly more children from low-deprivation schools and significantly more children from other ethnicities agreed that science SATs should be abolished.

There was a significant difference ( $p<0.05$ ) between the mean responses of children in high- and low-deprivation schools in Wales to the item 'how good do you think you are at science?' Approximately one third (36%) from high-deprivation schools said they were 'very good' at science, compared with only 16% those in low-deprivation schools.

**Table 3.4: Summary of differences between responses from children in high-deprivation and low-deprivation schools in England and Wales**

Questionnaire item	School deprivation	Percentage of responses	n	Significance of difference
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Wales						
<b>How good do you think you are at science?</b>	Low	Very good=16%,	OK=78%,	Not good=7%	377	p<0.01
	High	Very good=36%,	OK=65%,	Not good=0%		

### Children's year groups

The sample comprised children from year 6 (primary), who were currently undergoing KS2 science assessment, and those from year 7 (secondary), who reflected on the experience and its impact from the previous year. There was little difference in the overall responses of children in year 6 compared with children in year 7 (see table 3.5). However, there were significant differences in the mean responses between year 6 and year 7 children for four attitudinal items: 'Do you enjoy science lessons in school?', 'How good do you think you are at science?', 'Do (did) your science assessments in (primary) school make you want to learn more about science?', 'How useful do you think science assessments (in primary school) are for children?' (see Table 3.5). Children in year 6 were more positive about all four of these attitudinal items than children in year 7.

**Table 3.5: Summary of differences between responses from children in year 6 and year 7**

Questionnaire item	Year group	Percentage of responses	n	Significance of difference
<b>Do you enjoy science lessons in school?</b>	Year 6	Yes, a lot=25%; Yes, a little=67%; No= 8%	466	p<0.05
	Year 7	Yes, a lot=26%; Yes, a little=58%; no= 16%	478	
<b>How good do you think you are at science?</b>	Year 6	Very good=26%; OK=70%; Not good=4%	466	p<0.05
	Year 7	Very good=22%; OK=71%; Not good=7%	475	
<b>Do (did) your science assessments in (primary) school make you want to learn more about science?</b>	Year 6	Yes=45%; Not sure=28%; No=27%	472	p<0.05
	Year 7	Yes=40%; Not sure=28%; No=32%	475	
<b>How useful do you think science assessments (in primary school) are for children?</b>	Year 6	Very useful=39%; Useful=39%; A little useful=17%; Not useful at all=5%	320	p<0.001
	Year 7	Very useful=30%; Useful=36%; A little useful=23%; Not useful at all=9%	207	

### The online survey

The first part of the survey instrument (see Appendix 1) comprised questions designed to collect data relating to factors which may have some influence on children's attitudes towards science and its assessment, such as gender, ethnicity and socio-economic status. The main part of the instrument was designed to collect data relating to experience of and attitudes towards school science and its assessment. In the final section, children were invited to write their ideas as to how they might assess science if they were primary school teachers.

The questionnaire comprised a range of closed (mostly single select from yes/not sure/no and other 3-and 4-point scales, and multiple select from longer lists) and open questions. Some open questions provided a range of responses from the children's research advisory groups (CRAGs), which participants were invited to consider in the formation of their own responses (please see Appendix 1).

In most schools, the children were supervised by one teacher whilst taking the survey in an ICT suite. However, all children worked at their own computer to complete the questionnaire.

The online survey instrument was created using software supplied by Questback©. The CRAGs were involved in all stages of the questionnaire design (see chapter 4 for details). Closed question data from the surveys was collected for statistical analysis using the Statistical Package for the Social Sciences (SPSS). Non-parametric and parametric tests were performed, including analysis of frequencies, cross tabs, t-tests and analysis of variance.

Open question data was collected in Excel format for qualitative analysis. Open responses were categorised independently by members of the research team (including CRAGs - see chapter 4). The categories which emerged from this analysis were used to inform the stakeholder seminar discussions.

### **Piloting the questionnaire**

The CRAGs tested the online questionnaire before final piloting. The survey was piloted in two Northern Ireland primary schools. Members of the research team asked children to complete the survey and then to comment on different aspects of the design. A total of 40 children took part in the pilot studies which were designed to test the instrument before its general release. The time taken for completion ranged from 15 to 20 minutes, which was within the target range. Children liked the novelty of completing an online survey. They appreciated the videos at the start, which outlined why they were being asked to take part in the survey and gave guidance for its completion. Representative comments from the children in the pilot study were:

*"I liked that there wasn't much writing and you could put your own comments"*

*"You could give your own opinion without someone looking over you"*

*"It wasn't boring, it was colourful. I enjoyed it"*

*"It was a chance to say what you really like about science"*

*"Your name is not on the answers and you get to say what you think"*

*"I understood all the words, they weren't big long ones"*

*"It was good to see other people's opinions"*

*"I think you should give more options from some of the questions"*

*"I think there should be less reading, especially in the last bit"*

*"I think you should ask more kids about the answers"*

The children offered ideas for improving the instrument. In particular, some pages took a while to load because they were cartoon pictures. The children agreed that we should remove these so that other children could complete the questionnaire in a shorter time. The children also suggested that we add a reminder about anonymity and that their answers cannot be traced back to them. All of this was emphasised at the start and end of the final version of the questionnaire.

### Parents' survey and data analysis

Parents of all children who completed the online survey were invited to complete a paper-based questionnaire. The total number of parents who completed the postal questionnaires was 245 (1000 were targeted), representing almost a 25% return. This was higher than the characteristic 10-20% return for postal questionnaires. However, the return rate does raise the possibility of bias. Given that only 26% of surveyed children in England recorded their ethnicity as white, there was a low return rate from parents of children in families where English is an additional language. Some of the responses from parents did evidence literacy levels in written English which may be expected from those for whom English is not the first language. The parental views, therefore, may not reflect accurately the views of non-first language English speakers.

The sample of parents comprised mostly mothers (76%). There were similar proportions of primary and secondary parents. Approximately two-thirds of the sample was from parents of children in English schools. We were interested to see whether parent-teachers held different views from non-teaching parents, but only 3% of the sample were parent-teachers (see Table 3.6).

**Table 3.6: Sample characteristics of the parents who completed the paper based survey**

Characteristic		% of total sample (n=245)
<b>Gender</b>	<b>Male</b>	24
	<b>Female</b>	76
<b>School</b>	<b>Primary</b>	59
	<b>Secondary</b>	41
<b>Country</b>	<b>England</b>	67
	<b>Wales</b>	31
<b>Are you a teacher?</b>	<b>Yes</b>	3
	<b>No</b>	97

Parents were provided with summary findings from the children's questionnaire as well as their own survey instrument, so that they had the opportunity to comment on children's data. The first part of the parent survey (see Appendix 2) collected data relating to gender, number of children attending primary and secondary schools, and whether they were parent-teachers. The main part was designed to collect data relating to parents' views of children's experience of and attitudes towards school science and its assessment. In the final sections,

parents were invited to comment on the criteria they used for choice of children's secondary schools and to provide their ideas about how children should be assessed in science at Key Stage 2.

The short questionnaire comprised a range of closed and open questions. Closed question data from the surveys was collected for statistical analysis using SPSS. Non-parametric and parametric tests were performed, including analysis of frequencies, cross tabs, t-tests and analysis of variance.

Open question data was collected in Excel format for qualitative analysis. Open responses were categorised independently by members of the research team. The categories that emerged from this analysis were used to inform the stakeholder seminar discussions.

### **3.4 Stakeholder seminar**

The aim of the seminar was to bring together a wide range of expertise in primary science education to consider the key issues arising from the children's and parents' surveys. The focus was on identifying ways forward to enhance assessment of science in primary schools. Participants included policy makers, advisers, teachers, teacher educators, teacher unions, researchers, CPD providers and other representatives of the English and Welsh science education communities. The stakeholders were given two tasks to complete. For the first task the stakeholders were given quotes from the children's data on children's ideas about how science should be assessed. The stakeholders were asked to put these ideas into groups and to name the groups. Secondly, the stakeholders were given a summary of the children's ideas on how to assess science. They were asked to rank these in terms of desirability and feasibility for implementation into primary practice. The seminar provided data from a range of stakeholders across primary science education who had not been otherwise consulted as part of the project, and provided an opportunity for discussion of English-Welsh comparisons.

### **3.5 Ethical considerations**

All aspects of work in this project fully complied with the BERA ethical guidelines for educational research (BERA, 2004) and were approved by the Queen's University School of Education Ethics Committee. Ethical considerations included voluntary informed consent from all participants who were also given information on their right to withdraw. All involved were also reassured about anonymity and privacy. All aspects of the work with children complied with international children's rights standards on children's participation (see chapter 6 for details).

### **3.6 Timescale of data collection**

Table 3.7 summarises the timescale for data collection, including the pilot phase. It is important to note that the launch time of the online English questionnaire was different from the launch time for the Welsh questionnaire. This was because it was announced that the science SATs in England were being abolished. Therefore, we delayed the launch of the questionnaire to ensure that responses

were not based on immediate reactions and so that we could amend some of the items and add additional items about children's views on the abolition of science SATs.

**Table 3.7: Summary of timescale for piloting and conducting of questionnaires**

<b>Project aspect</b>	<b>Sample group</b>	<b>Date(s)</b>
<b>CRAG meeting 1</b>	Wales, year 6	Friday 6 <sup>th</sup> February 2009
<b>(capacity building – see chapter 4)</b>	Wales, year 7	Friday 6 <sup>th</sup> February 2009
	England, year 6	Thursday 12 <sup>th</sup> February 2009
	England, year 7	Thursday 12 <sup>th</sup> February 2009
<b>CRAG meeting 2</b>	Wales, year 6	Wednesday 18 <sup>th</sup> March 2009
<b>(questionnaire design – see chapter 4)</b>	Wales, year 7	Wednesday 18 <sup>th</sup> March 2009
	England, year 6	Monday 18 <sup>th</sup> May
	England, year 7	Friday 3 <sup>rd</sup> April 2009
<b>Pilot 1 - children's questionnaire</b>	Northern Ireland, primary 7 (year 6)	Friday 1 <sup>st</sup> May
<b>Pilot 2 - children's questionnaire</b>	Northern Ireland, primary 7 (year 6)	Tuesday 5 <sup>th</sup> May
<b>Online questionnaire completion</b>	Wales, year 6	From Monday 11 <sup>th</sup> May to Friday 22 <sup>nd</sup> May 2009
	Wales, year 7	From Monday 11 <sup>th</sup> May to Friday 22 <sup>nd</sup> May 2009
	England, year 6	From Monday 1 <sup>st</sup> June to Friday 12 <sup>th</sup> June 2009
	England, year 7	From Monday 1 <sup>st</sup> June to Friday 12 <sup>th</sup> June 2009
<b>CRAG meeting 3</b>	All groups (Wales, year 6; Wales, year 7; England, year 6; England, year 7)	Thursday 2 <sup>nd</sup> July
<b>Stakeholder seminar</b>	Stakeholders - representatives from policy makers, curriculum developers, teacher unions, teachers and other stakeholders	Friday 3 <sup>rd</sup> July
<b>Parental questionnaire</b>	Parents of year 6 and year 7 children in England and Wales	Posted week beginning 22 <sup>nd</sup> June

### 3.7 Summary

The methodology involved three strands which, when taken together, provided a range of data collection and analyses, both quantitative and qualitative. The strands comprised a literature review, surveys of parents and children, and a



stakeholder seminar day at which other stakeholders considered the findings in relation to their particular perspectives. This range of approaches was employed to build a comprehensive data set which best reflected the experiences and views of pupils and parents regarding science assessment at KS2. The field work was carried out between January and July 2009.

## 4. Methodology for children

### 4.1 Children's rights and research

Article 12 of the United Nations Convention on the Rights of the Child (UNCRC) gives children a right to express their views and to have those views given due weight in all matters affecting them (UN, 1989).

The Committee on the Rights of the Child, which monitors compliance with the CRC, has emphasised that the right should be "anchored in the child's daily life at home...and in his or her community; within the full range of early childhood health, care and education facilities, as well as in...the development of policies and services, including through research and consultations" (UN, 2005, para. 14). The research team sought an approach to the children's element of the research project which would respect this right. As such they drew on aspects of a children's rights-based methodology developed and employed in other projects (see Lundy and McEvoy, 2008, 2009; McEvoy and Lundy, 2007). This involved in particular:

- Children's participation in the research process, specifically through the work of children's research advisory groups (CRAGs)
- The development of children's rights-based research instruments, in this case an online survey.

Recent years have seen a substantial shift in research with children from a traditional approach which views them as objects of research to a recognition of them as subjects of research (Greene and Hill, 2005), due largely to an acknowledgement that children are experts on their own lives (Clark, 2004). As such children are being involved routinely in research which seeks to understand their experiences (Greene and Hogan, 2005) and their perspectives (Lewis and Lindsay, 2000). Moreover, and particularly within the social sciences, this has involved the development and use of a wide range of participatory research methodologies (see for example, Kellett and Ding, 2004; Lewis, Kellett, Robinson, Fraser and Ding, 2006; Fraser, Lewis, Ding, Kellett and Robinson, 2004) designed to engage children actively in the research study. In addition, children are taking increasingly active roles in research processes as co-researchers (Fielding, 2004), as peer-researchers (see Murray, 2006) and in child-led research projects (see, for example, Kellett, Forrest, Dent and Ward, 2004). This includes involving children in the selection of research methodologies and design of research instruments (see Hill, 2006), in data collection and analysis, and in the dissemination of research findings (Kellett, 2005a, 2005b; Coad and Evans, 2008). The methodology employed in the children's element of this project was informed by and aligns with this participatory style of research but in addition overtly 'up-fronted' children's rights.

As noted above this project drew on a methodology which was explicitly designed to first engage children as *co-researchers*, through establishing children's research advisory groups (CRAGs), and second to engage children as *subjects* of research through a children's rights-based research instrument. In doing so the project was informed particularly by a workable but legally sound means of

evaluating the extent to which children's participation is compliant with Article 12 and other relevant provisions of the UNCRC. This analysis (Lundy, 2007) has four key elements:

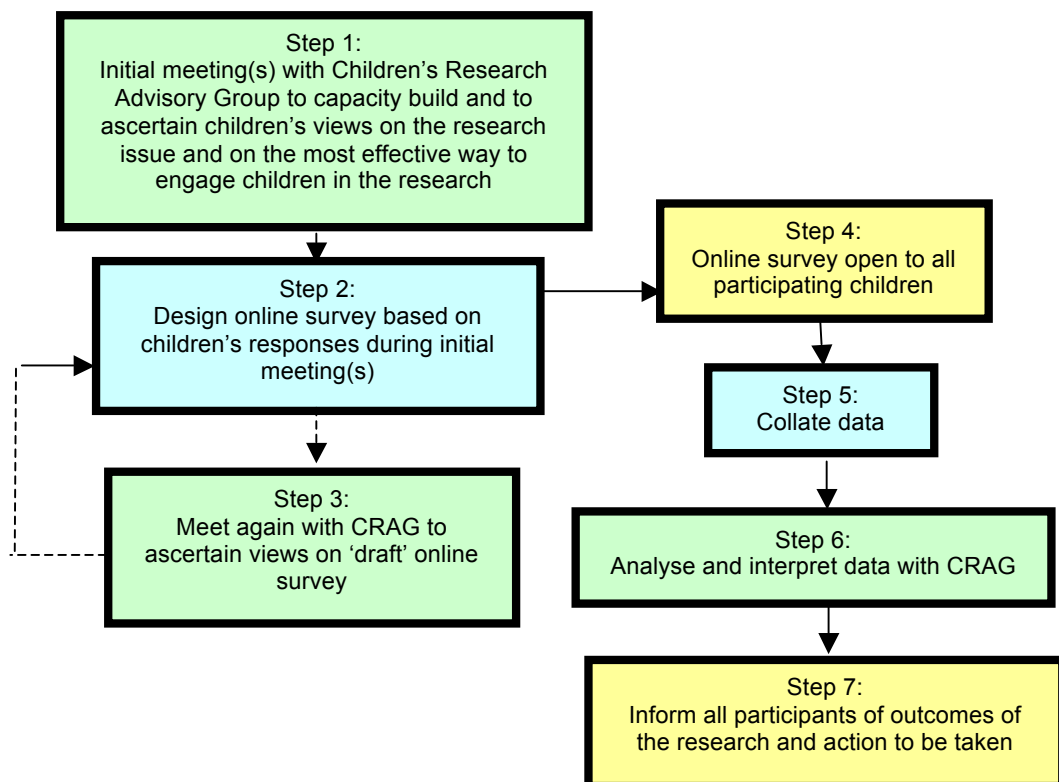
- SPACE: Children must be given the opportunity to express a view.
- VOICE: Children must be facilitated to form and express their views.
- AUDIENCE: The view must be listened to.
- INFLUENCE: The view must be acted upon, as appropriate.

#### 4.2 Children's participation in the research process

Four CRAGs (each with eight children) were established: a primary (year 6) and a post-primary (year 7) CRAG in two English schools, and a primary (year 6) and a post-primary (year 7) CRAG in two Welsh schools. The children involved in the CRAGs were not research subjects. Rather they were an expert group in relation to children's views on the issues. Their remit was to:

- i. advise on the research process and on appropriate ways to engage children in the research (the online survey)
- ii. provide insight on issues related to the research questions
- iii. provide a key stakeholder perspective

In accordance with the methodology noted above, the CRAGs were involved throughout the research, including the development of the online survey and in the analysis and interpretation of its findings. Figure 4.1 outlines the key steps taken in this process, indicating specific CRAG involvement. **Figure 4.1: Involving Children in the Research Process (Lundy and McEvoy, 2007)**



Before providing detail on the work with the CRAGs it is important to note the climate in which CRAG sessions were conducted:

- Good practice in research with children requires honesty regarding the degree of power sharing between the adults and children involved in the project (Lundy and McEvoy, 2009). The CRAGs were aware that the focus of the research had been determined and that the team intended to use an online survey. However they were also assured that their suggestions would be collated and would shape the content and, in particular, the wording and design of the survey.
- A children's rights-based approach also suggests that proactive steps should be taken to create a "safe" space where children are "able to express their views without fear of rebuke or reprisal" (Lundy, 2007, p. 935). As such the children who participated in the CRAGs were assured that their views would be treated as confidential and, since Article 12 is a right and not a duty (Lundy, 2007), that they were able to withdraw at any time from any of the activities or from the process as a whole.
- CRAG sessions were held in the schools. This can be problematic since there is a danger that children perceive the research as school work. As such there is a need to conduct sessions in as 'un-school-like' a manner as possible through for example asking the children to use pseudonyms of their own choosing, holding discussions as informally as possible, offering the children choice in how to discuss and record their views, and consulting the children regularly on the best way to proceed with the meetings (Lundy and McEvoy, 2009).

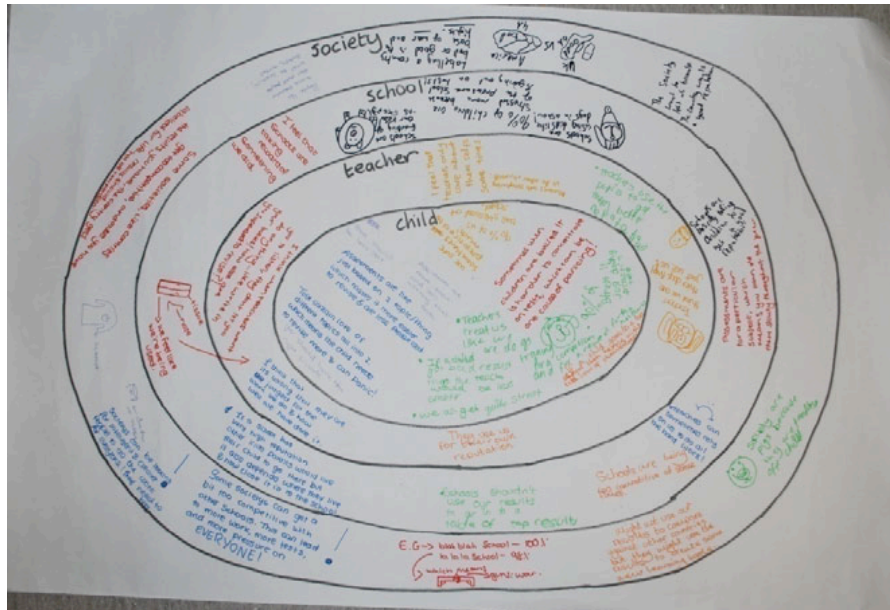
### **4.3 Capacity building with CRAGs**

Article 12 of the CRC requires not only that children are given the opportunity to express a view but also that they must be facilitated in forming and expressing their views (Lundy, 2007). As such the initial meeting with each CRAG involved a range of capacity building activities to assist the children in understanding the key issues surrounding assessment in general and assessment in science in particular.

#### Understanding the point of assessment

The first activity focused on the question 'What's the point of assessment?' The children in the CRAGs were asked to think about the purpose of assessment for children, teachers, schools and society. Newspaper articles and key findings from research were used as prompts where appropriate. The children discussed the issue and recorded their ideas on a series of concentric circles (see Figure 4.2 below).

**Figure 4.2: 'What's the point of assessment?' poster**



### Clarifying terminology

The second capacity building activity sought to assist children in clarifying the terminology surrounding the issues. The children were given a number of cards on which were written different examples of types of assessments and asked to sort them into three groups: assessments, tests and 'both'. The children could also add their own examples and the ensuing discussion allowed both the CRAGs and the research team to clarify terminology both for future sessions and for use in the online survey.

### Understanding the practice and impact of assessment

The final capacity building activity allowed the CRAGs to think through the practice and the impact of assessment. The children were invited to record their views (on large sheets of paper spread around the room) on the following questions: When are children assessed in science? How are children assessed in science? Where are children assessed in science? How often are children assessed in science? What are the effects of science assessment on children? They were also invited to interact with each other's views by showing through drawing or writing if they agreed or disagreed with their peers (see Figure 4.3).

**Figure 4.3: Posters on the practice and impact of assessment**



At the conclusion of the first session the children in the CRAGs were invited to suggest ideas for questions other children should be asked about assessment in science.

#### 4.4 Designing the survey

Having completed the capacity building activities with the CRAGs the adult researchers developed a draft online survey in accordance with the children's rights-based methodology noted above (Lundy and McEvoy, 2008). To this end the survey was designed to ensure that the children who would complete it as *research subjects* would also be assisted in forming and expressing their views in a safe, inclusive and actively created space and be assured they had an 'audience' who would listen to their views (Lundy, 2007).

##### Safe, inclusive, actively created space

Online surveys are particularly well suited for children's rights-based methodologies since they are, *inter alia*, adaptable to a range of children's ages and abilities, universally accessible within schools, can be engaging for the children taking part and provide an anonymous space in which they can share their views (Lundy and McEvoy, 2008). A video clip made by CRAG children was used to introduce the survey and to reassure the children taking part that their views would be anonymous, that the survey was not a 'test', and that they were not to worry about spelling etc.

##### Assisting children in forming and expressing views

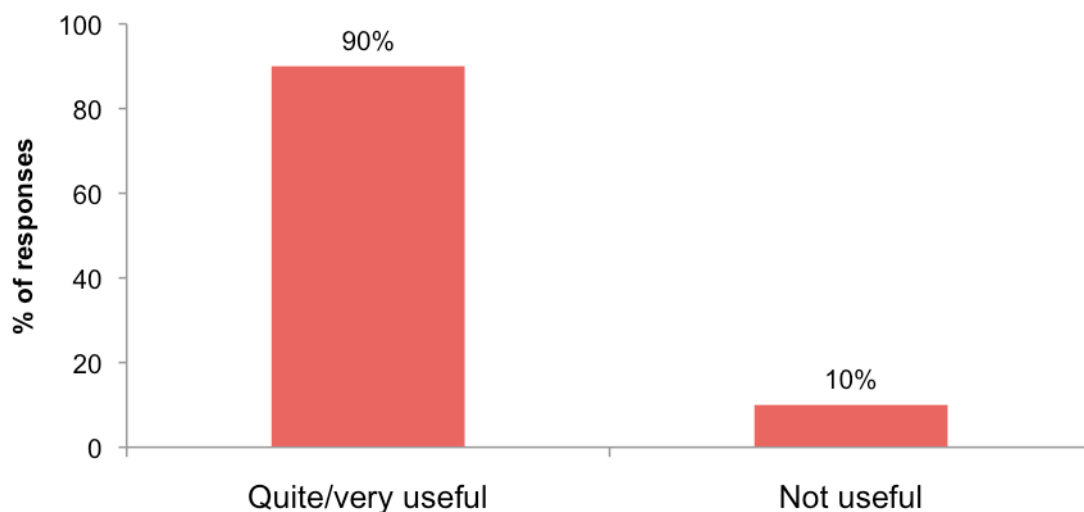
The survey questions not only ascertained children's views about their direct experiences of science and assessment but also provided children with opportunities to think about issues, to which perhaps they had not given much prior thought, before asking them to express their own views. This was achieved by using the views of other children (drawn from the CRAGs) to assist the children in forming and then expressing their own view (Lundy and McEvoy, 2008) (see for example Figure 4.4 below).

**Figure 4.4: A screen shot of a question which used the views of other children**

In accordance with the findings from a previous research project (Lundy and McEvoy, 2008), the children who completed the final survey indicated that they found reading other children's views helpful in supporting them in forming their own view (see Figure 4.5).

**Figure 4.5: Usefulness of reading other children's views**

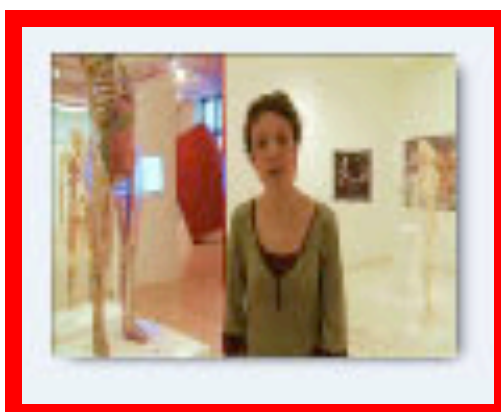
### In this questionnaire you got to read some other children's views on the issues. Did you find this...



#### Audience

In developing the draft survey the research team were cognisant that Article 12 of the CRC also requires that children are afforded an audience for their views: a “designated listener” (Lundy, 2007). As such a video by a representative of the Wellcome Trust was embedded at the start of the survey, which provided an overview of the purpose of the research, and explained how the children’s views would be used (Figure 4.6).

**Figure 4.6: A screen shot of the video embedded in the survey**



Having drafted the survey, members of the research team met with each of the CRAGs for a second time. During this session the CRAG children were asked to work through the draft online survey and to suggest amendments. In particular the CRAGs provided valuable insight into how to reduce the number of questions, reword the questions to make them more easily understood by children their age, and make the survey more appealing and visually engaging. To this end they decided on a name and colour scheme for the survey to be conducted with their



peers and provided illustrations for a number of questions. Finally one CRAG group suggested providing a web link to science games and activities at the end of the survey to facilitate its manageability in schools. Appendix 1 contains a copy of one of the online surveys.

#### **4.5 Analysing and interpreting the findings**

Once the data from the surveys had been collated the adult researchers had a final meeting with all four CRAGs. This provided an opportunity for each CRAG to explore the data from the survey conducted with their own peers and also for all four CRAGs to work together to compare the views of primary and secondary children and the views of children in England and Wales.

The CRAGs were asked first to explore the views of their peers in relation to what would constitute an 'ideal science assessment'. They were provided with cards containing a wide range of qualitative comments from the survey and asked to cluster these into groups as they saw fit. They then 'named' each of these clusters thereby drawing out key themes. The salient themes arising from this activity were that the 'ideal science assessment' should: focus on end of topic rather than end of year tests; involve 'children's choice' acknowledging that the best type of assessment might vary 'from child to child'; and be 'fun and engaging' (associated largely with assessment via investigations, projects and competitions). It was also noted that the children who completed the survey had suggested that assessments should involve both comments and marks. One group explained this with the following statement:

*"Marks tell you how you've done...comments tell you why"*

Each CRAG was then provided with a summary of the main findings from their survey and asked to design a poster outlining the following:

- What surprised you about the findings? Why?
- What didn't surprise you? Why?
- Is there anything extra you would like to find out from the survey results?

The CRAGs' interpretation of the findings provided valuable insight. For example the survey indicated that while most children liked science it ranked behind subjects like PE and maths. The children in the CRAGs were not surprised by this finding and explained it with comments such as:

*"You could like it [science] but like other things more"*

The survey indicated that science was seen as the least difficult subject when compared with English and maths. Again the children were not surprised by this result and suggested that this may be due to pressure, from school and home, to succeed in English and maths. The children also provided some insight into the finding that survey respondents viewed assessment as building confidence. They suggested that this may be due to teacher support. They also provided valuable insight into the findings regarding assessment and 'wanting to learn more'. They interpreted this to mean that the pressure to do well in tests made children want to learn (or know) more to 'do better in the next test' rather than associating it with a straightforward desire to learn more about science. Furthermore they connected

this pressure and desire to do better 'next time' to the reported increased confidence associated with assessment. Finally some of the CRAGs noticed and interpreted some gender differences. They explained that girls were more in favour of tests because:

*"They [girls] like to work harder"*

and:

*"Boys are afraid of not being cool or doing badly"*

In the final interpretation activity children representing each CRAG formed mixed CRAG teams and participated in a quiz to predict comparative findings from the four surveys. The children by and large predicted these findings correctly. Furthermore they connected most differences in findings to the existence of SATs in England and lack of SATs in Wales (including both 'negative' and 'positive' aspects of SATs).

#### **4.6 Summary**

The methodology employed for the children's element of the research drew on a children's rights-based approach to research with children. In this project this involved primarily involving children as *co-researchers* through establishing and working with four children's research advisory groups (CRAGs). Following capacity building sessions on the substantive issues associated with the research questions, the CRAGs worked with the adult researchers in the design and development of the research instrument (an online questionnaire) to be used with other children and in the interpretation of the research findings. The children's rights-based approach was also applied to the design of the online questionnaire which sought to actively engage children as research *subjects*. This research instrument created a safe and inclusive space in which children were assisted in forming and expressing their views and where they were assured their views would be 'listened to'. The research team has worked actively to ensure that children's views have been taken seriously throughout the research process and that the views of the children who participated in the survey have had a significant influence on the report's recommendations. A significant final step in this process relates to the degree of influence the children's views will have: the extent to which their views will be taken into consideration by those in a position to effect change.

## 5. Key issues in Key Stage 2 science assessment

### 5.1 Introduction

The findings in this chapter describe the attitudes of children in year 6 and 7 towards science in and out of school, classroom practice in science lessons, and children's experience and perceptions of KS2 (year 6) assessment in science. It also presents parents' views regarding the impact of science assessment on their children. There is a section at the end of the chapter describing children's and parents' opinions on the recent abolition of KS2 science SATs in England.

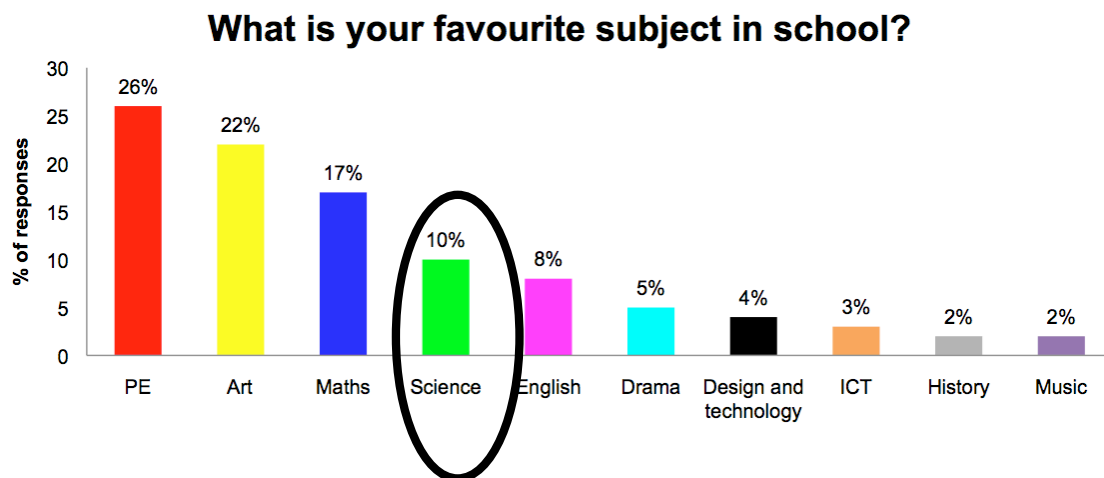
### 5.2 Attitudes to science

We asked children about their favourite subjects in primary school, their enjoyment of science in and out of school, and their perceived ability in science.

#### Favourite subject

Only a small proportion (10%) of children rated science as their favourite subject. This was an open response question. Figure 5.1 shows the percentage of children who named each subject as their favourite. The children's research advisory groups (CRAGs) interpreted this finding by suggesting that lots of children like science; it is just not their favourite subject.

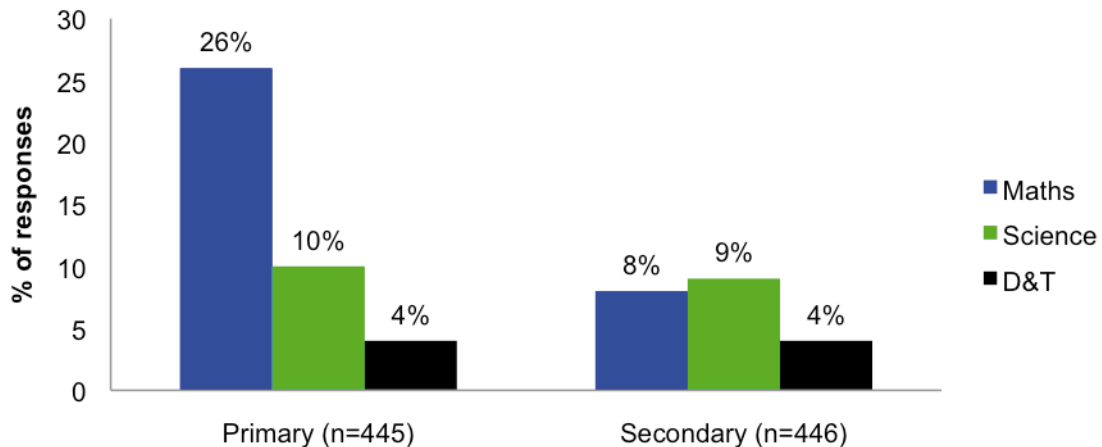
Figure 5.1: The children's top ten favourite subjects (n=891)



We compared children's responses to the STEM (maths, science, technology and design) subjects in England and Wales and in primary and secondary schools. Figure 5.2 shows the total percentage of children who chose maths, science or design and technology as their favourite subject. Mathematics was the favourite STEM subject in primary school (year 6 children) but not in the first year at secondary school (Figure 5.2).

Figure 5.2: Children indicating STEM subjects as their favourite

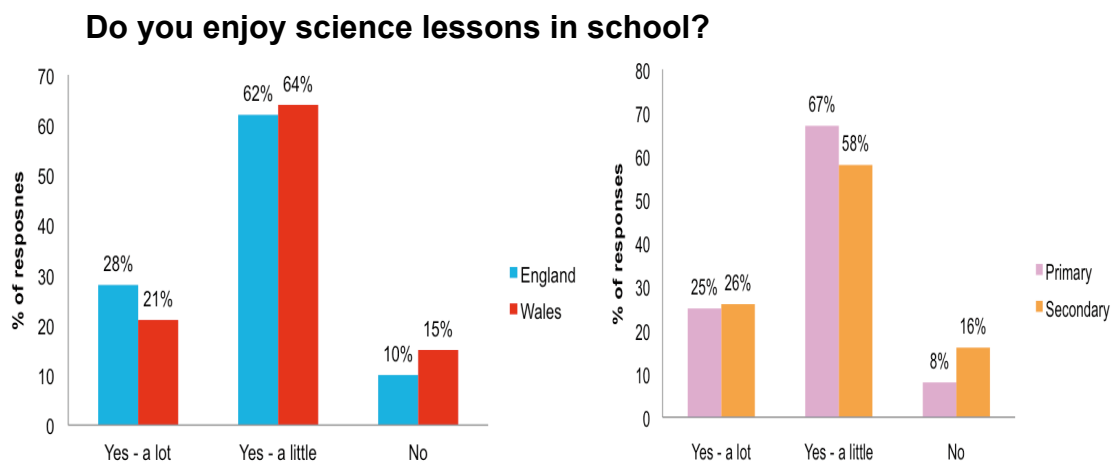
### What is your favourite subject in school?



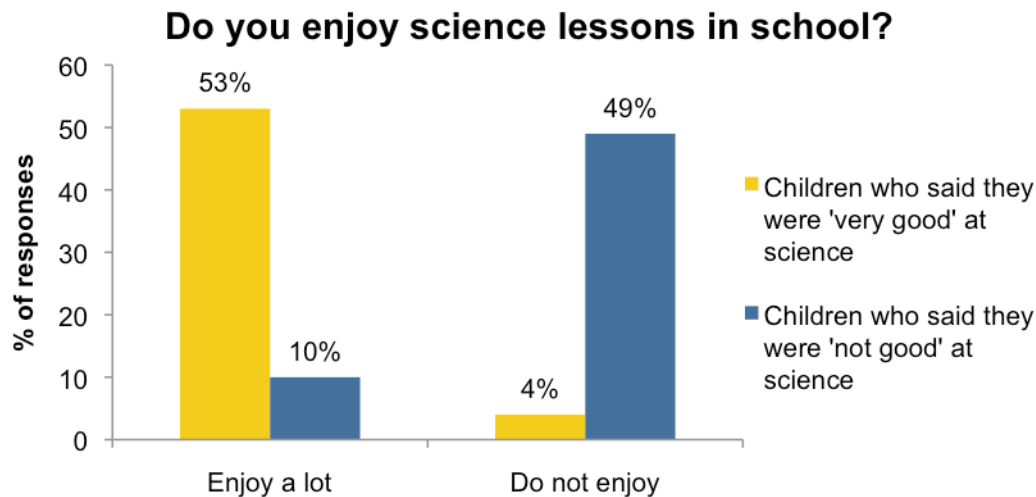
### Enjoyment of science

Most children enjoyed science lessons in school, although the majority enjoyed it 'just a little' (Figure 5.3). We did not record a mean response to this item, since two of the three responses indicated a positive attitude. The CRAG children indicated a preference for 'yes - a little' as opposed to 'not sure'. It is interesting then to compare this with the CRAG interpretation of the data indicating that only a small proportion of children chose science as their favourite subject with their suggestion that most children like science, it is just that they may like other subjects more (see above findings on 'favourite subject').

**Figure 5.3: Children's enjoyment of science lessons in English and Welsh schools, and in primary and secondary school**

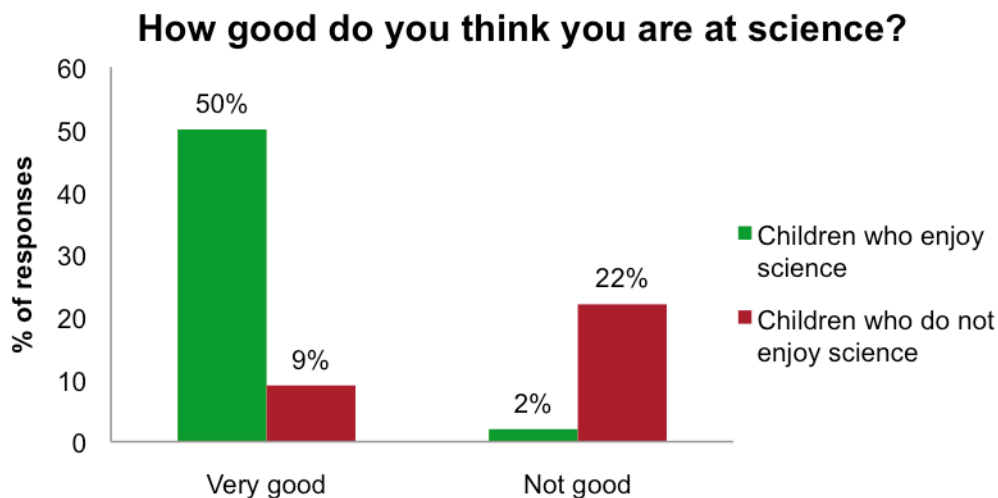


There was some relationship between children's perceived ability and their enjoyment of science. Over half of the children who said they were very good at science also enjoyed it a lot while 4% did not enjoy it, but only 10% of children who said they were not good at science said they enjoyed it a lot, while almost half said they did not enjoy it (Figure 5.4).

**Figure 5.4: Relationship between perceived ability and enjoyment (n=944)**

(The other response choice was 'enjoy a little')

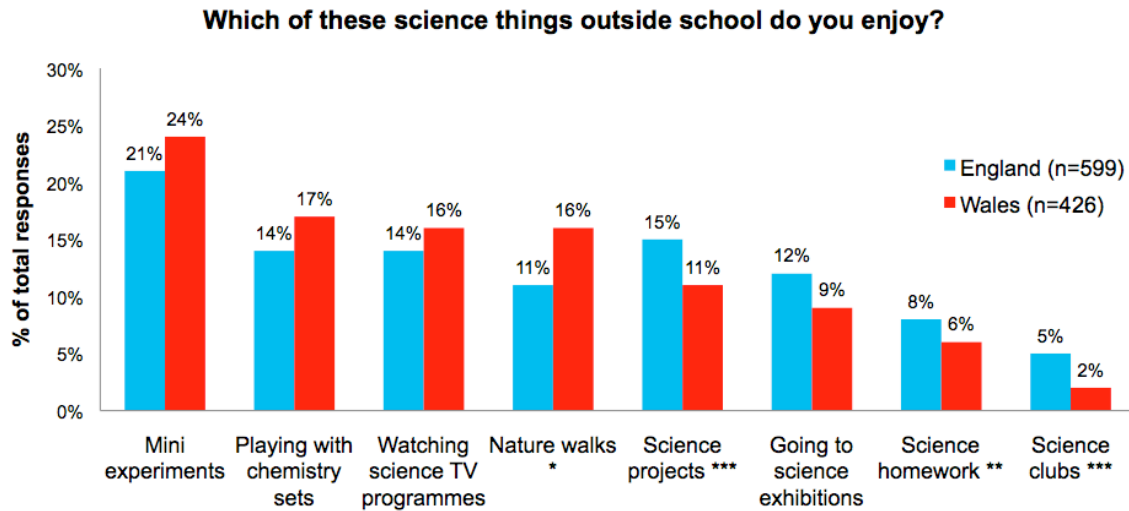
This relationship also holds strong when looked at from the other direction (Figure 5.5). Half of the children who enjoyed science a lot also thought they were very good at it while hardly any thought they were not good, but 9% of children who did not enjoy science thought they were very good at it while 22% thought they were not good.

**Figure 5.5: Relationship between enjoyment of science and perceived ability**

(The other response choice was 'OK')

The most enjoyable science activities outside school were mini experiments, playing with chemistry sets and watching science TV programmes (Figure 5.6).

**Figure 5.6: Enjoyment of science activities outside school**

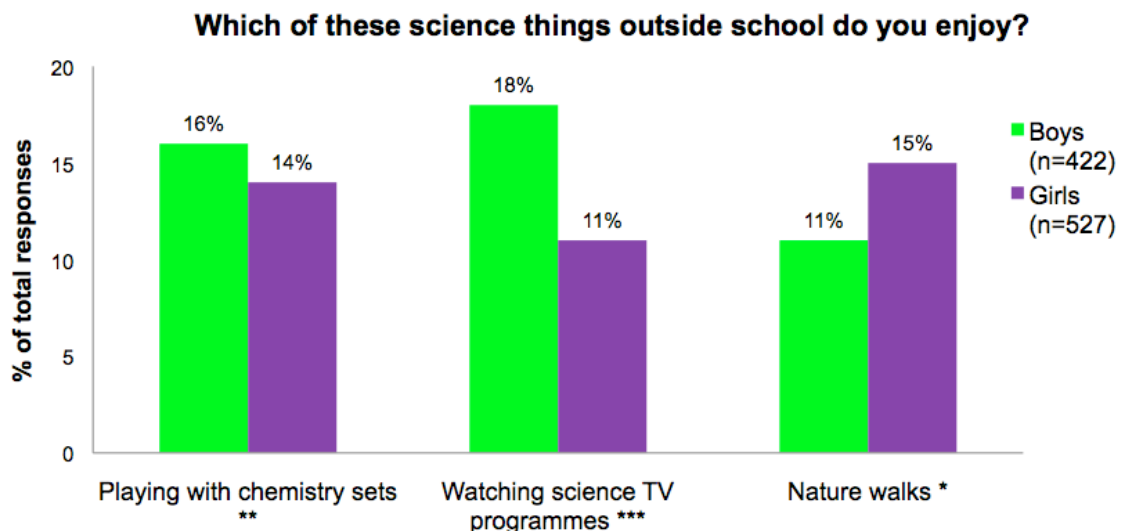


\* significant at  $p < 0.05$ , \*\* significant at  $p < 0.01$ , \*\*\* significant at  $p < 0.001$

Children in Welsh schools were more positive than those in English schools about their enjoyment of mini-experiments, chemistry sets, watching science TV and nature walks. English children were significantly more positive about their enjoyment of science projects, exhibitions, homework and clubs (see Figure 5.6).

Gender differences were apparent for some activities. Significantly more boys enjoyed playing with chemistry sets and watching science TV programmes, whereas significantly more girls picked nature walks (see Figure 5.7).

**Figure 5.7: Boys' and girls' relative enjoyment of out-of-school science activities**



\* significant at  $p < 0.05$ , \*\* significant at  $p < 0.01$ , \*\*\* significant at  $p < 0.001$

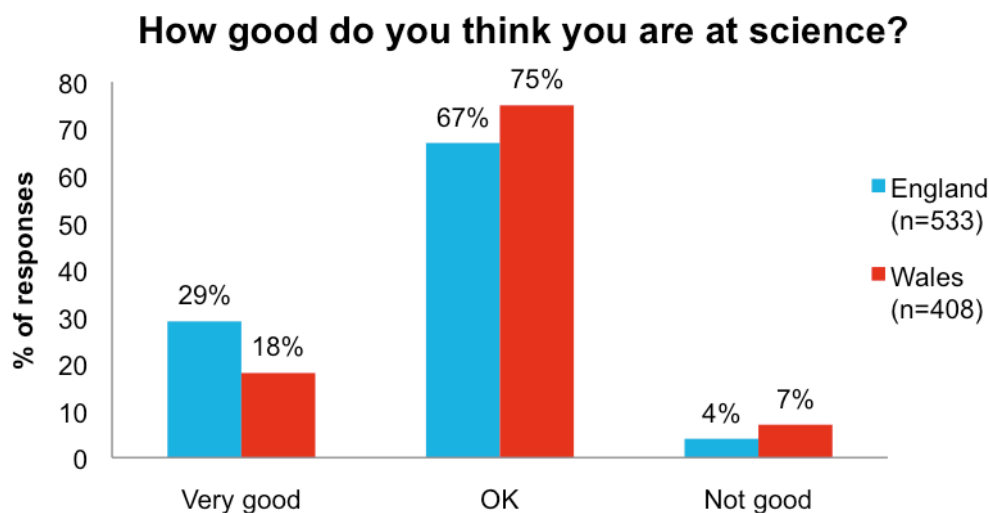
(Other response choices were 'going to science exhibitions', 'science clubs', 'mini experiments', 'science projects', 'science homework' and 'none of them')

### Perceived science ability

Few children responded that they were 'very good' at science; most perceived they were 'OK'. Children from English schools were significantly more positive than Welsh children about their level of ability (see Figure 5.8), nearly 1 in 3

children in English schools (29%) said they were very good at science compared with fewer than 1 in 5 in Welsh schools (18%).

**Figure 5.8: Children's perceived ability science**

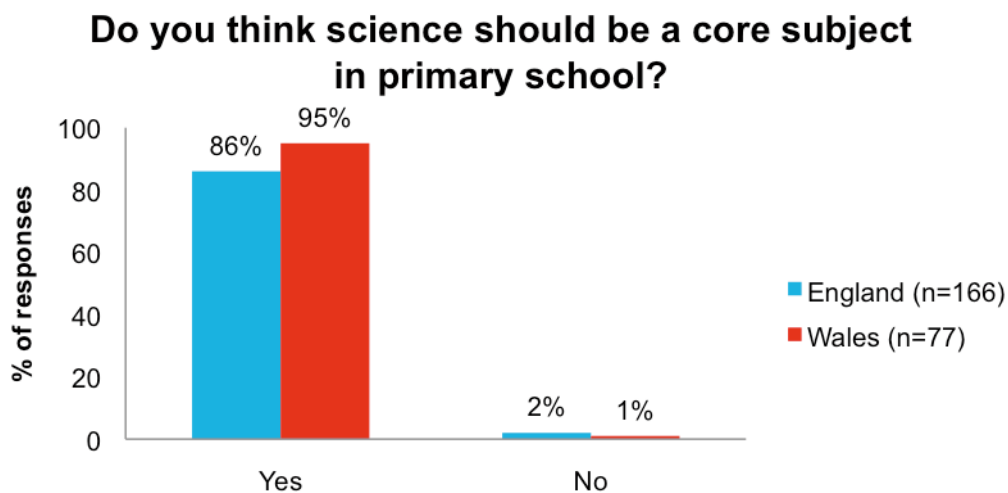


*Difference between England and Wales significant at  $p < 0.001$*

### Parents

Parents were asked if they thought science should be a core subject in primary school (Figure 5.9). Significantly more parents of children in Welsh schools compared with parents of children in English schools said they thought science should be a core subject in primary school ( $p < 0.05$ ).

**Figure 5.9: Parent responses on science as a core subject**



*Difference between England and Wales significant at  $p < 0.001$   
(The other response choice was 'not sure')*

Parents who were teachers were also significantly more positive about science being a core subject in primary school ( $p < 0.001$ ), although the sample of parent-teachers was very small.

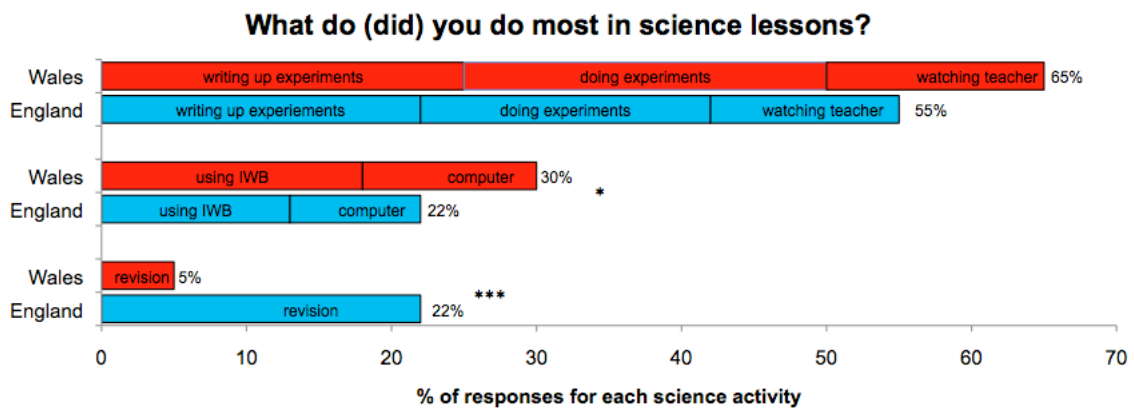
### 5.3 Classroom practice in science

This section of the survey identified children's perceptions in relation to what they did in science inside and outside of the classroom. It also compared their experience of science with English and maths.

#### Science activities

Children reported that they worked mostly at experiments, and spent time on computers and doing revision. Children from English schools responded that they spent significantly more time on revision than those from Welsh schools, and children from Welsh schools said they spent significantly more time working with computers in science lessons (see Figure 5.10).

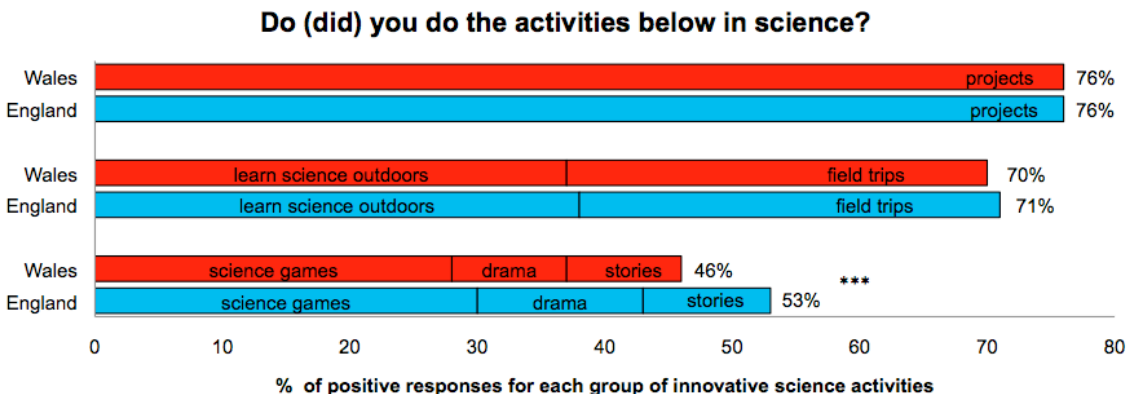
**Figure 5.10: Time spent on standard science activities (n=985) in English and Welsh schools**



Differences between England and Wales: \* significant at  $p < 0.05$ , \*\*\* significant at  $p < 0.001$  (IWB = interactive whiteboard)

The reported higher proportion of time spent on revision in English schools related to the SATs science tests which these children completed approximately a month prior to taking part in the online survey. Children in Welsh schools did not complete external SATs tests. The data for other science activities showed that the majority of children in England and Wales said they carried out projects, fieldtrips and outdoor science activities (see Figure 5.11).

**Figure 5.11: Positive responses (n=929) for innovative science activities**



\*\*\* Difference between England and Wales significant at  $p < 0.001$



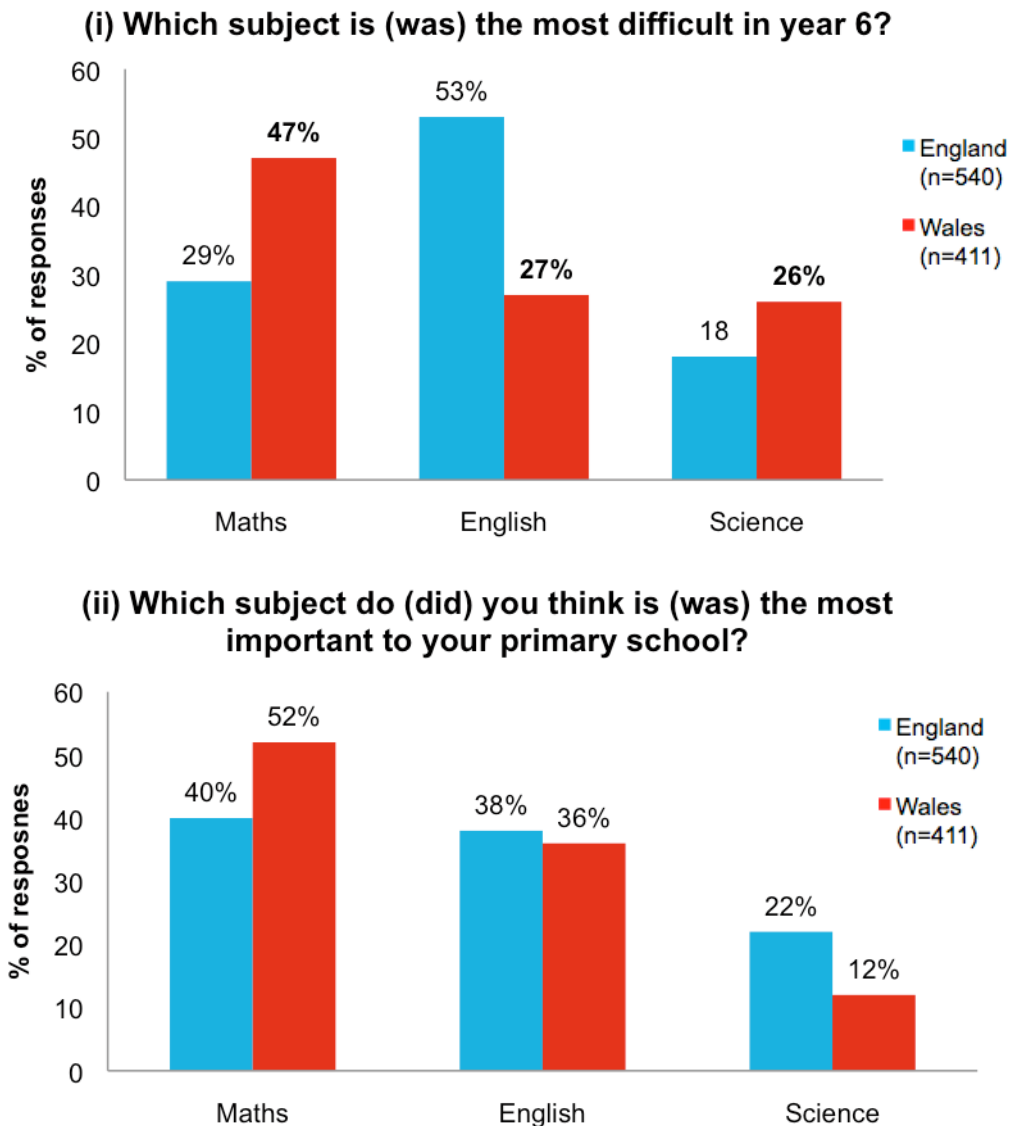
Around half of the respondents also said they experienced science games, drama and stories in the lessons (Figure 5.11).

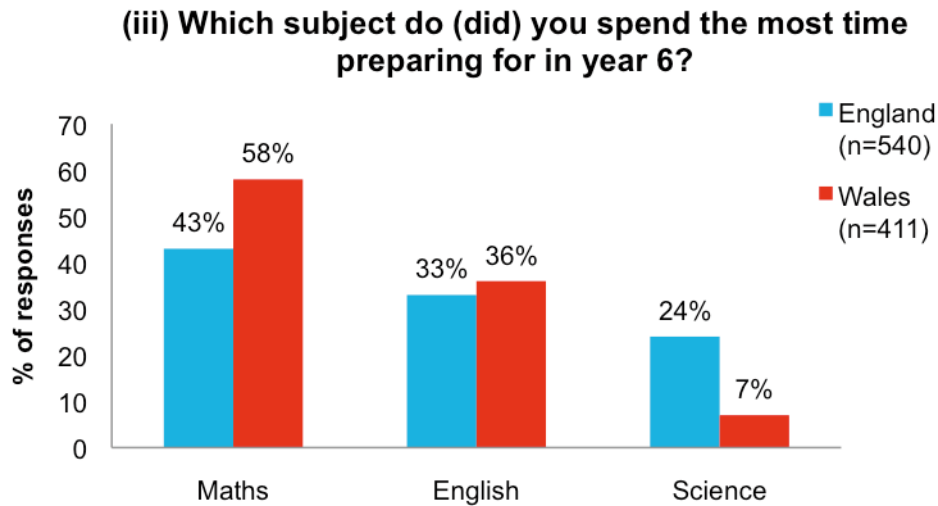
### Comparing maths, English and science

#### *(i) Differences between England and Wales*

Children perceived science to be the least difficult of the three core subjects, and the least important for the school. They spent less time preparing for science tests/assessments than for English and maths (see Figure 5.12).

**Figure 5.12: Comparisons of maths, English and science**





There were differences in the data from England and Wales. The most striking of these were:

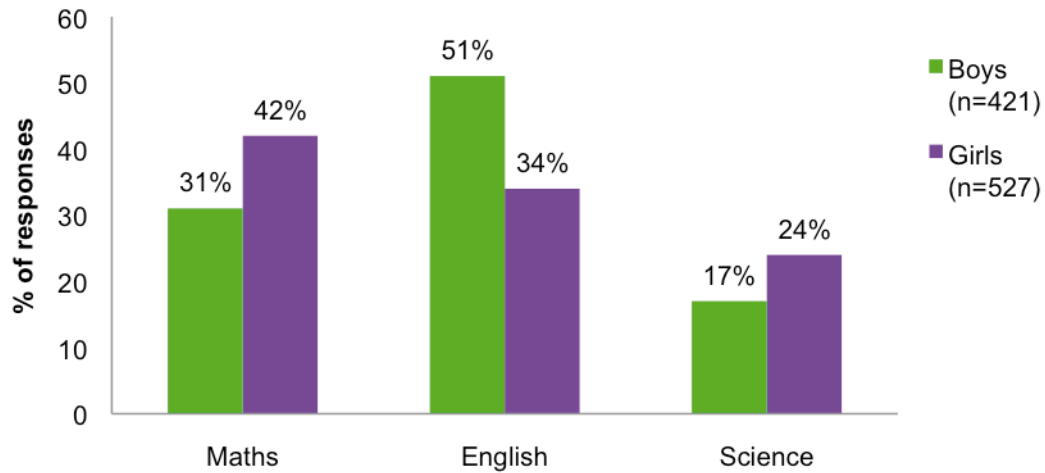
- More than half of the children in English schools perceived English to be the most difficult of the three core subjects, compared with only a third of children in Welsh schools [Figure 5.12(i)]. This could be related to the greater ethnic mix of children in English schools, compared with Welsh schools (see Figure 3.1), although data were not collected on whether children spoke English as their first or another language. Only a third of children in English schools perceived that they spent more time preparing for English than maths or science.
- Nearly half of the children in Welsh schools perceived maths as the most difficult of the three core subjects [Figure 5.12(i)].
- More children in Welsh than English schools found science the most difficult of the three core subjects [Figure 5.12(i)]. There was a big difference in the amount of time children spent preparing for science. Almost a quarter of children (24%) from English schools but only 7% from Welsh schools said they spent more time on science than English or maths [Figure 5.12(iii)].

*(ii) Differences between girls and boys*

There were gender differences in the relative difficulty of English, maths and science (see Figure 5.13). More boys than girls responded that English was their most difficult subject, whereas more girls than boys indicated that science or maths was the most difficult.

**Figure 5.13: Relative difficulty of maths, English and science for boys and girls**

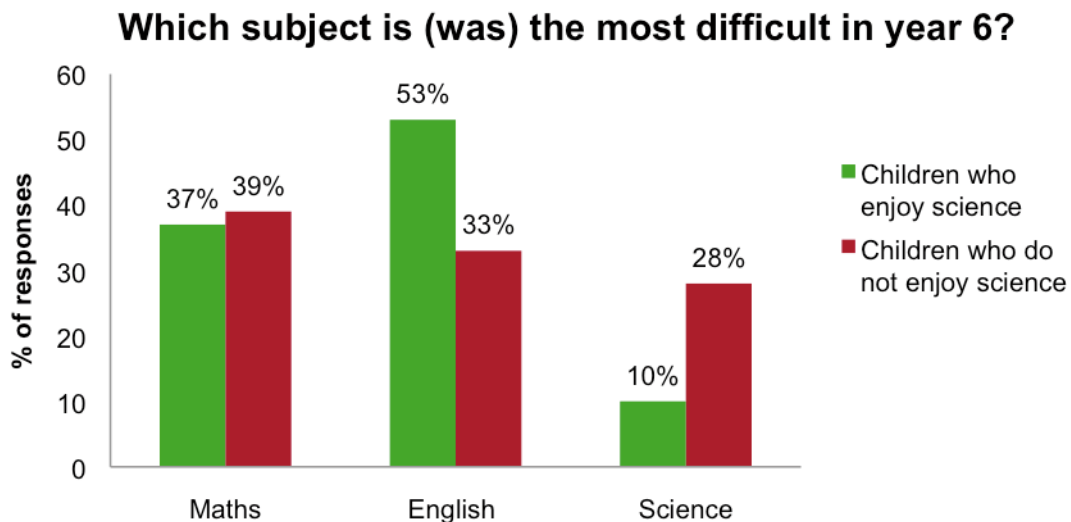
### Which subject is (was) the most difficult in year 6?



#### (iii) Differences between children who enjoy science a lot and those who don't enjoy it

More than half (53%) of the children who enjoy science perceived that English was the most difficult core subject and only 1 in 10 selected science. On the other hand, over a quarter of those who did not enjoy science perceived it as the most difficult (Figure 5.14).

**Figure 5.14: Relative difficulty of English, maths and science for children who enjoy science a lot and those who don't enjoy it**



#### 5.4 Assessment in science

Children indicated how they were primarily assessed in KS2 (year 6) science. We separated the more 'traditional' forms of assessment from the recently introduced assessment for learning (AfL) approaches. Children also considered how useful they felt different forms of assessment were for knowing how well they were doing and for how they could improve. They were also asked to comment on the impact

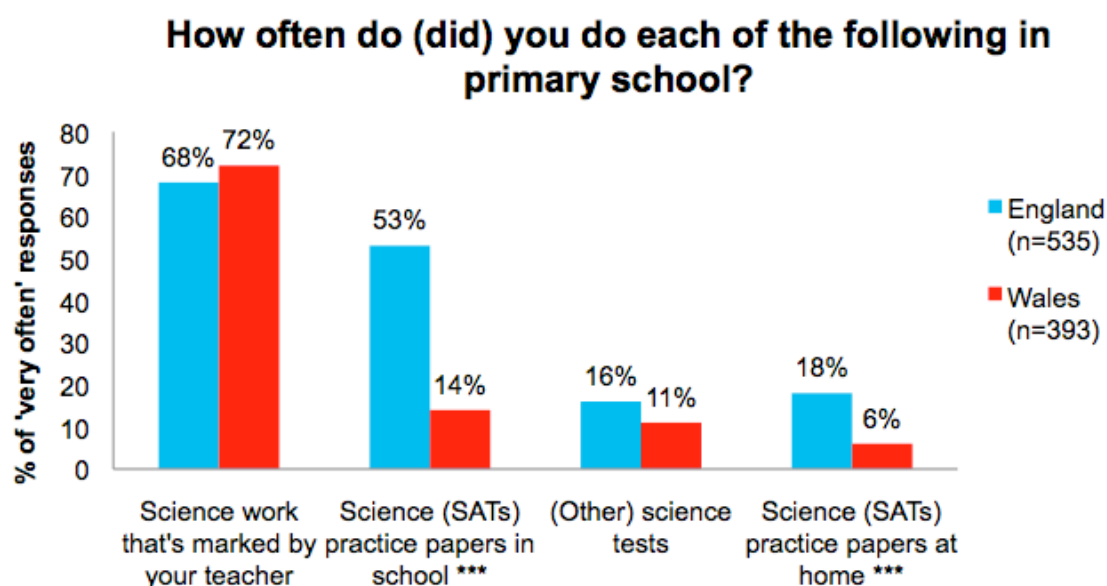
of KS2 (year 6) science assessment on themselves, their friendships and their home lives. Children from English schools were also asked for their views relating to the recent abolition of science SATs.

### Classroom practice in science assessment

#### *'Traditional' science assessment*

The proportion of science work marked by the teachers as opposed to the completion of SATs practice papers at home and in school differed between English and Welsh schools (Figure 5.15). The most striking difference was evident for SATs practice papers in school ( $p < 0.001$ ) and SATs practice papers at home ( $p < 0.001$ ). This result is consistent with the different assessment practice in science primary schools in England and Wales: English schools still prepared children for SATs science tests (which have been abolished for 2010 and beyond), whilst Welsh children were not assessed by SATs in science (abolished in Wales in 2004). It can be seen, however, that some Welsh schools still use SATs practice papers as part of their science work (Figure 5.15).

Figure 5.15: Frequency of the use of 'traditional' assessment in English and Welsh schools

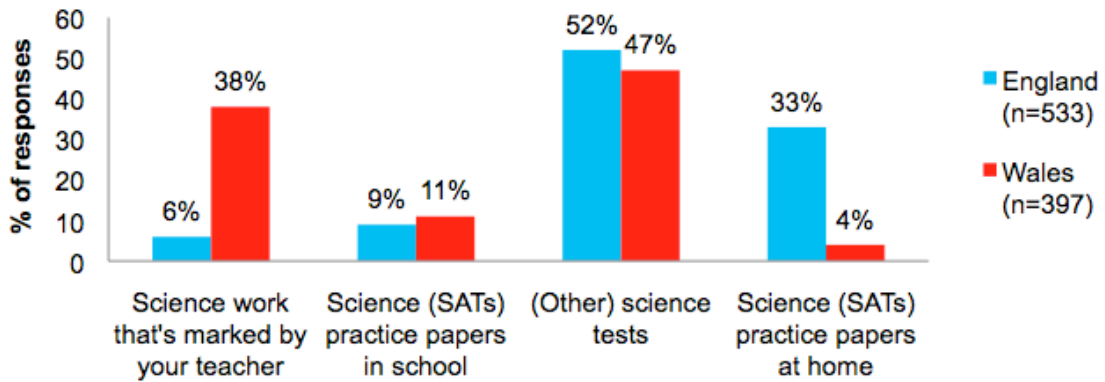


\*\*\* Difference between England and Wales significant at  $p < 0.001$   
(Other response choices were 'sometimes' and 'never')

Children's perceptions of the usefulness of these assessment methods showed that science tests (other than SATs) were perceived by children in England and Wales as the best for letting them know how well they were doing in science, although considerably more children from Welsh schools than English schools considered science work marked by the teacher to be the most useful and one third of children in English schools selected SATs practice papers at home as the most useful (Figure 5.16).

Figure 5.16: Best assessment type for finding out how well children have done in science

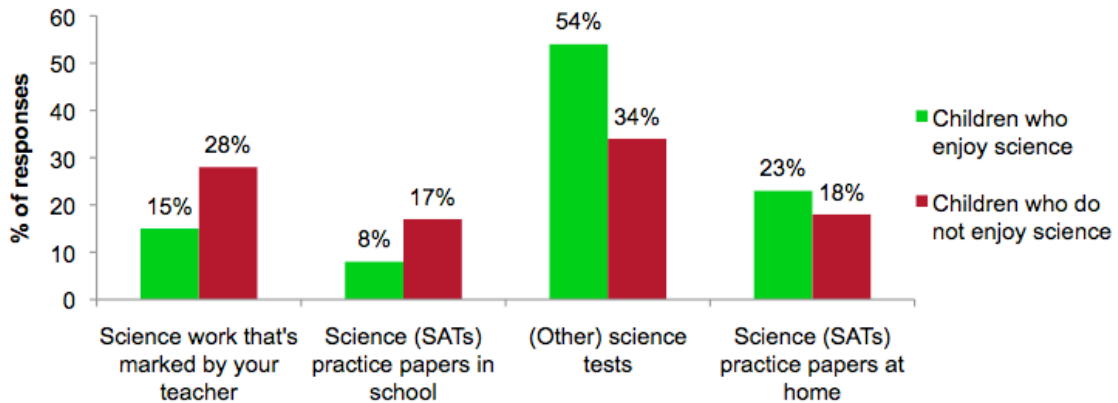
### Which one do you think is (was) the best for finding out how well you've done (you were doing)?



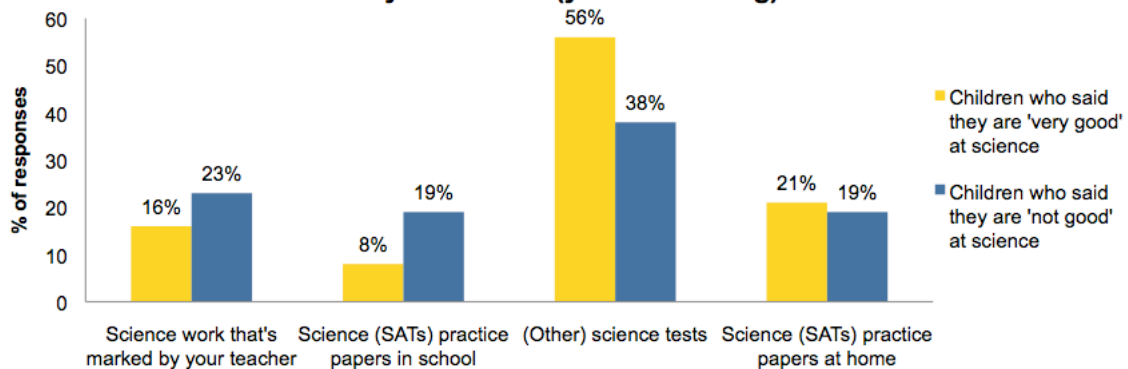
The finding that children felt science tests other than SATs were the best way of finding out how well they were doing was true of both children who did and did not enjoy science [Figure 5.17(i)] and for children who perceived they were good or not good at science [Figure 5.17(ii)].

Figure 5.17: Relationship between the best assessment type for finding out how well children are doing and enjoyment of science/perceived ability

#### (i) Which one do you think is (was) the most useful for finding out how well you've done (you were doing)?



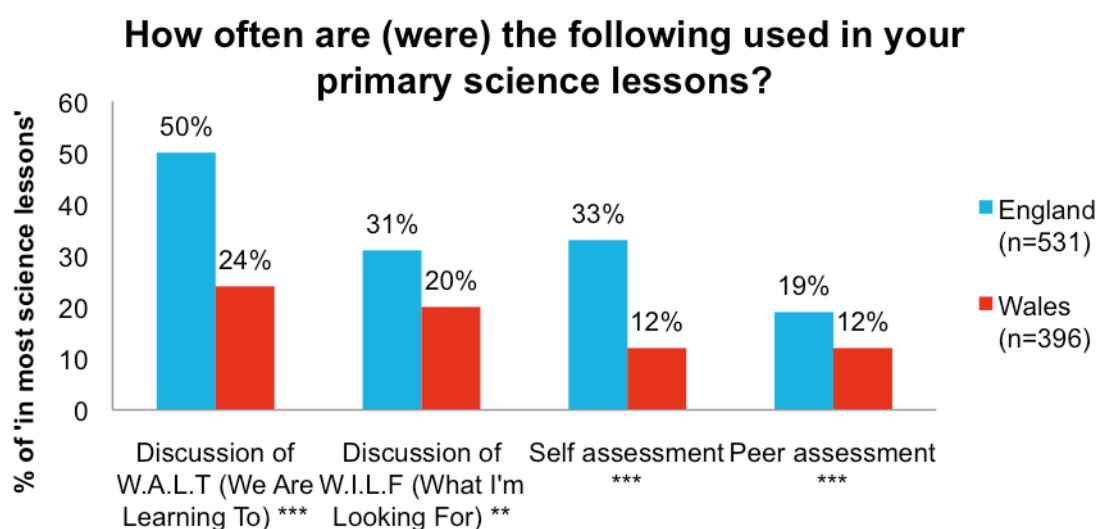
#### (ii) Which one do you think is (was) the best for finding out how well you've done (you were doing)?



### Assessment for learning (AfL) approaches

In recent years, teachers in the UK have been encouraged to use assessment for learning (AfL) approaches in school, following from the research findings reported by Black and Wiliam (1998). These approaches comprise the sharing and negotiation of learning intentions and success criteria, self and peer evaluation, comment-only marking and deriving effective feedback on children's learning. The data in Figure 5.18 suggest that the discussion of learning intentions and success criteria using 'We Are Learning To' (W.A.L.T) and What I'm Looking For (W.I.L.F) boards were used more often than self and peer assessment in both English and Welsh schools.

Figure 5.18: Frequency of the use of AfL approaches



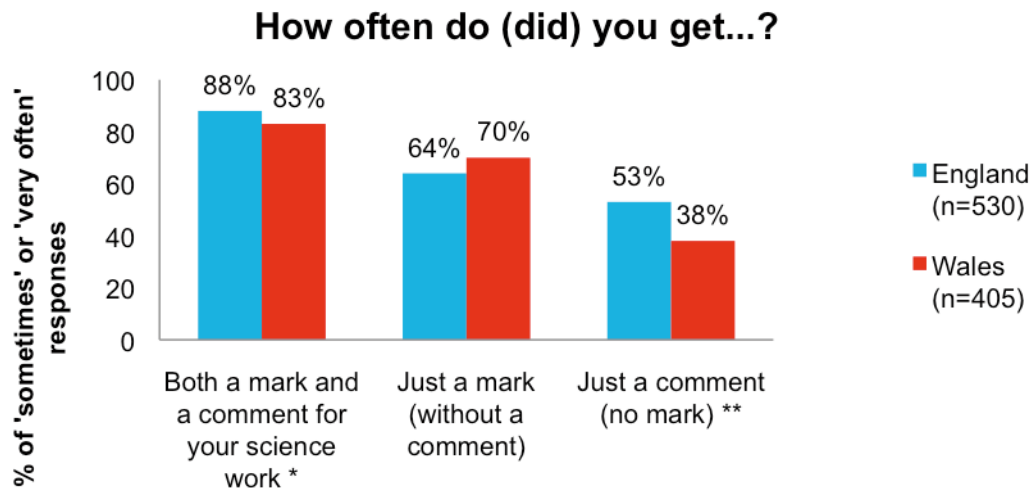
Difference between England and Wales: \*\* significant at  $p < 0.01$ , \*\*\* significant at  $p < 0.001$  (Other response choices were 'in some science lessons' and 'never in science lessons')

Significantly more children in English schools than in Welsh schools reported that they used each of the four AfL approaches in most of their science lessons.

### Marks and comments

The literature promoting the use of AfL approaches in schools indicates that comment-only marking is the most effective for learners' improvement (Black and Wiliam, 1998). However, we had much anecdotal evidence from teachers and children that the preferred form of feedback was a combination of a mark and comments. Children in this survey responded that marks plus comments was the most frequent feedback they received from teachers (Figure 5.19).

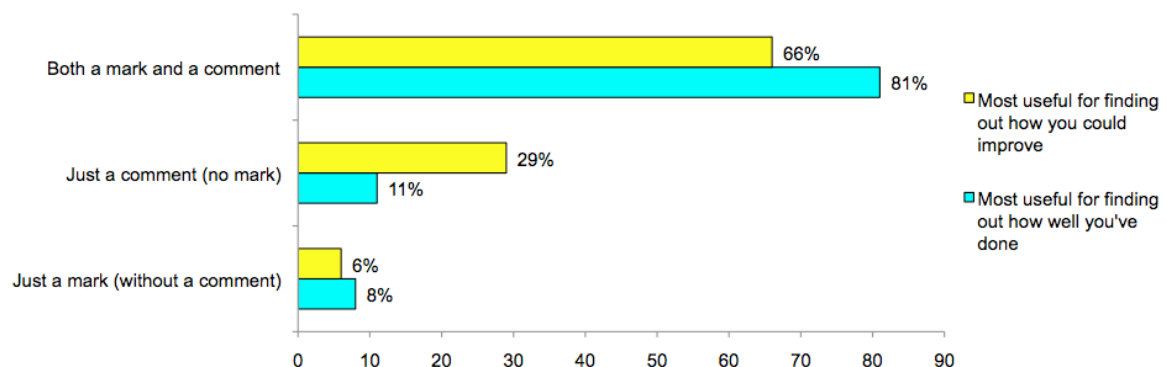
Figure 5.19: Frequency of use of different types of feedback in science



Difference between England and Wales: \* significant at  $p < 0.05$ , \*\* significant at  $p < 0.01$   
(Other response choices were 'hardly ever' and 'never')

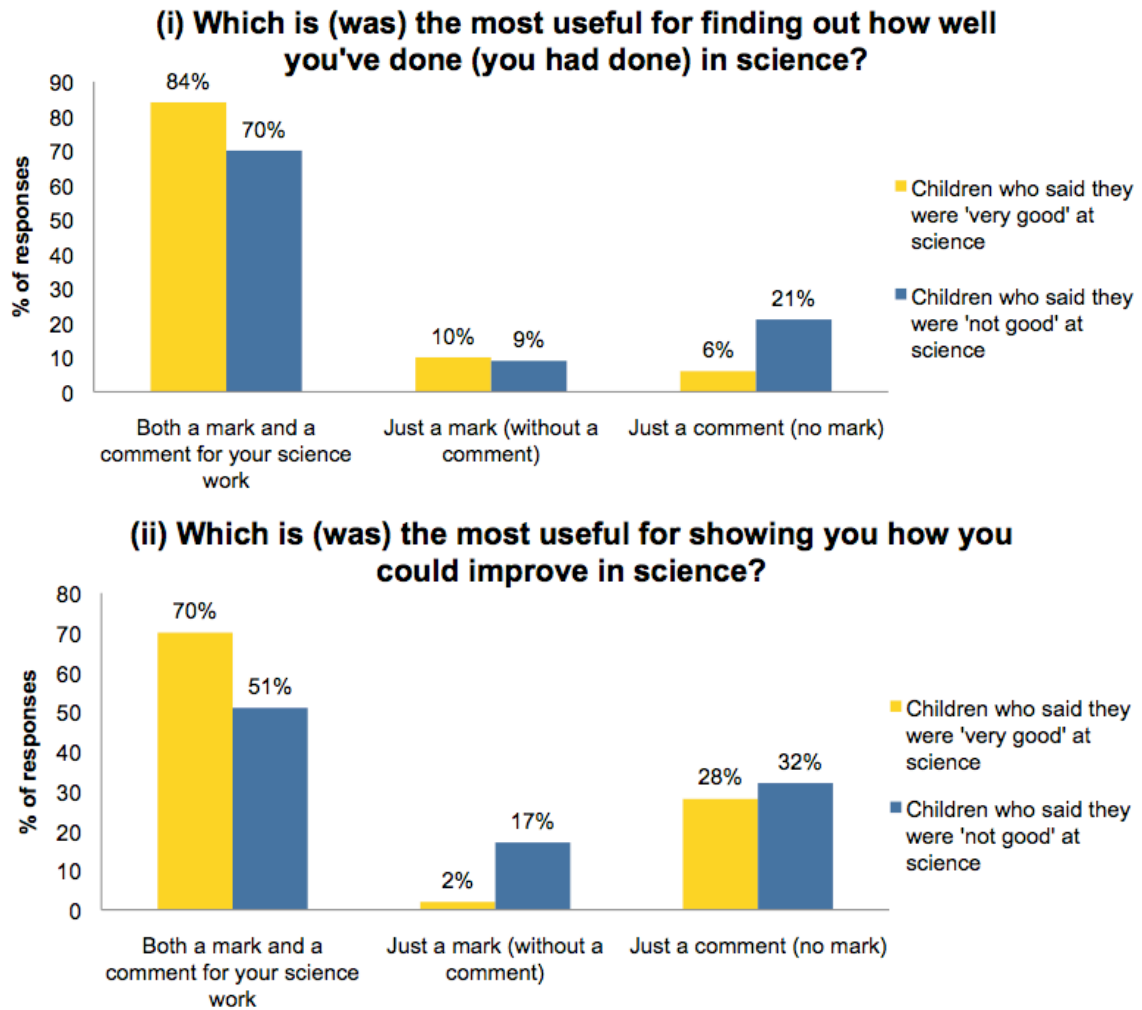
Children also valued mark plus comment feedback much more highly than either marks alone or comments alone, both for indicating how well they had done and for how they could improve (see Figure 5.20).

**Figure 5.20: Usefulness of each type of feedback for finding out how well children have done and how they could improve**



When children who rated their ability as 'very good' or 'not good' were compared, both groups considered comment-only feedback more useful for guiding them on how to improve than for finding out how well they had done (Figure 5.21). In their review of the effectiveness of feedback, Kluger and DeNesi (1996) concluded that feedback only leads to learning when it includes guidance on how to improve, something which the children in the current study appeared to value.

**Figure 5.21: Feedback preference of children with different perceived abilities in science**

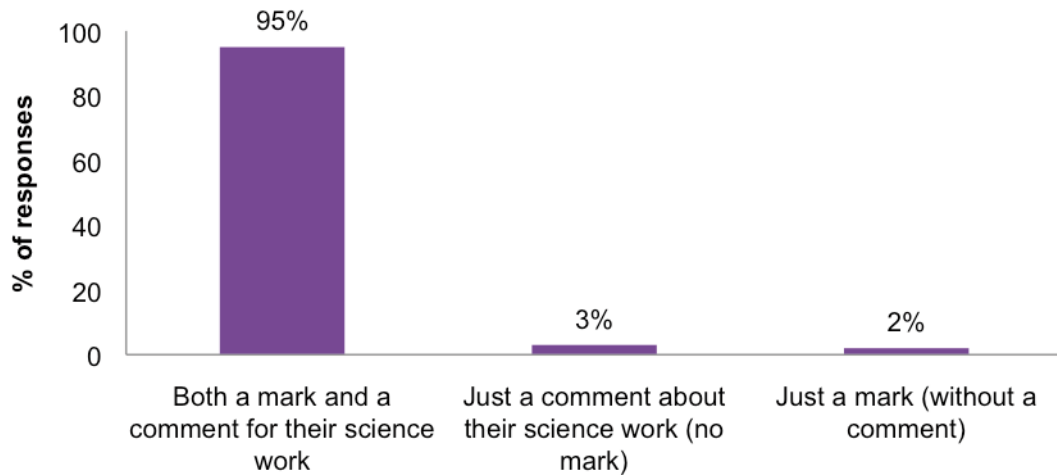


The parents of children in English and Welsh schools were also asked which type of feedback they preferred for their children (both a mark and a comment, just a comment or just a mark). Most parents reported preference of both a mark and a comment about their children's science work (Figure 5.22). There was no appreciable difference in the responses to this item given between parents of children in English and Welsh schools.

**Figure 5.22: Parental preferences for different types of feedback (n=241)**



### When you get feedback about how your child is doing in science, what type do you prefer?



#### Fitness for purpose

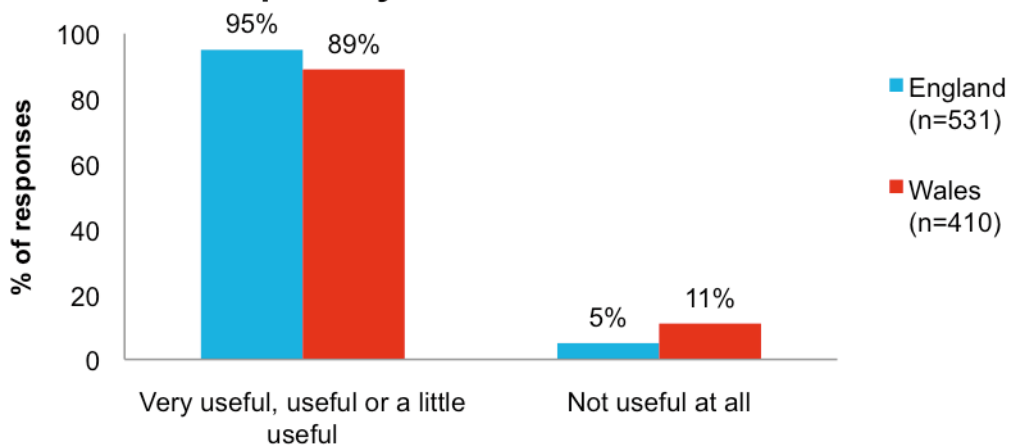
In this section we show children's views on the usefulness of science assessment and whether it made them enjoy science more and/or learn more science.

#### *Usefulness of science assessment*

Nearly all children (>90%) responded that science assessments were useful. Children in English schools were significantly more positive (Figure 5.23).

**Figure 5.23: Usefulness of science assessment**

### How useful do you think science assessments in primary school are for children?

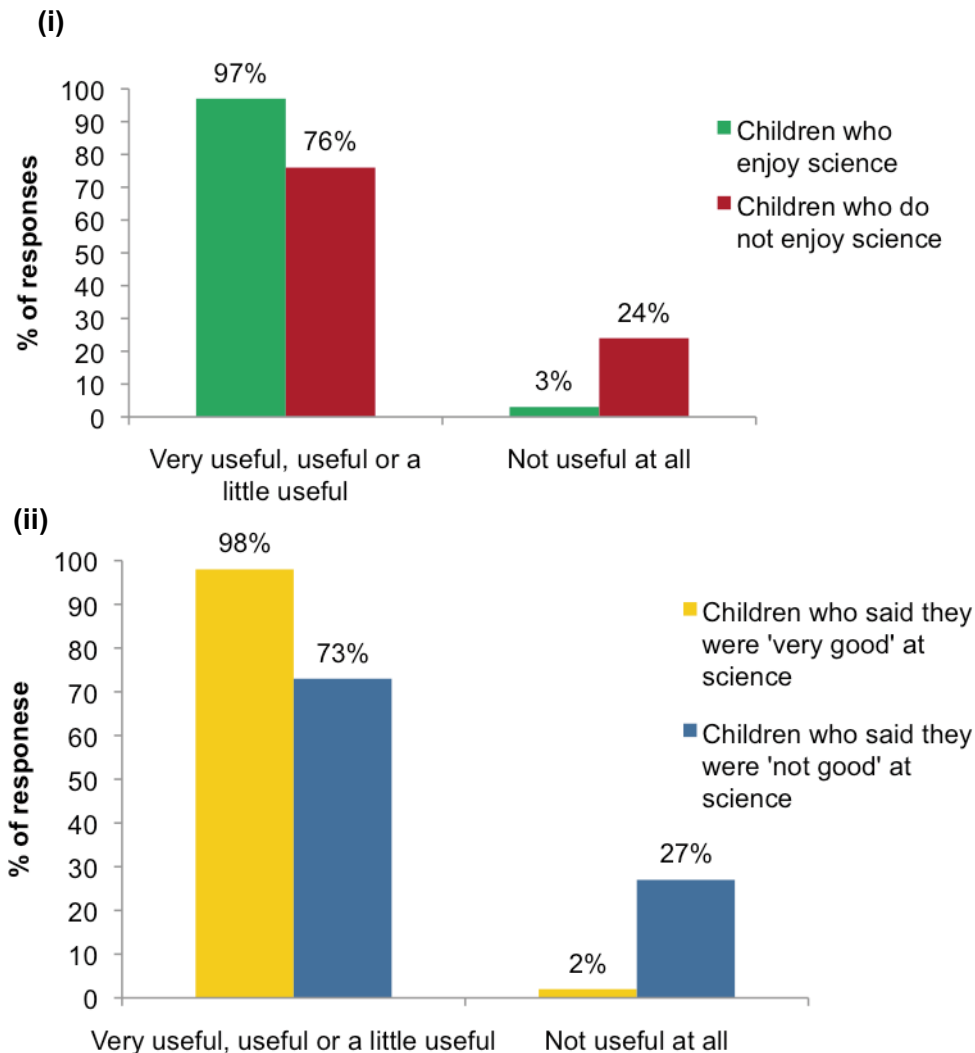


*Difference between England and Wales significant at  $p < 0.001$*

Children who enjoyed science more tended to appreciate its usefulness more than those who did not enjoy science [Figure 5.24 (i)]. The trend was similar in the relationship between perceived ability in science and its usefulness; nearly all children who felt they were good at science perceived assessment as useful,

whereas more than a quarter of children who said they were not good at science thought its assessment was not useful [Figure 5.24 (ii)].

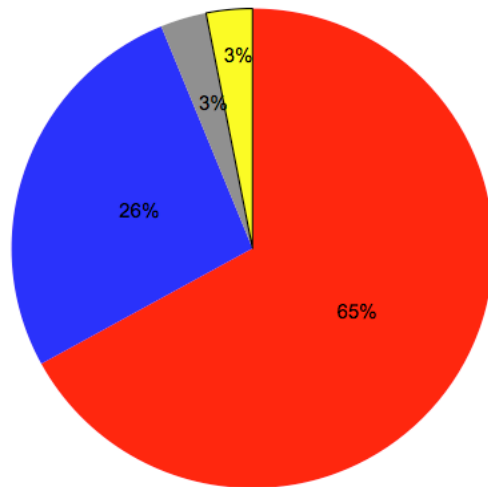
**Figure 5.24: Relationship between perceived ability and usefulness of science assessment**  
**How useful do you think science assessments in primary school are for children?**



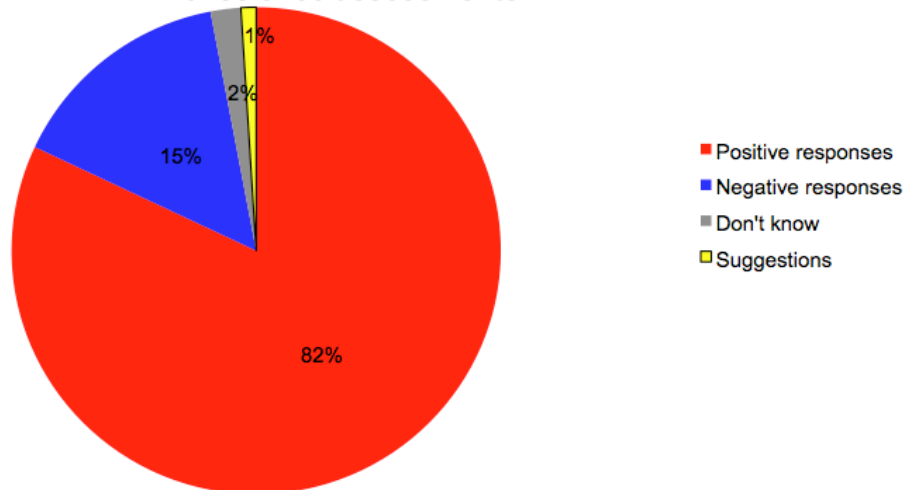
In total, 80% of the children responded to the open question about usefulness of science assessment. In the open responses, most children commented favourably on the usefulness of science assessments, although, as with the closed responses, children from English schools were more positive (Figure 5.25).

**Figure 5.25: Open responses about usefulness of science assessments**

**Welsh schools: % of 'positive', 'negative', 'don't know' responses and 'suggestions' in relation to the usefulness of science assessments**



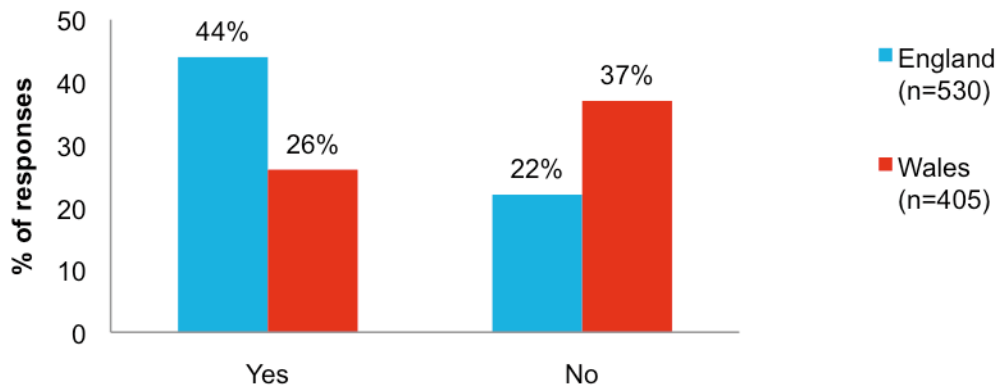
**English schools: % of 'positive', 'negative', 'don't know' responses and 'suggestions' in relation to the usefulness of science assessments**



Children were asked if science assessments in primary school helped them enjoy science. More children in English schools than Welsh schools said that science assessments helped them enjoy science (see Figure 5.26).

**Figure 5.26: Science assessments and enjoyment**

### Do (did) your science assessments in primary school help you enjoy science?

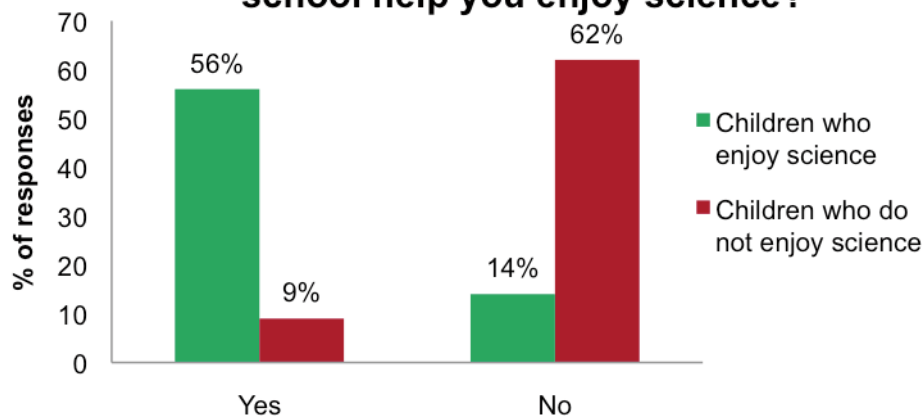


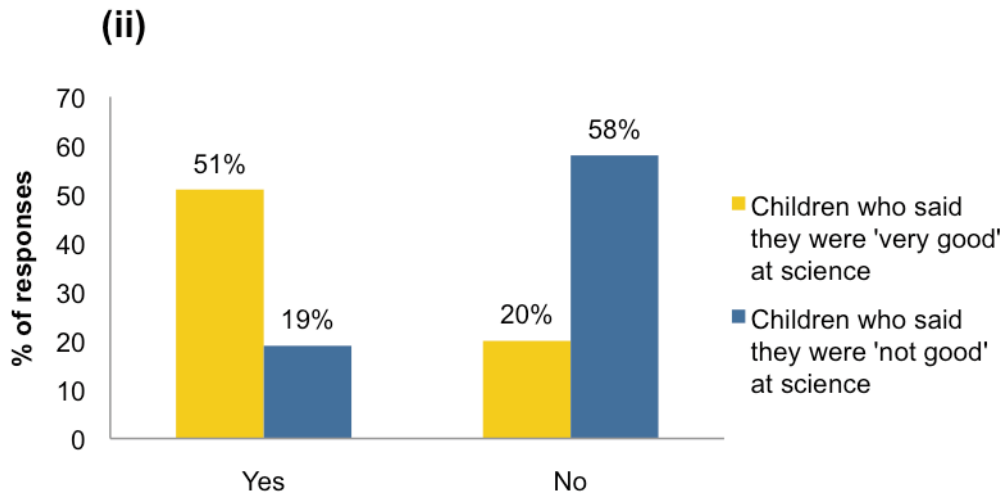
*Difference between England and Wales significant at  $p < 0.001$   
(The other response choice was 'not sure')*

There was a relationship between enjoyment of science in general and whether science assessment enhanced that enjoyment: fewer than 1 in 10 of those who did not enjoy science thought that assessment in science helped them enjoy it [Figure 5.27 (i)]. Similarly, children who perceived they were very good at science were more likely to agree that science assessment helped them enjoy it. This was not the case for children who perceived themselves as not good at science - the majority (58%) indicated that science assessment did not help them enjoy the subject [Figure 5.27 (ii)].

**Figure 5.27: Relationship between perceived ability and usefulness of science assessment for enjoyment**

#### (i) Do (did) science assessments in (primary) school help you enjoy science?

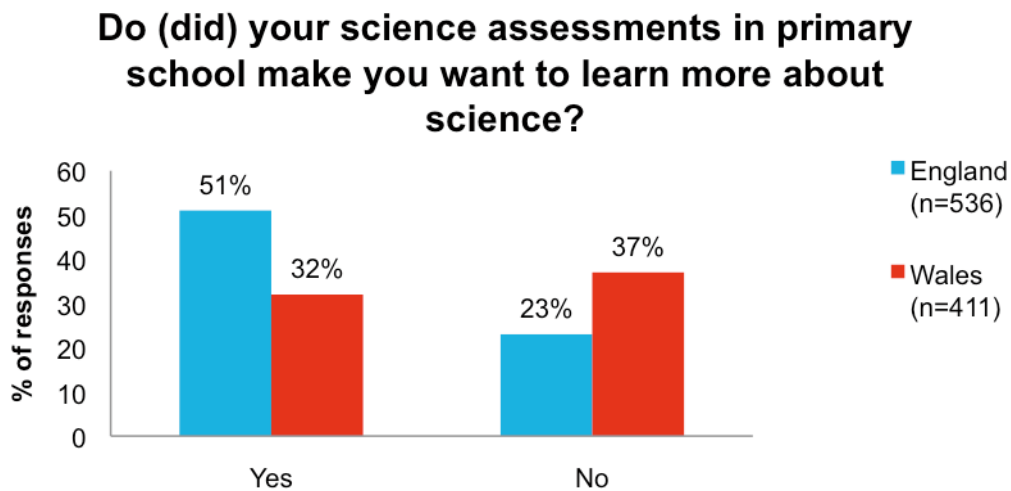




(The other response choice was 'not sure')

Children were asked if science assessments in primary school made them want to learn more about science. Half of children in English schools and a third of children in Welsh schools said that science assessments made them want to learn more about science (see Figure 5.28).

Figure 5.28: Usefulness of science assessment and learning

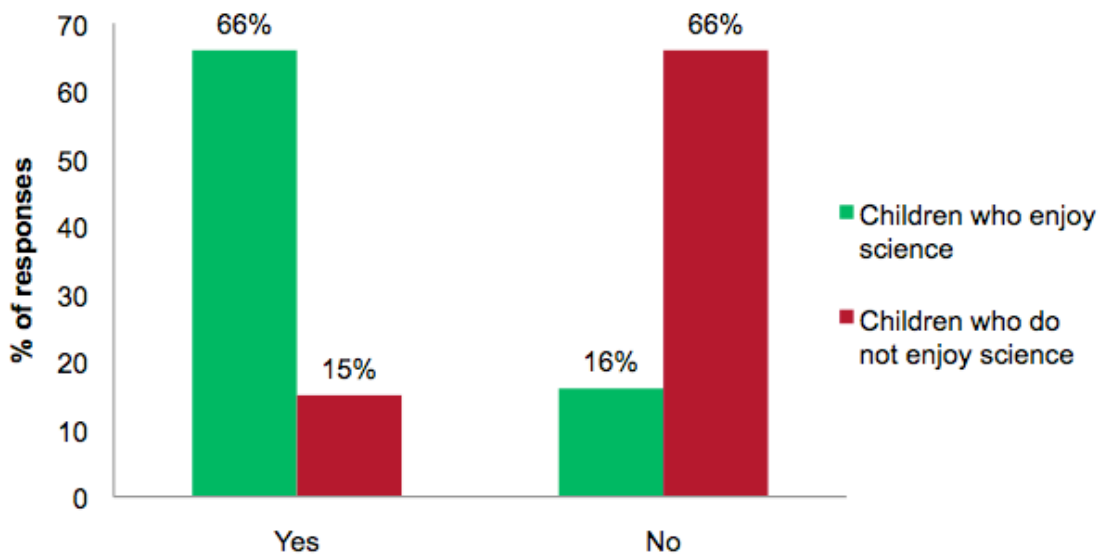


Difference between England and Wales significant at  $p < 0.001$   
(The other response choice was 'not sure')

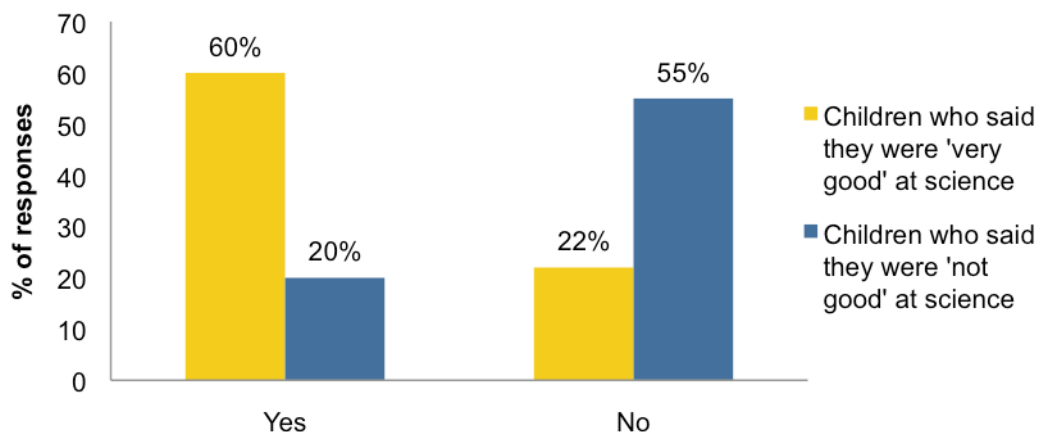
Figures 5.29(i) and Figure 5.29(ii) show that children who enjoy science more and those who perceive they are better at science are much more positive about the motivation effect of science assessment to make them want to learn more about science. Children in the CRAG groups interpreted this finding as children wanting to learn more science to improve their performance in tests (see section 4.5).

Figure 5.29: Relationship between perceived science ability and motivating effect of science assessment

**(i) Do (did) your science assessments in primary school make you want to learn more about science?**



**(ii)**



(The other response choice was 'not sure')

Children's open responses about the usefulness of assessment were a mix of positive and negative, and some children gave suggestions. Typical positive responses related to the value of assessment for motivation towards science learning, helping their learning now and in the future and practice for secondary school:

*"They are useful because they make you want to do good so you will try hard and maybe you will do good. It will also get you ready for when you get tests in secondary school"* (Welsh primary)

*"Because if you are good at it you might want to be a scientist when you are older"* (Welsh primary)

*“Science assessments help children to see how much they have improved in science and what they need to improve on. They are very useful as they help children to feel good about themselves and motivated them”* (English primary)

*“Don’t take in as much as I would in assessments”* (English primary)

*“Help you in your future life and make you more confident”* (English primary)

*“They are useful cause if you want a really good job you will need a good education if you don’t do science assessments you would not know if a question comes in a science test, you wouldn’t know how to do the question”* (English primary)

*“It makes you learn more and gets your brain more interactive”* (English secondary)

*“They help children learn more about the lessons and it would be less trouble doing assessments in secondary school”* (English secondary)

Their negative comments mostly described factors such as stress as being counterproductive:

*“Not useful at all, they make you stressed and angry and not very good and makes you feel scared”* (Welsh secondary)

*“They make you feel bad if you get a bad mark”* (English secondary)

*“Exams make children nervous and stressed so they get a lot of pressure from their parents”* (English secondary)

*“I think they are not useful because it puts children under too much pressure”* (English secondary)

Some children also made suggestions about how science is assessed in relation to its usefulness:

*“I think it is the same if the teacher assesses your book instead of putting pressure on us while doing tests”* (Welsh primary)

*“Well you shouldn’t really have to do them in primary”* (Welsh primary)

*“I don’t think it’s very useful as you should be tested at an older age”* (English primary)

*“An equal amount of time should be spent on both teaching and assessments”* (English primary)

*“It’s better to learn science than have the pressure of a test”* (English secondary)

*“I think too many assessments can make children shy away from subjects. It’s better to test children in a fun way”* (English secondary)

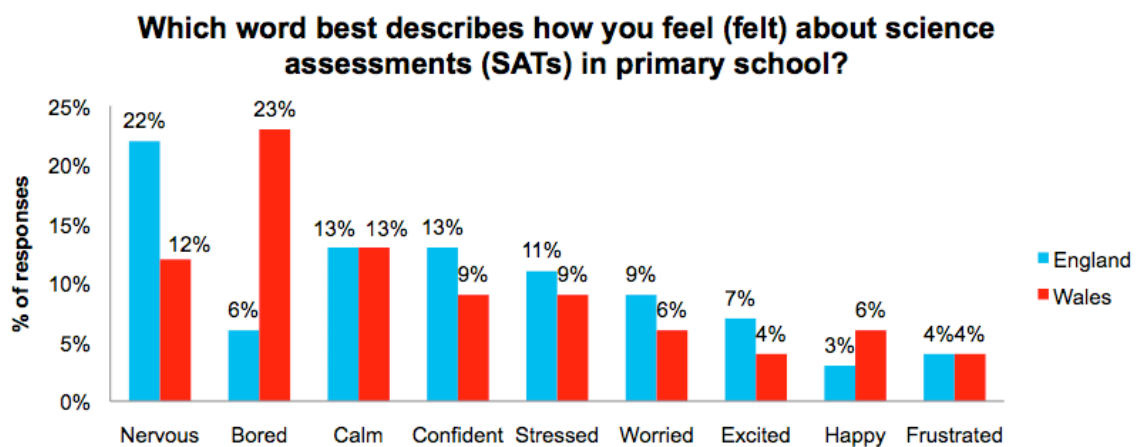
### Impact of KS2 (year 6) science assessment

Despite children's overall perception of science assessments as useful (Figures 5.23, 5.25, 5.26, 5.28), there were signs of a negative impact of science assessments in terms of how it made them feel, their general confidence and the impact on their friendships and home life.

### *Doing science tests/assessments*

Children were given a variety of different words which could be used to describe how they feel (felt) whilst doing science assessments (SATs) in primary school. Children could choose from: 'happy', 'frustrated', 'nervous', 'stressed', 'confident', 'bored', 'calm', 'excited' or they could write a word of their own. The choice of words was provided by the CRAGs. Figure 5.30 shows the percentage of responses given for each word selected in response to this question.

**Figure 5.30: Words selected by children to describe how they felt about science assessments**



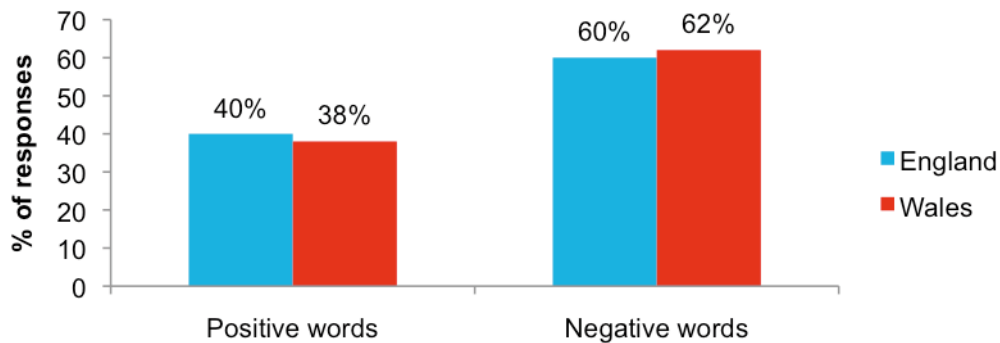
The most frequent word chosen from children in English schools was 'nervous', whereas the most frequent word chosen by children in Welsh schools was 'bored'. Child researcher Xiao (2006) also asked 69 English children to circle a word which described their 'emotions towards SATs'. Children could choose between 'apprehensive', 'optimistic', 'concerned', 'confident', 'worried', 'nervous', 'encouraged' and 'other (please specify)'. Xiao (2006) also found that 'nervous' was the most common response (38% in school A and 62% in school B).

When the positive and negative words were compared for the current sample, the majority of children in England and Wales recorded negative words (Figure 5.31).

**Figure 5.31: Feelings about science assessments**



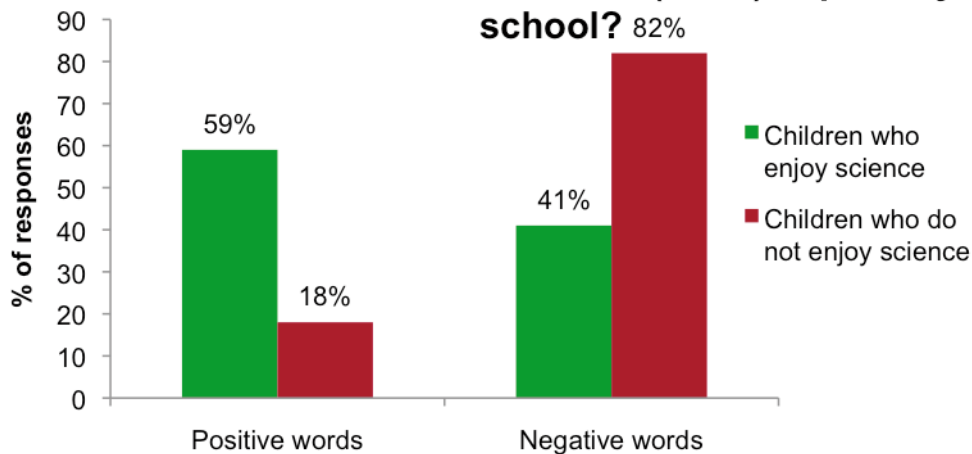
### Which word best describes how you feel (felt) about science assessments (SATs) in primary school?

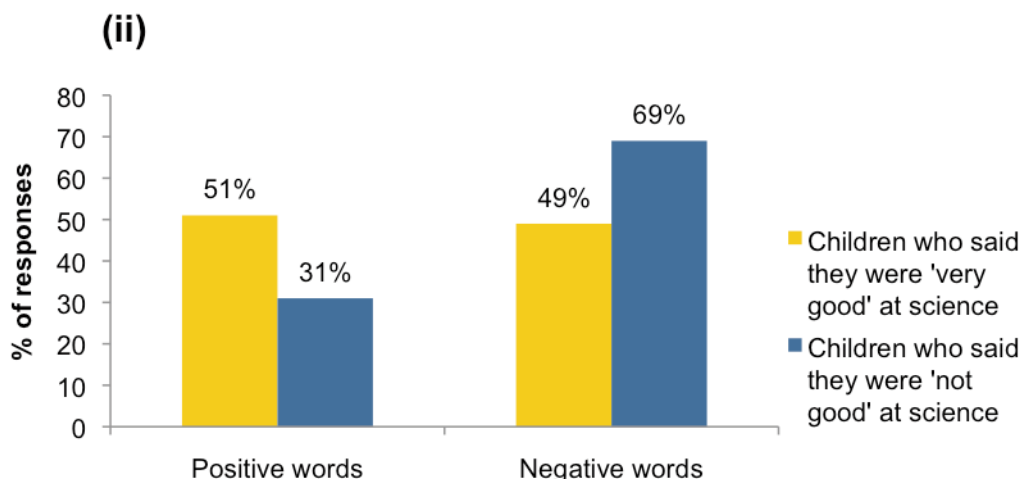


There was also a relationship between the positive/negative words chosen by children and their enjoyment [Figure 5.32(i)] as well as their perceived ability [Figure 5.32(ii)]. Enjoyment had a greater impact than perceived ability on how children felt about science assessment.

**Figure 5.32: Relationship between feelings about science assessments and enjoyment/percieved ability**

### (i) Which word best describes how you feel (felt) about science assessments (SATs) in primary school?





### Impact on confidence in science

The children were asked an open question about the impact on confidence and 83% of the sample answered this question. The overall impact of assessment on science confidence was that children in English schools perceived a more positive impact of assessment on their science confidence, whilst children in Welsh schools were more neutral (see Figure 5.33):

*"It doesn't affect my confidence at all"* (Welsh primary, theme: no effect)

*"I think that science assessments have made no difference to my confidence"* (Welsh secondary, theme: no effect)

*"They didn't really do anything with my confidence"* (Welsh secondary, theme: no effect)

The positive comments suggested that assessment raised their self-esteem, helped them with their learning, improved their science ('science specific' in Fig 5.33) and prepared them for secondary school, for example:

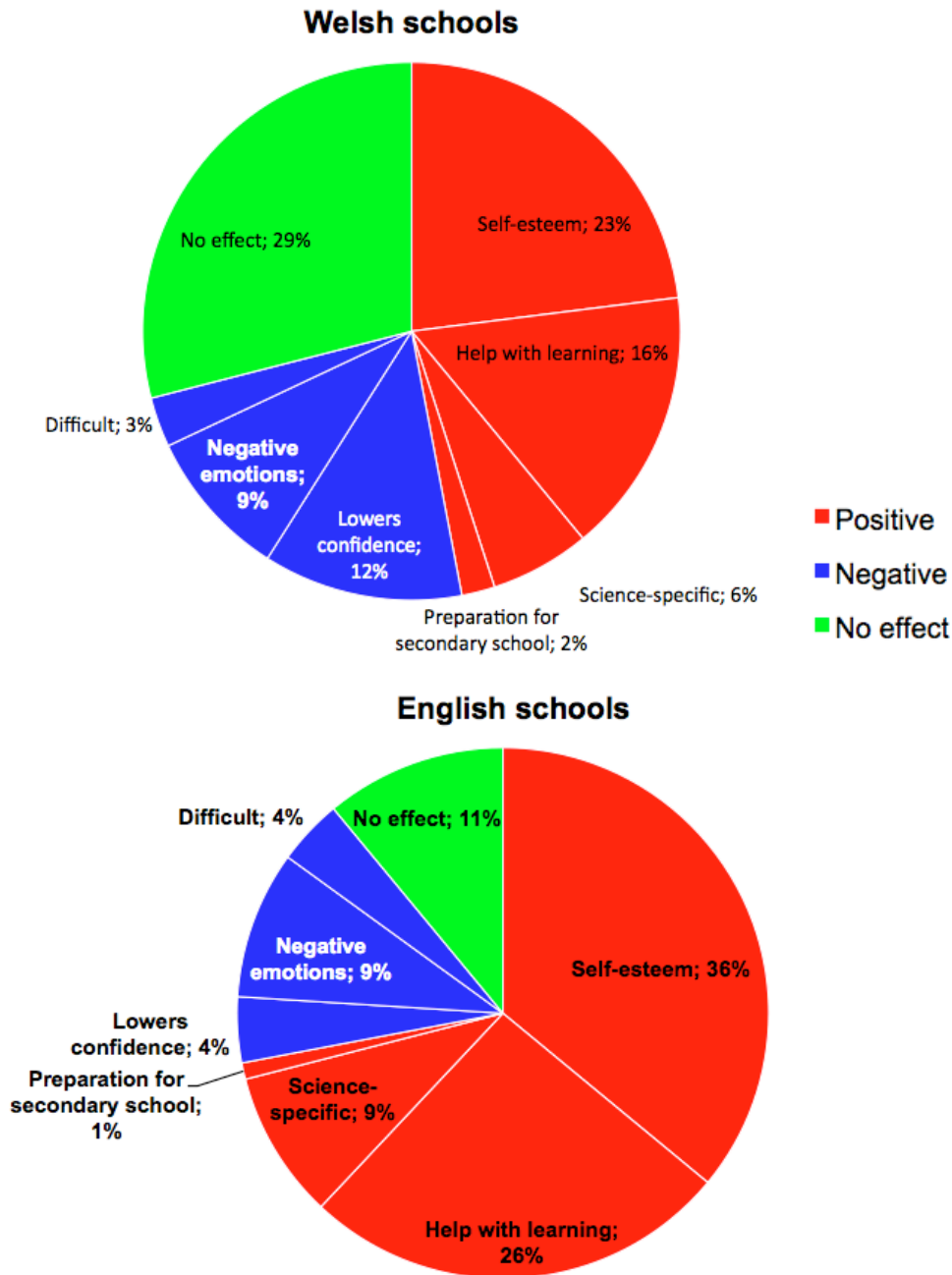
*"I think science assessments affected my confidence in a good way and has helped me to understand science"* (English primary, theme: help with learning)

*"It helped a lot for me to get ready in secondary school as I will have a lot"* (English primary, theme: preparation for secondary school)

*"Science assessments let you see how you are coping so you feel more confident about yourself"* (Welsh secondary, theme: self-esteem)

*"It made me better at writing things about experiments"* (English primary, theme: help with learning)

**Figure 5.33: Open responses about the effect of science assessments on confidence**



Negative comments about the effect of science assessment on children's confidence (Figure 5.34) were mostly about how it generally lowered their confidence, contained many negatively expressed emotions (for example: scared, frustrated, angry, sad) and about difficulty of the assessments:

*"it might put more stress which will make you lack in confidence"* (Welsh primary, themes: lowers confidence, negative emotions)

*"Because it's like a test and it makes kids nervous"* (Welsh primary, theme: negative emotions)

*"It makes you less confident because there is a lot of pressure"* (English primary, themes: lowers confidence, negative emotions)

*"It only makes you less confident when you're doing the assessment on paper, if it were practical it would be more fun"* (Welsh secondary, theme: lowers confidence)

*"It can make you nervous and that could make you do bad and that could put your confidence down and make you feel like you were rubbish at science"* (Welsh secondary, theme: lowers confidence, negative emotions)

### Impact on friendships and home life

Children's written responses in this section were more extensive than in any other part of the questionnaire. For example, the average word count for the open questions on friendships and family life was 18.7 (compared with 6.6 for the confidence question, 13.2 for the usefulness question and 15.1 for the question on ideas for improving science assessment). In total, 96% of the children responded to this question. When they evaluated the online survey, children said that they valued the space to express their feelings, the fact that they were being listened to, and their anonymity.

The impact of science assessment on friendships and home life was largely negative. Fewer than 1 in 5 children recorded any positive effect (Figure 5.34). Children in English schools voiced stronger negative experiences than children in Welsh schools. The main reasons for the negative impact of assessment on children's friendships were related to competitiveness, deteriorating relationships, negative emotions, and bullying. Some representative comments are:

*"If I get a low mark I don't want to tell my friends because they get good marks so I feel embarrassed"* (Welsh primary, theme: negative emotions)

*"When you do SATs you can get in competition with your friends, also, since you have more homework and revision you have less time to hang with family"* (English primary, themes: competitiveness, revision, lack of time with family)

*"Sometimes my friends make fun of me for getting low marks so I revise a lot so I don't get to play with them that often"* (English primary, themes: bullying, competitiveness, revision)

*"You don't get time to talk to your family and sometimes you can break up with your friends because you're so pressurised and you can't think. Also, my parents put pressure on me so much that I have a headache"* (English primary, themes: lack of time with family, effect on relationships, negative emotions, pressure from home)

*"If you don't do well it can affect your life and you will get shouted at and you could get bullied for not getting a good result and also your friends might laugh at you if they got a higher mark than you"* (English primary, themes: competitiveness, bullying)

The negative impact on their home lives was typically feeling pressure from people at home to study/do well, having less time to spend with their family, the impact of revision and the negative impact on relationships at home:

*"It affects my home life if I get a bad mark in a test as my parents are angry. It does affect my friendships as people might call you dumb."* (Welsh primary, themes: pressure from home, deteriorating relationships)

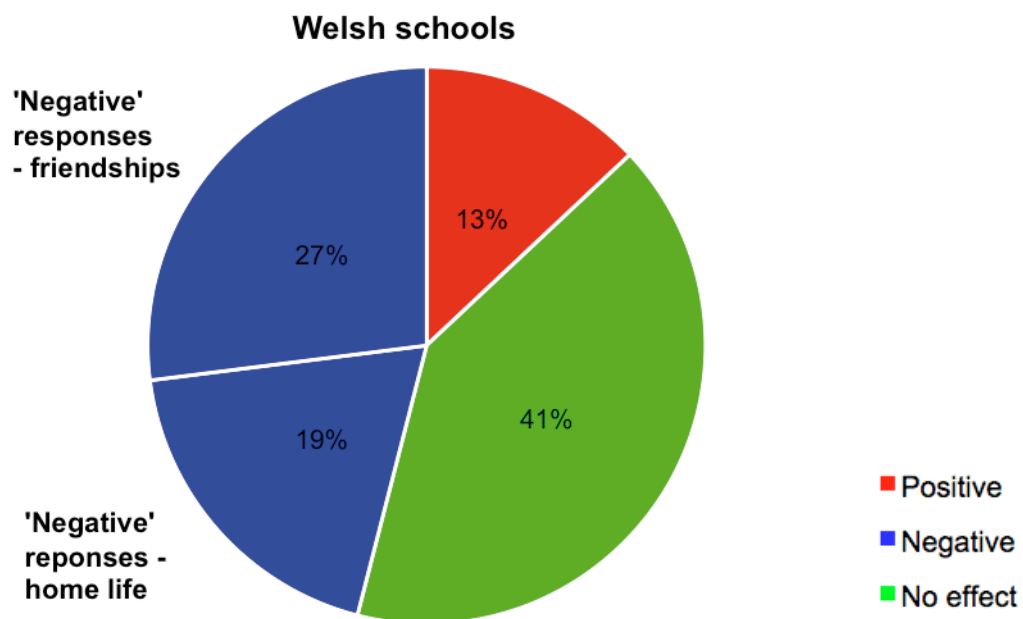
*"My family push me too much and my friends get all nervous and angry and don't want to be friends anymore"* (English primary, themes: pressure from home, negative emotions, effect on relationships)

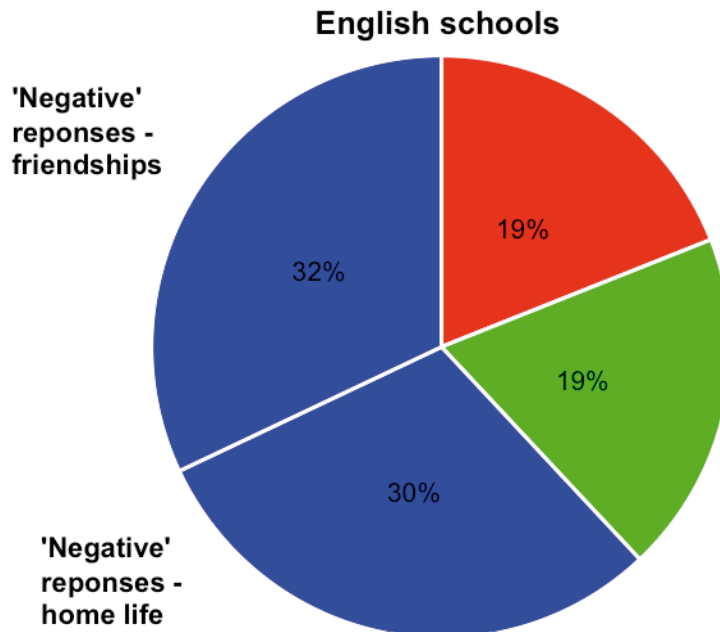
*"Well it made me nervous and I had too many things in my head and I had to revise every day"* (English secondary, themes: negative emotions, revision)

*"I was just stressed and my siblings wouldn't leave me alone to study and I would be mad and my parents would take everything away from me: phone, computer etc... They put too much pressure on me"* (English secondary, themes: negative emotions, effect on relationships, pressure from home)

*"I get frustrated because I have a sister that did very well in science and if I don't get high marks it kind of makes me feel like everyone just thinks of me as the dumb one in the family and when my friends get higher than me I am proud for them but it makes me left out and feeling useless"* (English secondary, themes: negative emotions, pressure from home, competitiveness)

**Figure 5.34: Open responses about the effect of science assessments on friendships and home life**



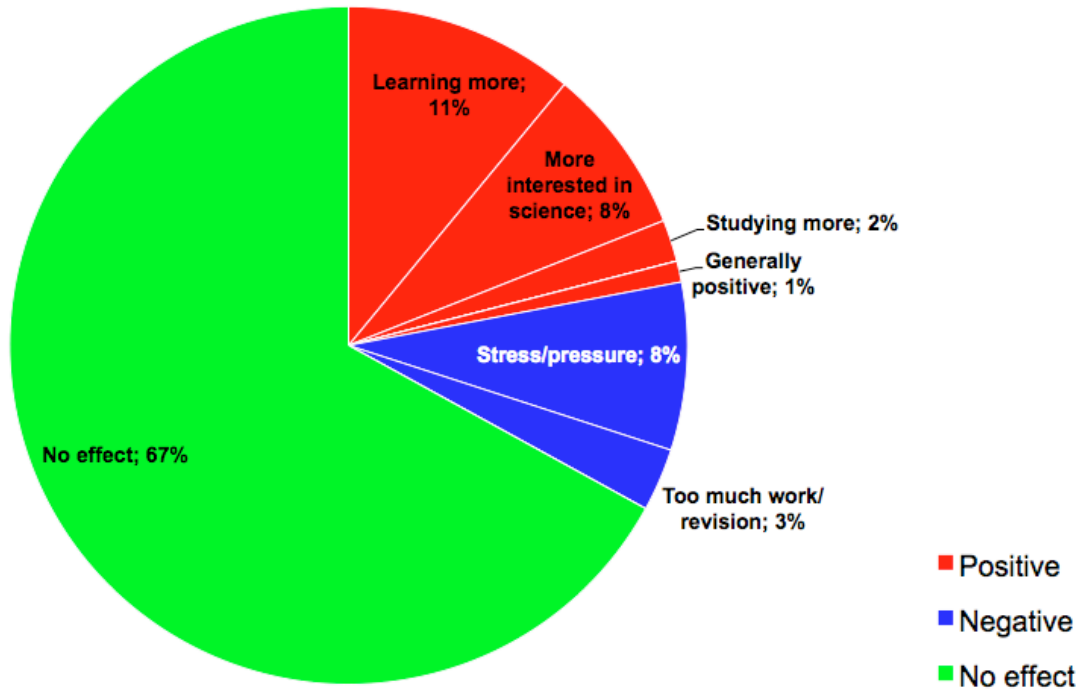


### *Parents*

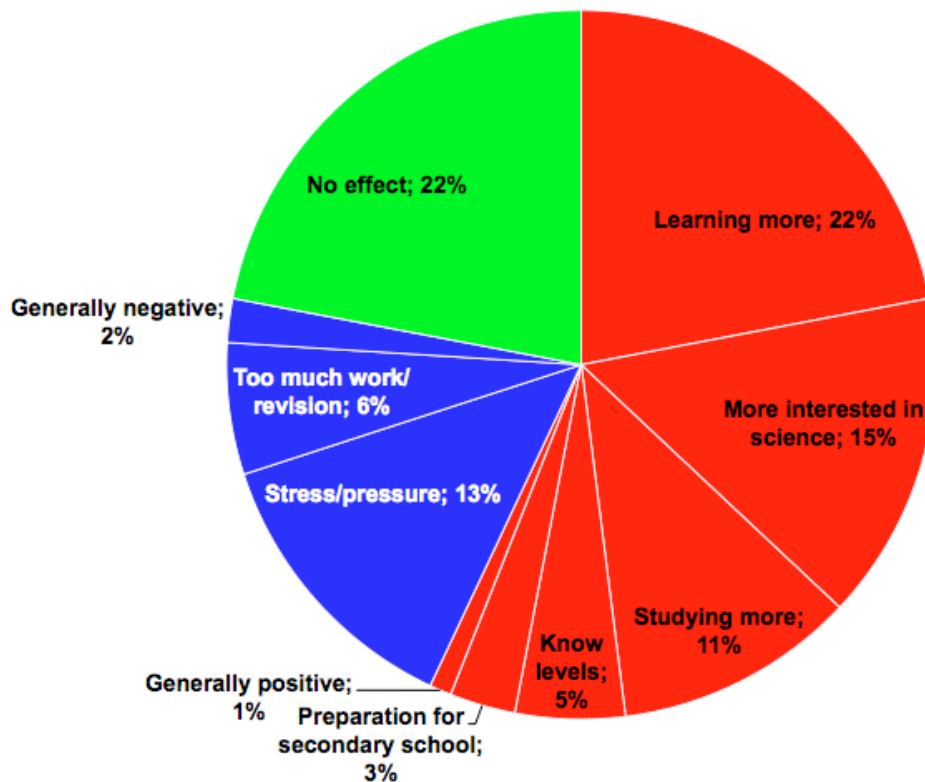
Parents were more positive than children about the impact of science assessment on children's home lives (Figure 5.35). The majority of parents of children in Welsh schools (67%) said that science assessments had no effect on their children's home life. More than half (57%) of parents of children in English schools, however, said that science assessment had a positive effect on their children's home lives. This contrasts strongly with the children's views which indicated a largely negative impact of science assessment on their friendships and home lives.

**Figure 5.35: Open responses about the effect of science assessments on home life**

### Welsh schools



### English schools

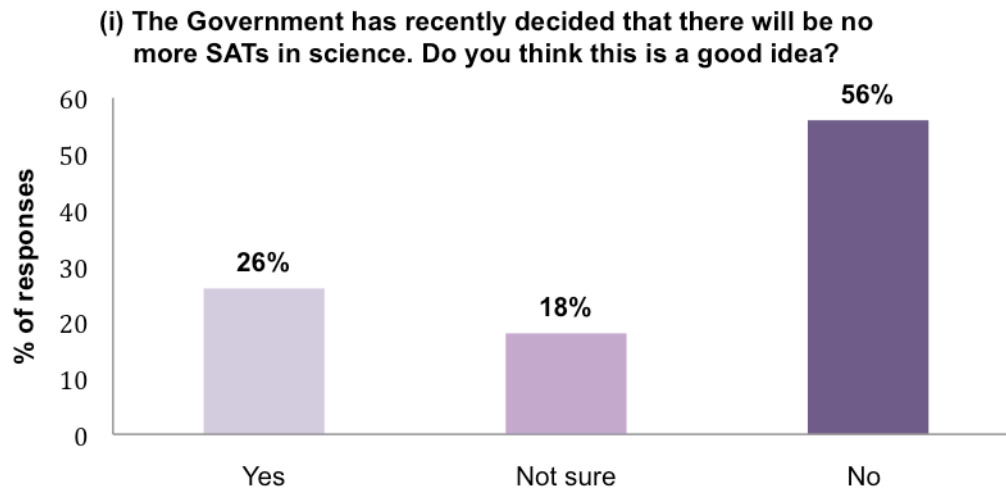


### 5.5 Abolition of SATs

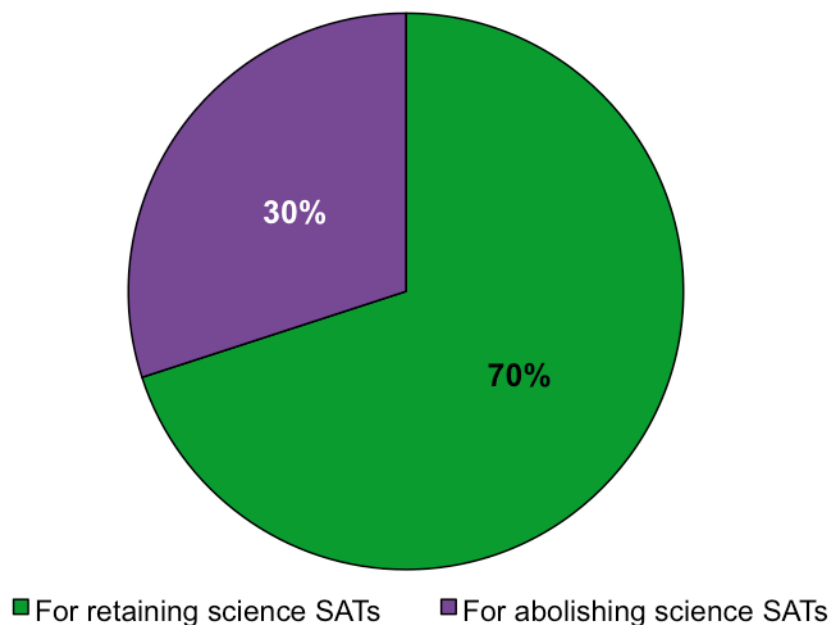
Children in English schools were asked whether they thought that the abolition of SATs was a good idea and to explain their response. In the closed response,

more than half of the children in English schools said 'no' and around a quarter said 'yes' [Figure 5.36(i)]. In total, 78% of the children in English schools responded to the open question on abolition of science SATs. In the open question, when asked to explain their response, most (70%) were against abolition of SATs, whilst 30% favoured the move [Figure 5.36(ii)].

**Figure 5.36: Closed and open responses for whether or not the abolition of SATs is a good idea**



(ii) The Government has recently decided that there will be no more SATs in science. Do you think this is a good idea?  
Explain your answer in the box below



*(These questions were only asked in England)*

The data in Table 5.1 and 5.2 show representative comments from the major themes emerging from children's explanations of why SATs should be retained, in rank order of reason frequency:



**Table 5.1: Children's reasons for retaining science SATs, with exemplar quotes**

REASONS FOR KEEPING SCIENCE SATs (in rank order from top to bottom)	
1. Children will not learn as much	<p><i>"Because the science test helps you get better at it and your knowledge gets better"</i> (English primary)</p> <p><i>"People will not do their best if they know that there is no test"</i> (English primary)</p> <p><i>"I think this because other children need to know science properly as well"</i> (English primary)</p> <p><i>"because pupils can decrease their education in science"</i> (English primary)</p> <p><i>"because how are you going to learn?"</i> (English secondary)</p> <p><i>"I don't think it is a good idea to stop SATs because the children won't try as hard and they will learn less because they won't revise"</i> (English secondary)</p>
2. To know your level	<p><i>"If there's no science SATs then you won't know your level in science"</i> (English primary)</p> <p><i>"No, I don't think it's a good idea because every child at school should do a test to show the government how well they are doing and how well their teachers are teaching them"</i> (English secondary)</p>
3. Preparation for secondary school	<p><i>"They won't know much when they come to secondary school"</i> (English secondary)</p> <p><i>"Children who will be going to secondary school will have an idea and will have experience of what you have to do in secondary school"</i> (English primary)</p>
4. Importance of science	<p><i>"it means that other exams have a higher rank over science"</i> (English secondary)</p> <p><i>"because there are going to be SATs in English and maths still and so it could make children think that science isn't as important"</i> (English secondary)</p> <p><i>"because people that wanna do science in the future will need science now to help them"</i> (English secondary)</p>
5. Unfair for those who have already done them	<p><i>"It is not fair because the last class had to do them, it feels that I've been betrayed by my teachers"</i> (English primary)</p> <p><i>"I think it is unfair because all the other children that have done it have been stressing and worrying and the children that don't have to do it are getting it easy"</i> (English primary)</p>

**Table 5.2: Children's reasons for abolishing science SATs, with exemplar quotes**

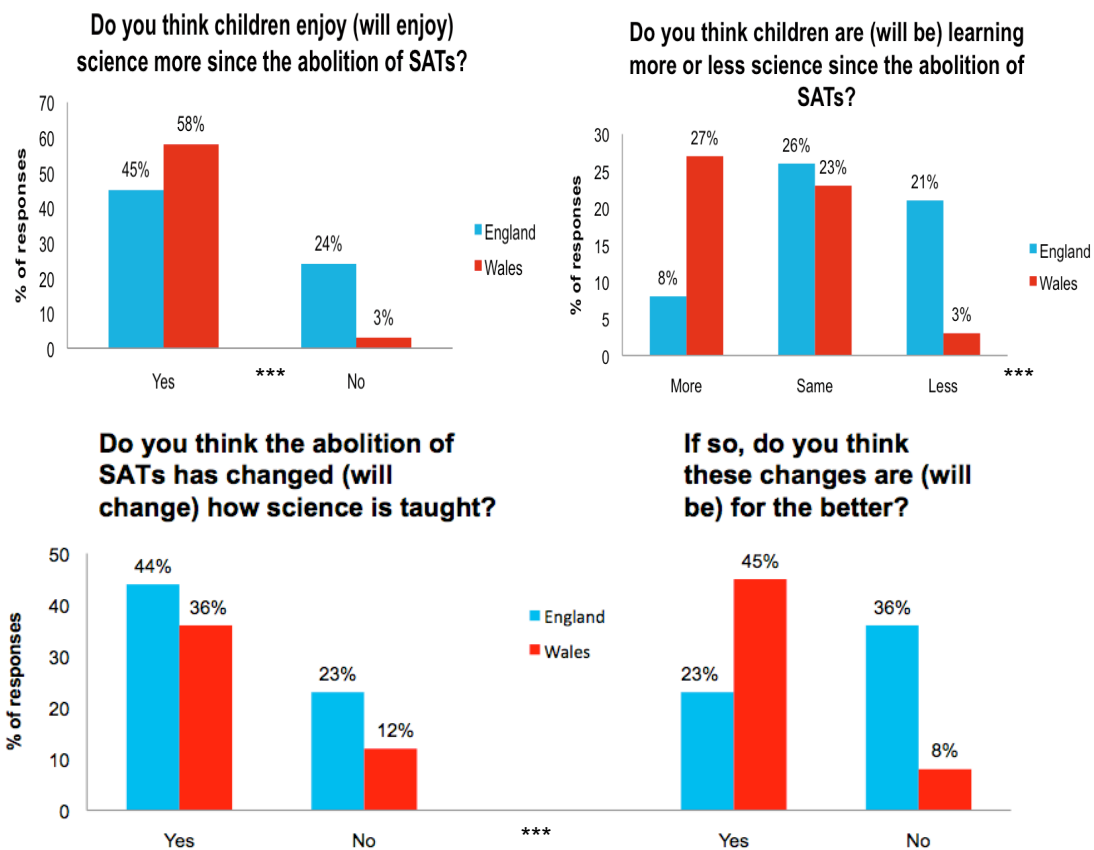
REASONS FOR ABOLISHING SATs (in ranked order from top to bottom)	
1. Less stress, pressure or worry	<p><i>"I think this should be a good idea because many children are very stressed and nervous about what their mark is and they will feel very worried"</i> (English primary)</p> <p><i>"So they won't be as stressed out when they go to secondary"</i> (English secondary)</p> <p><i>"It takes pressure off children"</i> (English primary)</p> <p><i>"I think yes because science tests are putting a lot of pressure on children so they won't be stressed if they don't have to worry about science tests"</i> (English primary)</p>
2. Better teaching/ learning	<p><i>"I think it is a good idea because mostly children and teachers work on questions and answers instead of doing experiments and trips to science areas"</i> (English primary)</p> <p><i>"I think yes, because it's just better for the children to be taught instead of the children being assessed. Primary schools can have little tests to check how they are doing, but not an important test that will stress them out"</i> (English secondary)</p> <p><i>"I think this is a good idea because now science can be taught the way it should be taught which means more experiments can be done"</i> (English primary)</p> <p><i>"Because you will get more education from a teacher than you ever will from a SATs paper"</i> (English primary)</p>

3. Disappointment with grades	"If people get low scores it hurts their feelings" (English primary)
4. More time for other things	"children want to spend time with their relatives" (English primary)
5. Too young	"When I was preparing for my science SATS I was very stressed and it is unfair to put that amount of pressure on children" (English primary, also theme: less pressure/stress)

**Parents**

Parents of children in English schools were apprehensive about the abolition of SATs. They expressed similar views to those of their children, which related to the downgrading of science without SATs. Most Welsh parents, on the other hand, indicated that after five years without SATs, children learn more science and that the changes post-SATs have been for the better (Figure 5.37).

**Figure 5.37: Parent responses relating to the abolition of SATs**



\*\*\* significant at  $p < 0.001$   
 (The other response choice for each of these items was 'not sure')

Parents' views on the abolition of SATs indicated that those in England were concerned that science would be downgraded, that children would be less motivated to learn science and would not know their levels. Some representative quotes are:

*"To abolish SATs in science will make science go down"* (parent, English primary)

*"SATs ensured that pupils were up to a national standard"* (parent, English primary)

*"Well it helps them to know exactly where they are at (level) in science, therefore allowing them to take further science"* (parent, English primary)

*"Understands better the use of science and the meanings of things, i.e. the body, objects, solids, liquid, mass etc"* (parent, English primary)

*"Focused learning and consolidated scientific method. Useful building blocks for secondary school and huge amount of insight and knowledge gained"* (parent, English primary)

*"Made them work more and did challenging tasks enabling them to learn more"* (parent, English primary)

*"We will know how they're doing in science and if they're improving in science"* (parent, English secondary)

*"I think it is good that they did SATs so I can find out what my child is capable of doing (VERY IMPORTANT)"* (parent, English secondary)

*"I think SATs should continue as this prepares children for secondary school, it's a core subject in secondary and allows my child to get a taster of what's expected"* (parent, English primary)

Many of the Welsh parents, on the other hand, commented that the abolition of SATs in Wales has led to increased learning and interest in science. Other parents in Wales commented that children (and some parents) were not aware that they were being formally assessed in science.

*"He would bring any homework home and just get on with it. He seemed to enjoy it more and just do it. Life made easier"* (parent, Welsh secondary)

*"Made my child think of science subjects around the home"* (parent, Welsh secondary)

*"No impact, I didn't think it was little more than as assessment by the teacher"* (parent, Welsh secondary)

*"My children had no recollection of science assessment in year 6"* (parent, Welsh secondary)

*"Very little (impact)-SATs were low key at my eldest child's primary school: he took them in his stride. No pressure was applied"* (parent, Welsh secondary)

*"SATs had very little impact on the two of my children who sat them. They were kept fairly low key until the test day"* (parent, Welsh secondary)

*"I was not aware of any formal assessment"* (parent, Welsh secondary)

*"Wasn't aware she had taken an assessment"* (parent, Welsh secondary)

## 5.6 Summary of findings relating to key issues in KS2 science assessment

### Children's attitudes to science

- Most year 6 and year 7 children (85%, n=944) enjoyed science lessons, with approximately 25% enjoying them a lot.
- More than 90% (n=243) of parents thought that science should continue to be a core subject in primary schools.
- One in 10 children chose science as their favourite subject, which could suggest that lots of children *like* science; it is just not their favourite subject.
- Most children rated their science ability as 'OK', with nearly a third (29%) from English schools and almost a fifth (18%) in Welsh schools rating their ability as 'very good' (n=941).
- Science was perceived by children to be easier and less important to the school than English or maths.
- Children enjoyed science lessons significantly more in year 6 than in year 7.
- There was a significant decline in children's enjoyment of science and other STEM subjects between the end of primary school and the end of their first year in secondary school. It could be argued that it is not KS2 (year 6) science assessment *per se* that puts children off science; it could be due to a combination of factors in year 7 and/or the transition into year 7.
- There were few significant gender differences. Boys thought English was more difficult than science or maths, whereas girls thought science and maths were harder than English.

### Science assessment at KS2: practice

- Children said they spent less time revising for science assessments than for English or maths.
- Children from English schools thought that they spent more time on revision and less time on experiments and computer work, whereas children from Welsh schools thought they spent more time on experiments and computer work and less time on revision.
- There were no major differences in the perceptions and experience of KS2 science assessment between final year primary children who were being assessed this year and secondary children looking back to their KS2 assessment a year ago.
- Children found that science tests (*not* SATs practice papers) were the most useful for finding out how well they were doing in science. A close second in England was SATs practice papers done *at home* and, in Wales, teacher-assessed science work. Least useful was SATs practice papers done in school, although more than half (53%) of children in English schools and 14% in Welsh schools said they did SATs practice papers 'very often' in science lessons (n=930).
- Parents from Wales chose teacher assessment of children's work as the best way to assess them in science; parents from England chose SATs. This could be because parents in England may be less familiar with

teacher assessment, given the focus on SATs, and parents in Wales may be more aware of teacher assessment since SATs were abolished in 2004.

- Both parents and children rated mark-plus-comment feedback as the most useful, followed by comment-only and lastly mark-only.
- Significantly more children in English schools than in Welsh schools said they used AfL approaches in science lessons.

### **Science assessment at KS2: fitness for purpose**

- More than 90% (n=941) of children agreed that science assessment was useful. This could be interpreted as children appreciating the importance of science even if they did not always enjoy it.
- Children were positive about the use of *non-SATs tests* to find out how well they were doing in science. Children's and parents' views of science assessment at KS2 (year 6) were largely positive.
- Nearly half the children in English schools (44%) and 26% in Welsh schools found that science assessment helped them enjoy science (n=935). It might be the case that tests can make them learn more and give them 'a boost'.
- Half the children in English schools (51%) and a third (33%) in Welsh schools found that science assessment made children want to learn more about science (n=947).
- Children who enjoyed science and perceived they were better at it were more positive about the usefulness of KS2 (year 6) science assessment.

### **Science assessment at KS2: impact**

- The words children chose most commonly (from a list given by the CRAGs) to describe their feelings about doing science assessments were 'nervous' in England and 'bored' in Wales.
- KS2 (year 6) assessments had a largely negative impact on many children's friendships and/or home lives. The effect was more pronounced in children from English schools.
- Parents were more positive than children about the impact of science assessment on children's home lives.

### **Abolition of science SATs in England**

- In the open responses, the majority of children (70%) in English schools *did not* agree with the abolition of science SATs (n=444). Their reasons included a concern that they would not learn as much science, they would not know their levels in science, that SATs are a good preparation for secondary school and that science would become less important in school without SATs.
- Children who enjoyed science a lot and those who perceived they were very good at science were more positive about retaining SATs than those who didn't enjoy science or perceived that they were not very good at it.
- Parents of children in English schools were apprehensive about the abolition of SATs.
- Most Welsh parents (science SATs were abolished in Wales in 2004) agreed that children enjoy science more and learn more science without

SATs and that the change from SATs for science assessment has been for the better.

- Children who agreed with the abolition of science SATs cited reasons including reduced stress and pressure on children, better learning and teaching in science and more time for other things.

## 6. Improving Key Stage 2 science assessment

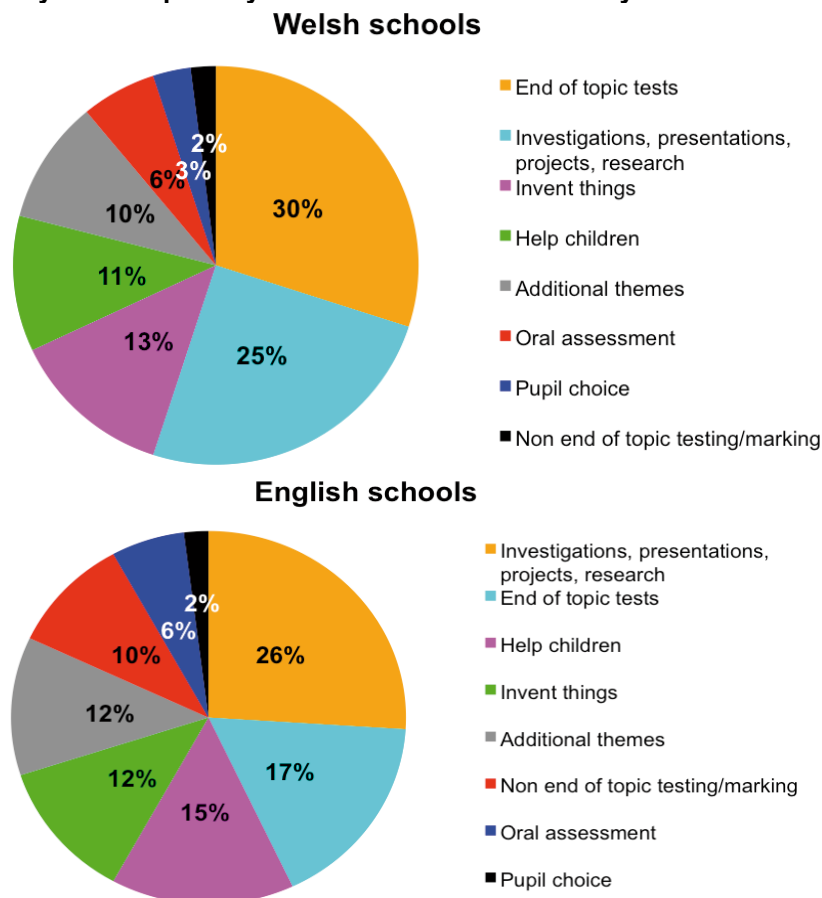
The findings in this chapter illustrate children's and parents' ideas about how science should best be assessed at Key Stage 2. Children's ideas were categorised into themes by three different groups: the CRAG, other stakeholders and the research team.

### 6.1 Children's ideas for improving Key Stage 2 science assessment

Each child who participated in the questionnaire was invited to imagine they were a primary school teacher and to suggest how they might assess children. In total, 84% of children responded to this question. Two researchers independently categorised each comment and several themes emerged (see Figure 6.1). Most comments from children in Welsh and English schools fell into two major categories: use of end-of-topic testing, and mixed assessment comprising investigations, presentations, projects and research. The other categories covered inventing things, helping children, 'additional themes' (difficult to categorise), oral assessment, pupil choice and non end of topic testing/markings.

**Figure 6.1: Responses from children in English and Welsh schools on how to assess science in primary school**

Imagine you are a primary school teacher. How would you assess science?



The CRAGs also analysed the data. CRAG sub-groups (each sub-group comprised eight children, representing Welsh primary, Welsh secondary, English

primary and English secondary) collated children's ideas from their own sector, categorised them into groups and commented on the overall findings from this process. The following groupings represent the common categories:

- Games/fun/inventing/enjoying
- Investigations, projects
- Tests/end of topic tests
- Sharing/helping
- Marking non-test work
- Saying aloud
- Children's choice.

The categories arrived at by the researchers and those given by the CRAGs were similar. Representative quotes from the combined categories (arrived at by the researchers and the CRAGs) are outlined below.

### **Imagine you were a primary school teacher. How would you assess science?**

**Researcher category: INVESTIGATIONS, PROJECTS**

**CRAG category: INVESTIGATIONS, PRESENTATIONS, PROJECTS, RESEARCH**

*"Put children in groups of 5 and do projects for each topic and present your project to the class. You could do different things for the project such as: models, PowerPoint, presentations etc"* (English, year 7)

*"I would organise trips to science museums but make it fun and enjoyable. I would also enter them in science competitions so that they can get a reward out of it. Then after every three to five weeks I would hand out some sheets asking them to write down how they feel, how this can be improved and if they have any questions I will also give out something like an assessment where they can research and write down info so they have a taste of secondary school"* (English, year 7)

*"I think I would do a group assessment to assess the children with different abilities and learning style. I would do this because I think it is unfair to some children doing well because they are more of writing answers and some children are more of talking and some are more drawing. So I would do some assessments as class work, orally asking questions to direct and by themselves"* (English, year 7)

*"I would do it in a fun way like projects and fun games"* (Welsh, year 6)

**Researcher category: END OF TOPIC TESTS**

**CRAG category: TESTS/END OF TOPIC TESTS**

*"You should test them at the end of each topic"* (English, year 6)

*"You should have assessments at the end of each topic so you don't have to remember it all"* (Welsh, year 6)

*"I would do the assessments after the topic because I don't want them to struggle at the same time"* (Welsh, year 7)

*"I would make them have an assessment after every topic so it's easier for the pupils to understand and the questions wouldn't be mixed up"* (Welsh, year 7)

**Researcher category: INVENT THINGS**

**CRAG category: GAMES/FUN/INVENTING/ENJOYING**



*"You should be able to invent things - more like a science competition"* (Welsh, year 7)

*"They should assess science by making the lesson more fun so the kids get into it and think it's fun so they will actually work hard during lesson time"* (Welsh, year 7)

*"You should be able to make things and have competitions and have fun that would make people enjoy science even more!!!"* (Welsh, year 7)

*"You should be able to invent things and make it fun instead of boring"* (English, year 6)

*"I would help the children enjoy it so they are listening"* (English, year 7)

**Researcher category: HELP CHILDREN**

**CRAG category: SHARING/HELPING**

*"I would assess it by giving them the questions and letting the pupils get on with it and help them if they need it"* (Welsh, year 6)

*"I would mark the work and help the people that need help"* (Welsh, year 7)

**Researcher category: NON END OF TOPIC TESTING/MARKING**

**CRAG category: MARKING NON-TEST WORK**

*"I would mark their work with a comment to improve their science knowledge"* (English, year 7)

*"I would assess my pupils work by using a project and marking them with a comment and definitely not self-assessment!!!"* (English, year 7)

**Researcher category: ORAL ASSESSMENT**

**CRAG category: SAYING ALOUD**

*"I think you should be able to say your answers out loud as you then could explain in more detail and people who have difficulties reading could answer more questions. I also think it should be more fun because some people think that the time of SATs is very stressful and not fun. If it could be like a project we could enjoy."* (English, year 7)

**Researcher category: PUPIL CHOICE**

**CRAG category: CHILDREN'S CHOICE**

*"I would only do an assessment if the child wanted me to, but if a child didn't want to do an assessment, I wouldn't make them"* (English, year 6)

*"At the end of each topic it would be good if we could choose whether to do a test or a project then there will be less stress because you get a choice."* (Welsh, year 7)

The researchers also arrived at a theme called 'additional themes'. This category was made up of quotes which were difficult to categorise. A few examples are outlined below:

*"I would find it really hard as a teacher to assess because: the government will not know the scores that people are getting. Imagine if one person was not good before and good now, the government will not know they will still think the child is struggling"* (English, year 7)

*"I would assess it because"* (English, year 7)

*"Give more lessons"* (English, year 7)

At the stakeholder seminar day, other stakeholders - including advisers, curriculum developers, representatives from teacher unions, a Qualifications and Curriculum Authority (QCA) representative, teachers and parents - also grouped the comments. In addition to some of the categories already given by the researchers and the CRAG children, the key stakeholders added the following groups:

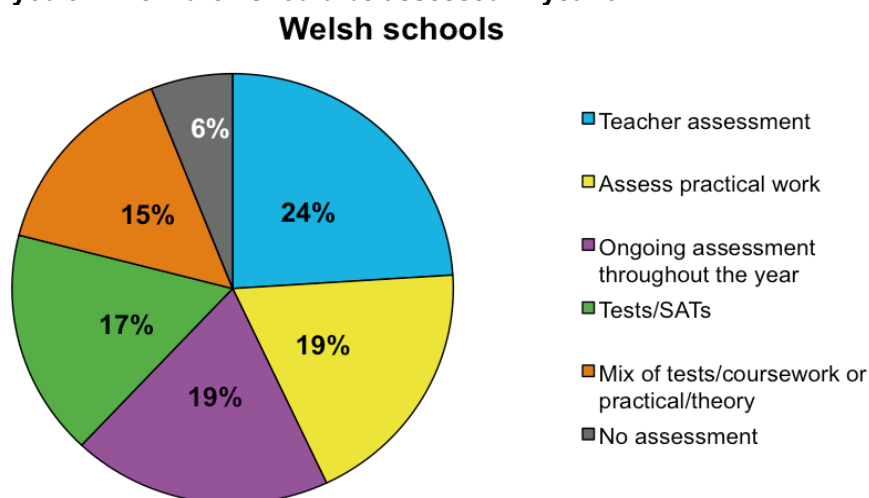
- How to assess
- When to assess
- Why assess.

## 6.2 Parents' ideas for improving Key Stage 2 science assessment

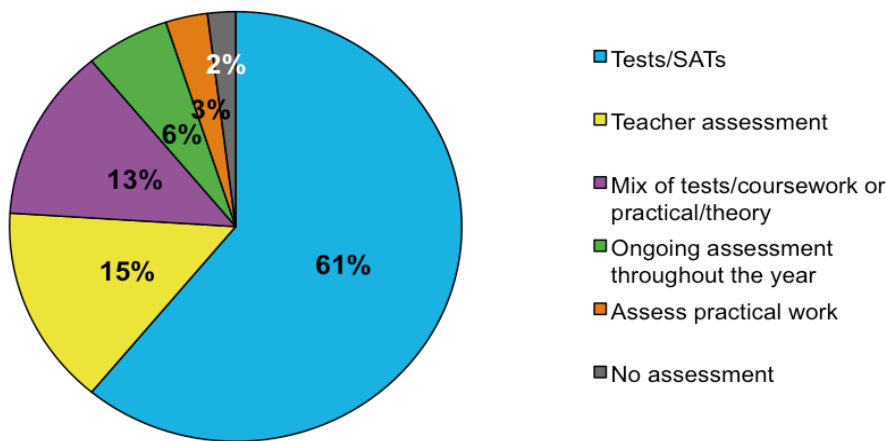
The parents of children in English and Welsh schools were asked to suggest how they think children should be assessed in science in year 6. An interesting difference was observed from parents of children in English and Welsh schools, which tended to reflect how the children were assessed currently. The majority of parents from English schools favoured SATs and other tests, whereas the responses from Welsh school parents were more diverse, with no one major approach being favoured (Figure 6.2).

**Figure 6.2: Responses from parents of children in English and Welsh schools on how to assess science in primary school**

**How do you think children should be assessed in year 6?**



### English schools



The ideas suggested by parents were similar to some of those of the children, as illustrated by a selection of quotes (overleaf) from parents' open responses in the questionnaire to an item asking how they think children should be assessed in science at KS2. However, there were no comments directly relating to children enjoying assessment, oral assessment or children's choice in how they are assessed. The following are representative comments from the categories above:

### How do you think children should be assessed in science in year 6?

#### TESTS/SATs:

*"SATs or equivalent examination, ideally externally audited"* (parent, English, year 6)

*"As a preparation for secondary school, it would be useful to have an end of year exam. So maybe SATs should stay"* (parent, English, year 6)

*"I do not agree with the abolition of SATs in science. I do think it is an important subject and part of daily life so some kind of testing should be done"* (parent, English, year 6)

*"Test and exam"* (parent, English, year 7)

*"By using tests and marking them"* (parent, English, year 7)

*"Test that is independently marked. This will give parents guide as to which school is doing well"* (parent, English, year 7)

#### TEACHER ASSESSMENT:

*"Teacher assessment over the year"* (parent, Welsh, primary)

*"Teacher keeping a general eye on pupil's abilities. Obviously if extra help is needed"* (parent, Welsh, secondary)

*"Teacher assessed"* (parent, Welsh, year 7)

#### ONGOING ASSESSMENT THROUGHOUT THE YEAR:

*"Through continuous assessments through school year"* (parent, Welsh, primary)

*"They should be assessed on their work throughout the year"* (parent, Welsh, secondary)

*“Assessment throughout the year”* (parent, English, year 6)

#### **MIX OF TESTS/COURSEWORK OR PRACTICAL/THEORY:**

*“Combined practical and theory without the child knowing it's a test”* (parent, Welsh, primary)

*“Coursework and occasional tests to get used to it and prepare for later exams, but no pressure”* (parent, Welsh, secondary)

*“Both tests and coursework throughout the year”* (parent, English, year 6)

*“Experiments and exam”* (parent, English, year 7)

#### **ASSESS PRACTICAL WORK:**

*“On practical rather than theory work”* (parent, Welsh, primary)

*“I think children in year 6 should be assessed by hands on science”* (parent, Welsh, year 7)

*“On completing physical work rather than just written work”* (parent, Welsh, year 7)

#### **NO ASSESSMENT:**

*“Do not think any formal assessment is necessary in primary school”* (parent, Welsh, year 7)

*“No requirement”* (parent, English, year 6)

### **6.3 Stakeholder seminar: addressing children's ideas in terms of desirability and feasibility of implementation**

The participants at the stakeholder conference looked at the children's ideas on how they might assess science if they were primary school teachers. We selected the 22 most representative ideas from children. Different small groups ranked these ideas in terms of desirability and feasibility for implementation into primary practice. There was much discussion during this activity between and within groups. Indeed, there was some disagreement about actually ranking these ideas at all. Some groups preferred to classify ideas in categories, as opposed to ranking them. From the data we had available for ranking, we attempted to pool the rankings from the groups in terms of desirability and feasibility. The most popular ideas for desirability (not worrying about how feasible their implementation might be) were:

- Do investigations, present work and let the class ask questions.
- Listen to children's ideas about science and assess them.

The same two ideas from the children were also shown by the pooled rankings to be the most popular among stakeholders in terms of feasibility for implementation.

We present these findings most tentatively because of the lack of engagement of some participants in the process of ranking in the manner we had suggested.

One group wished to change the entire exercise, which may have provided a useful approach but made it more difficult for us to generate the data as we had intended (to plot these ideas as a function of feasibility). However, even though we did not have sufficient data for the plot, all groups had included these two ideas amongst most favourable in terms of both desirability and feasibility. What is interesting to note is the positive reaction towards listening to children's ideas about science and assessing these ideas. It is not known whether this finding might be similar if the children's ideas had been presented in a context which did not focus on children's voice in relation to science assessment at KS2.

#### **6.4 Summary of main findings related to improving KS2 science assessment**

From these sources, the most popular ideas to emerge from a synthesis of all the comments and categories analysed by the researchers, CRAGs, stakeholders and those given by the parents were related to *when* and *how* children were assessed on their science learning in year 6.

There was a strong feeling that end-of-topic as opposed to end of year testing was preferable. CRAG children, when interpreting this finding, suggested that end of year tests meant that they had to mix everything they had done, whether it be in one subject or, in the case of SATs, they were having to mix together all the learning in science, English and maths. They talked about end of topic tests acting as both summative and formative assessments, in that they could find out about how well they knew a topic, as well as finding out how much more they needed to go over before they were ready to move on to the next topic. Teachers could keep records of these test marks and track a child's progress throughout the year, and combine this with their progress on non-test assessments.

Non-test assessments were very popular suggestions by children. They suggested that being assessed on investigation work, including group assessment, would be a fairer way to provide an indication of progress than by tests alone. They expanded on this suggestion by explaining that some children were better at oral presentation of their ideas than writing them down. Such children would be able to gain marks for this work which might be denied to them if only written testing was performed. Some also suggested group assessments, in which different members of the group could 'showcase' the way of expression that best suited their skills: some might express their scientific ideas best via diagrams and drawings, others as role-play, models, 'inventions', PowerPoint presentations, etc. Children advocated that an element of enjoyment should be an integral part of their assessment in science, which would make it motivating. Some children also indicated that assessment of science should involve choice, such as whether they should do a test or a presentation.

Parents' views reflected the system that they were in, insofar as many from England favoured SATs-type testing and were disappointed by the abolition of science SATs. A smaller proportion of parents from England suggested that the best way to assess children was continuous throughout the year and included assessment of practical work. None of the Welsh parents mentioned science SATs as a good way to assess year 6 children. They favoured the current system

of teacher assessment and a few highlighted the importance of not putting too much pressure on children when they are being assessed; some suggested children should not know when they are being assessed. However, no parent included suggestions that children's science assessment should be enjoyable, or that children should be able to exercise a certain amount of choice in the way they are assessed.

The participants at the stakeholder seminar looked at the children's ideas on how they might assess science if they were primary school teachers. The most popular ideas for desirability (not worrying about how feasible their implementation might be) *and* for feasibility were:

- Do investigations, present work and let the class ask questions.
- Listen to children's ideas about science and assess them.

## **7. Discussion, Conclusions and Recommendations**

### **7.1 Introduction**

The project set out to provide data to help answer three research questions:

- What are the key issues arising from pupils' and parents' experiences of and attitudes towards testing and assessment of science at Key Stage 2 in England and Wales?
- How do pupils and parents perceive that science assessment at Key Stage 2 can be improved?
- What recommendations can we make, based on the findings of this study, which can usefully inform policy makers in their drive to improve science assessment at Key Stage 2?

This chapter considers critically the findings and their implications in terms of the issues surrounding data interpretation and the abolition of science SATs in England, which occurred during the data collection phase of the project.

The main part of the research with children comprised the design, administration and interpretation of findings from an online questionnaire. We adopted a specific methodology for working with children (see chapter 4 for details) which was designed to ensure that the research process was compliant with international children's rights standards on children's participation. We felt that our approach, in which children were subjects, as opposed to objects, of the research helped us to reflect more faithfully the children's perspectives in relation to science assessment at Key Stage 2 (year 6). The methodology used to access children's perceptions and ideas empowered children to voice informed, considered and reflective views about science assessment at KS2 (year 6). Children valued the space to express their views, seeing a range of other children's opinions, being listened to and the assurance that their opinions will be passed on to Government policy makers in England and Wales. Children's comments and ideas about science assessment at KS2 (year 6) were incisive, creative and constructive. The children participating in this research provided a legitimate, important perspective on issues relating to their education.

The parental survey was carried out via a paper-based questionnaire, which was sent to the parents of each child taking part in the online survey. We considered that the responses to this survey could potentially derive from some discussion between parent and child in relation to the issue, since both were invited to participate.

The next sections provide an overview of some of the main findings in relation to the three research questions and the implications which may be drawn from them.

### **7.2 Key issues surrounding pupil's and parents' attitudes to and experience of science assessment at Key Stage 2**

#### **Attitudes to KS2 science and its assessment**

Most children (almost 90%) indicated at least a low level of enjoyment of school science and most parents agreed that science should be a core subject in primary school. As might be expected, children who enjoyed science more were more positive about the usefulness of KS2 (year 6) science assessment compared with those who did not enjoy science. Also, children who perceived that they were better at science were more positive about the usefulness of KS2 (year 6) science assessment than those who felt they were not good at science. Children's generally positive attitude towards school science was an encouraging finding, but we also detected a statistically significant decline in interest in science observed as children moved from year 6 into year 7. A decline in positive attitudes to science between primary and secondary school has been well documented (for example: Braund and Driver, 2002; Jarman, 1997; Donnelly, 2001). Children's and parents' views of *science assessment* at KS2 (year 6) in relation to its usefulness were also largely positive. More than 90% of children agreed that science assessment was useful. It could be argued, therefore, that it is not KS2 (year 6) science assessment *per se* that puts children off science; it could be due to a combination of factors in year 7 and/or transition into year 7. We feel that a similar study to the current project may help to identify what it is that causes the downturn in many children's interest in science after they start secondary school. That is, a study which foregrounds giving children an informed voice and enables them to reflect on issues before they express their views.

Nearly half of the children in English schools (44%) and a quarter (26%) in Welsh schools found that science assessment helped them enjoy science. It could be the case that tests can make them learn more and give them a boost. More than half of the children in England (51%) and a third of the children in Welsh schools (33%) found that science assessment made children want to learn more about science. The latter finding was interpreted differently by the children's research advisory groups (CRAGs) compared with the researchers' interpretation. The CRAGs suggested that 'wanting to learn more science' indicated the pressure to do better in the next test, whereas we (the researchers) suggested it might motivate children to learn more about science topics. **Such a difference in interpretation is an example of researchers perhaps using their own lens to interpret findings in a way which does not sufficiently take the children's perspective into account.** We would emphasise the importance of including research participants in the interpretation of findings, especially when the research involves children.

Children's perceptions of the usefulness of different types of assessment for finding out how well they were doing in science indicated that they thought the best ways were *non-SATs* tests and teacher assessed science work. Indeed, children's preference for non-science SATs tests as the best way for determining their progress in science was consistent for *all* groups (England and Wales, enjoy/not enjoy science, perceive themselves as good/not good in science). They did *not* find that doing SATs practice papers in school was beneficial, despite the fact that 53% of children in schools in England and 14% children in Welsh school reported that they did practice SATs papers 'very often' in school. Children were slightly more positive, however, about the usefulness of doing SATs practice papers at home. This finding would suggest that the emphasis on revision via intensive completion of SATs practice papers in school may not be the most ideal



way for children to gain insight as to how well they are doing in science. We would suggest that evidence for learning in science could be better derived from special tasks, including non-SATs tests, embedded into normal science class work (see section 7.3 for children's and parents' ideas for improving KS2 science assessment).

### **Experience of KS2 science assessment in school**

Children's perceptions of their experience of science assessment at KS2 (year 6) reflected the assessment system of their country. Children from English schools, where the main form of science assessment was SATs tests, said they spent more time on revision and less time on experiments and computer work than children in Wales, where SATs tests were abolished in 2004. However, science SATs in England were discontinued during the months in which data collection was being carried out for the current project, so the cohort of year 6 (primary) children in this study represents the last group of children to complete science SATs in England.

There was a significant finding relating to how KS2 science is viewed by children in relation to its importance. In both England and Wales, children indicated that they spent less time revising for science than for English or maths, and that science was less important to the school than English or maths.

Children's experience of assessment for learning (AfL) seemed to indicate that AfL approaches were used more extensively in English than in Welsh schools. The specific approaches we looked at were: discussion of WALT (we are learning to...) and WILF (what I'm looking for), self assessment and peer assessment. However, it could be the case that children in England were more aware of the terminology and that AfL might have been addressed more overtly in English schools. A survey of AfL approaches in schools across the UK might provide interesting data in relation to the use of AfL approaches in schools. Another AfL approach which has been emphasised in the literature (Black & William, 1998) is comment-only marking. Our findings showed that children and parents both valued a mark *and* a comment more highly than mark-only or comment-only marking. The full sample of children indicated a preference for mark-only over comment-only marking, but this trend did not hold for groups of children who perceived they were good/not good at science. Children who said they were not good at science were more positive about comment-only marking when compared with mark-only, especially when relating to which was best to show how they could improve in science. The implication of this finding is that children could be consulted more about how their science work is assessed, particularly those children who perceive themselves as not good at science. It could be the case that they might benefit more from comments from the teacher on their work.

### **Impact of KS2 science assessment on home and family**

The data for impact of KS2 science assessment on friendships and home lives was drawn from children's responses to the open question, which contained some views provided by children in the CRAG groups to aid children's reflection on the issue prior to expressing a view (please see questionnaire, Appendix 1). This question generated the highest response of all the open questions in the

questionnaire (96% of children responded). Children's individual responses to this question were also more extensive than those of all other open questions in the survey instrument (the average word count was 19, but some were in excess of 100 words). We identified a largely negative impact of KS2 science assessment on children's friendships and home lives in their open responses to this question. The negative response was more marked for children from English schools (72% of comments were classed as negative, 11% no effect and 17% positive) than those from Welsh schools (47% negative comments, 29% no effect and 24% positive). This finding alone provides grounds to support the abolition of science SATs, although we cannot be sure whether, in their responses, children from English schools might have been responding to SATs as all SATs, not just science. However, the negative impact of science assessment experienced by children in England and Wales was not consistent with their positive responses to the usefulness of school science assessment; children in England were more positive than those in Welsh schools about school science and its assessment but more negative about its impact on their friendships and home lives. We could tentatively suggest that children might be expressing compliance when responding about their school experiences and more spontaneous when reflecting on their friendships and home lives. Again, it is the case that more consultation with children can help us to improve their own and teachers' experience and performance in relation to assessment and its impact.

Parents were not as negative as children about the impact of science assessment on children's home lives. Focus group discussions involving children and their parents together might provide a valuable insight into the impact of science assessment on children and their families at home and in school. A lot of children mentioned negative emotions such as stress and nervousness as their reaction to science assessment. Many spoke of being made fun of or bullying if they get lower marks than their friends; some talked of assessment causing break-ups between friends. Others felt that if their marks were high, friends might get jealous and not wish to be friendly with them anymore. Some wrote about feeling significant pressure from home, be it siblings or parents. A large proportion of children indicated that poor performance at tests had a negative impact on their self-esteem; a small proportion noted a negative effect of getting high marks on their self-esteem due to being ostracised by those who were in competition with them.

It is difficult to make solid conclusions from the data relating to the impact of KS2 science assessment on children's well-being. Their responses may address assessment in general and not just in science. However, the extent of the response (96% of children responded to this item) and high word length of many individual responses indicates that children were very interested in responding to this question. Such a question does not appear on many primary science survey instruments. The implications of this finding are that teachers and parents could help children a lot by discussing the impact of different methods of assessment on their friendships and home lives. It could be the case that if *non-SATs* science tests, which children indicate are the best way for finding out how well they are doing in science, were used frequently as formative and ipsative assessment, there might not be as negative an impact of KS2 science assessment on children's friendships and home lives.

## Abolition of KS2 science SATs

We sought the views of children and parents from English schools about the abolition of the SATs. The majority of children in English schools *did not* agree with the abolition of science SATs. Their reasons included a concern that they would not learn as much science, they would not know their levels in science, that SATs are a good preparation for secondary school and that science will become less important in school without SATs. Children who agreed with the abolition of science SATs cited reasons including reduced stress and pressure on children, better learning and teaching in science and more time for other things. Parents of children in English schools indicated a level of apprehension about the abolition of SATs, citing reasons similar to those of the children. Some were concerned about a possible decline in the perceived importance of science as a school subject at primary level. Parents from Wales, however, where SATs were abolished in 2004, were much more positive about abolishing SATs. Welsh parents indicated that children enjoy science more and learn more science without SATs and that the change from SATs for science assessment has been for the better. They also felt that prior to 2004, SATs were a lot more 'low key'. In the five years since their abolition in Wales, SATs have become more prominent in the media. Collins et al. (2008) reported that Welsh teachers felt that the abolition of SATs in Wales had had a positive effect on science teaching. It could be suggested that the higher level of negative impact of science assessment on children from English than Welsh schools reported in this study could be a consequence of SATs testing in England.

The science SATs were abolished during the data collection phase of this study, resulting in a delay of data collection from children in English schools until the media coverage had died down. It could be the case that children and parents from English schools were responding to the abolition of science SATs before they had considered the full implications. For instance, we detected some children's responses that indicated that they might be considering that the abolition of science SATs was the same as the abolition of science assessment *per se*. Some of the parents' responses indicated a similar concern, to a lesser extent, that abolition of SATs would lead to less science assessment at KS2.

### 7.3 Pupil's and parents' ideas for improving science assessment at Key Stage 2

Children and parents were invited to consider how KS2 science assessment might be improved. Children's reflections on how they might assess children if they were a year 6 teacher were enhanced by the provision of some views from the children's research advisory groups (CRAGs) as part of the item (please see children's questionnaire in Appendix 1).

Children's and parents' ideas for improving KS2 science assessment suggested that assessment should be designed to motivate science learning by employing a variety of approaches, including *non-SATs* tests, which allow for choice and have a strong emphasis on investigative work. Such assessment would be embedded into their 'normal' science work, without the stress and intensive repetitive practices in preparation for national tests.

The responses from children included some very carefully thought-out schemes, which addressed some of the views from the CRAG children that had been presented in the questionnaire. Such views had been expanded upon and extended to include other approaches (please see section 6.1 for details). The top two categories of children's ideas for improving assessment were: 'assessment of science investigations such as research projects and presentation of findings' and 'end of topic, as opposed to end of year, tests'. These two categories covered responses from 55% of the children in Welsh schools and 43% of the children in English schools. The next two most popular ideas were that assessment should include support for children and also give credit for 'inventions'. A small proportion (6%) of responses indicated a preference for oral testing and some children (3%) said that they would include pupil choice in their assessment scheme.

A summary of the children's ideas for how they might assess children in KS2 science is presented in Table 7.1. Participants at the stakeholder seminar considered how these ideas could best be operationalised in terms of feasibility and desirability of implementation. They selected two ideas which they considered most feasible and most desirable, as indicated by the shaded sections in Table 7.1. Their selections fit well with the rest of the findings of this project in that these ideas both correspond with embedding science assessment into normal classroom practice and listening to children's ideas about science. The latter idea could be extended to listening to children's ideas and needs in relation to science assessment, so that assessment of their science knowledge and understanding more accurately reflects their progress.

**Table 7.1: Summary of children's ideas for assessing science (the two shaded ideas were considered the most desirable and feasible by participants at the stakeholder seminar)**

Assess/test at the end of each topic	Put all science tests/projects together from a year's work and give a grade
Teachers to let children know they're doing their best for them	Assess after every 2/3 topics and then at the end of the year
Groups do projects and present to class	<u>Do</u> rather than write up experiments
Assess a child's understanding of science via their own project	Do investigations, present work and let the class ask questions
Research a topic and get marks for it	Assess more science homeworks/projects
Give and mark tasks instead of tests	Play games and do little tests on them
Enter children in science competitions	Let children learn from their mistakes
Make assessment fun	Assess their <u>attitude</u>
<u>Listen</u> to children's ideas about science and assess them	Do part writing, part speaking as a test
Teacher practice with them and revise with them	Oral tests/questioning for children who are not good at writing down
Give each child targets - let the <u>child</u> say what difficulties they have	Tests and assessments, but not <u>too many!</u>

Parents' ideas for improving assessment of science at KS2 (year 6) closely matched those from children, although they were largely limited to one or two short sentences. We observed (from the written responses) that there appeared to be many non-first language English speaker parents in our sample. The total parent sample only constituted about 30% of those invited to respond and it could

be suggested that some parents may not have responded because their English language skills may not have been at a level required for completion of the questionnaire. We therefore conclude that the parental views may not reflect accurately those of non-first language English speakers.

Parents from Wales chose teacher assessment of children's work as the best way to assess them in science; parents from England chose SATs. Parents' ideas for ways to assess children were largely similar to those put forward by the children, but no parent suggested that assessment should be fun or that children should have choice.

Overall, the suggestions given by participant children and parents, researchers, CRAGs and other stakeholders to improve science assessment at KS2 were consistent with ideas for good science assessment practice identified in the literature review section of this study (see Table 7.2). We feel that children's and parents' views are expressed as goals for effective assessment and that they reflect a desire for science assessment to be geared more towards helping children learn science and less at providing data for judging teachers and schools.

**Table 7.2: Relationship between children's and parents' ideas for good assessment and good practice identified in the literature**

Suggestions from this project	Suggestions from the literature
<p>Non-test assessment of science including assessment of investigations, inventions and projects where children are involved in research, presentations and competitions</p>	<ul style="list-style-type: none"> <li>• Use of numerous different sources of evidence for science assessment including:               <ul style="list-style-type: none"> <li>- children's oral responses and written work as evidence for assessment (Dudley and Swaffield, 2008)</li> <li>- questioning, observing, children's drawings and writings, concept maps, concept cartoons, 'eavesdropping' (Harlen and Qualter, 2009)</li> </ul> </li> <li>• A teacher's goal can be to assess skills of investigation (Harlen, 2008)</li> <li>• National testing has inhibited the development of children's knowledge and understanding, in particular the development of inquiry skills (Collins et al., 2008) - these should be part of assessment</li> <li>• Making school science more applied to real life and involving children in raising questions and carrying out investigations could form the basis of assessment programmes (Murphy and Beggs, 2005 - for the Wellcome Trust)</li> <li>• Primary science assessment programmes should be reworked to ensure that children's scientific thinking and how they can relate science to their everyday lives forms the basis of what is being tested (Murphy and Beggs, 2005 - for the Wellcome Trust)</li> </ul>
<p>A mixed approach of non-test assessment and end of topic tests</p>	<ul style="list-style-type: none"> <li>• Combine various ways in which evidence is collected (Harlen and Qualter, 2009)</li> <li>• Use various ways of interpreting and reporting (Harlen and Qualter, 2009)</li> <li>• Summative assessments can be used formatively (Harlen and Qualter, 2009)</li> <li>• A previous report for the Wellcome Trust recommended that "national tests should be replaced by moderated teacher assessments" (Wellcome Trust, 2008, p. 3)</li> </ul> <p style="text-align: right;">} Harlen and Qualter (2009) argue that using these two approaches will create different methods of assessment</p>
<p>Sharing and helping by the teacher. Children sharing and helping each other</p>	<ul style="list-style-type: none"> <li>• Use a range of assessment data, not just figures and numbers, to personalise learning (Dudley and Swaffield, 2008)</li> <li>• A teacher's goal can include "understanding to be developed" (Harlen, 2008)</li> <li>• Children have a role in assessment (Harlen and Qualter, 2009)</li> <li>• Use of peer and self assessment when clear and explicit criteria are given for evaluating learning achievements, when peer assessment is used to help the objectivity required for self assessment and when students are encouraged to bear in mind the aims of their work and to assess their progress to meet these (Black, Harrison, Lee, Marshall and Dylan, 2003)</li> <li>• Assessment can help create formative 'lessons'. Black et al. (2003, p. 65) defined formative 'lessons' as those which create opportunities for students to reveal their own understanding of the criteria for</li> </ul>

	<p>success to their peers and then to improve it.</p> <ul style="list-style-type: none"> <li>• Involving children more should be a goal to form the basis of assessment programmes (Murphy and Beggs, 2005 - for the Wellcome Trust)</li> </ul>
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To conclude, this report and its findings can be considered in light of values relating to children, their learning and their assessment. In carrying out this project, the research team worked with four children's research advisory groups (CRAGs), each comprising eight children in the design of the questionnaires and their interpretation, and two classes of about 30 children each for piloting the questionnaires. Consulting with these children demonstrated that perhaps their voice has been undervalued and ignored to date in decisions made about many aspects of their learning. It was a privilege and learning experience to engage closely with their views about their learning and assessment and how these can be improved. It also made us realise that we need to hear their interpretation of what and how they learn in order to enhance our work with them, within and beyond the classroom. We discovered instances in informal discussions with children in the CRAGs which illustrated differences between what we thought children might benefit from and their actual experience. O'Connor (2009) also reported a mismatch between children's experience and teachers' ideas of what they like best in relation to AfL approaches. We would emphasise the value of 'radical listening' (Kincheloe, 2008) to children as a way to greatly improve our work with them in schools. They provide a valuable, legitimate and important voice, which can serve to benefit schooling in the UK, Ireland and beyond.

## 7.4 Recommendations

### Policy makers

1. Children should be consulted about decisions that are being made about their learning and assessment. They provide a legitimate, important perspective which can serve to improve policy and practice.
2. The Wellcome Trust should try to represent the voice of the children, as expressed in this report, in its dealings with policy makers in relation to KS2 science assessment.
3. Policy-makers in England should also consult with Welsh colleagues in formulating policies and procedures for post-SATs science assessment. Welsh parents indicated that science learning and teaching have improved since SATs were abolished there in 2004.

### Curriculum developers, advisers and teachers

4. Science assessment at KS2 should be embedded in normal science class work and should include the use of end-of-topic, as opposed to end-of-year, testing. It should cover a range of sources of evidence from practical, oral and written work, and should focus on the understanding of science as opposed to knowledge recall.
5. KS2 science should be linked with children's everyday experience, their learning in other subject areas, and with the world of great science achievements and wonders. Children should be excited by school science and assessment should increase their motivation to learn more.

6. Teachers need to be guided in relation to communicating with children about the impact of completing assessments on their friendships and home lives to ensure that the experience is as positive as is possible.

### **Researchers**

7. Ideas for assessment of science at KS2 presented by children, parents, other stakeholders and researchers in this study, particularly in relation to consulting with children and embedding assessment in normal classroom practice, should form the focus of intervention studies. A rigorous evaluation of the effects of such interventions could be completed using a randomised controlled trial whereby children are randomly allocated to an intervention or control group and the resulting outcomes data compared.
8. Research using a children's rights approach should be pursued to explain the decrease in popularity of STEM subjects in early secondary school and suggest ways to reverse this trend.



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## 9. Appendices

### 9.1 Appendix 1: Children's Questionnaire



We are trying to find out what you think about primary science assessment and how to make it better.



Watch the video below to find out more about this research project:



This box is shown in preview only.  
These actions will take effect for the following alternatives:  
no | <no end

Now that you know what the questionnaire is about, click 'yes' if you want to continue and 'no' if you don't.

Remember there are no right or wrong answers and this is not a test. It is about your opinions and these will help make science better in primary school. Your answers will be anonymous - that is, your name will not be on the questionnaire. No one will know how **you** answered.

If you click 'yes' your ideas will be sent to the university research team along with those of all the other children who take part.



yes  
 no

Next >>

6 % completed

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PREVIEW

ENGLISH primary

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Please enter your school code

---

<< Back | Next >>


11 % completed

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PREVIEW

ENGLISH primary

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Before we start the questions we would like to find out a little bit more about you.

Are you a boy or a girl?

boy  
 girl

---

Which of these words describes you?


White  
 chinese  
 black African  
 black Caribbean  
 black other  
 Indian  
 Irish  
 Pakistani  
 Bangladeshi  
 Japanese  
 Other  
 Mixed race

---

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What is your favourite subject in primary school?

---




Do you enjoy **science lessons** in school?

yes- a lot  
 yes- a little  
 no

---

Which of these science things **outside school** do you enjoy?



You can choose as many things as you like

- watching science TV programmes
- going to science exhibitions
- science clubs
- playing with chemistry sets
- nature walks
- mini experiments
- science projects
- science homework
- none of them

---

How **good** do you think you are at science?

very good  
 ok  
 not good

---

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## BRAINTASTIC SCIENCE SURVEY

### 1. About science lessons in your school



#### a) What do you do most in science lessons?

You can choose up to 3 boxes from the answers below.

- using the interactive whiteboard  
 revision  
 watching teachers do experiments  
 doing experiments yourself  
 using computers  
 writing up experiments

#### b) Do you do the activities below in science lessons?

	yes-a lot	yes-a little	no- never
learn science outdoors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
using stories to teach science	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
drama and role play	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
science games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
field trips	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### c) How do you mostly work in science in school?

You can choose only one answer.

- on your own  
 in pairs  
 in groups  
 as a whole class

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## BRAINTASTIC SCIENCE SURVEY

### 2. Comparing science, English and maths assessment



#### a) Which subject did you spend the most time preparing for in year 6?

- maths  
 english  
 science

#### b) Which SATs were the most difficult in year 6?

- maths  
 English  
 science

#### c) Which subject do you think was the most important to your school?

- maths  
 English  
 science


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PREVIEW

ENGLISH primary



The rest of the questions are about how science is assessed in primary school.


Assessments are used to look at how you are doing in science. You can be assessed through things like **tests, level assessments, homeworks, projects, investigations etc.**

Click on the 'Next' button to continue.

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**3. Your experience of science assessment**

**a) How often do you do each of the following in school?**



	very often	sometimes	never
science SATs practice papers in school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
science SATs practice papers at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
other science tests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
science work that's marked by your teacher	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>


**b) Which one do you think is the best for finding out how well you've done in science?**


- Select answer -

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**c) How often are the following used in your school science lessons?**

	in most science lessons	in some science lessons	never in science lessons
discussion of W.A.L.T. 'We are learning to...'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
discussion of W.I.L.F. 'What I'm looking for...'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
self assessment e.g. you decide how well you are doing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
peer assessment e.g. pupils decide how well classmates are doing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**d) How often do you get...**



	very often	just sometimes	hardly ever	never
both a mark and a comment for your science work?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
just a mark (without a comment)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
just a comment for your science work (no mark)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**e) Which is the most useful for finding out how well you've done in science?**

- Select answer -

**f) Which is the most useful for showing you how you could improve in science?**

- Select answer -

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**We asked some children what they thought about science SATs.**



**Read what they said and for each one click whether you agree or disagree with their view.**

**g) "If there were no SATs, we might not all learn about the same things in science"**

agree  disagree  neither agree or disagree

**h) "If there were no science SATs, school would be more fun"**

agree  disagree  neither agree or disagree

**i) "Science SATs decide in a fair way who's good at science"**

agree  disagree  neither agree or disagree








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**BRAINTASTIC  
SCIENCE SURVEY**

j) We asked some children how they felt when they were doing science SATs in primary school.

Here's some of the words they used

happy 	frustrated 	worried 
nervous 	stressed 	confident 
bored 	calm 	excited 

Use these words to help you answer the next question.

Which word best describes how you felt about doing science SATs in primary school?  
You can choose a word from the list above or you can choose your own word. Please write one answer.

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**PREVIEW**

ENGLISH primary

**BRAINTASTIC  
SCIENCE SURVEY**

4. Science assessments and you




a) How do you think doing science assessments affected your confidence in science?

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We asked some children if doing science assessments helps them enjoy and learn more about science.

Read what they said and for each one click whether you agree or disagree with their view.

b) "When you're assessed on topics you're good at and like, you enjoy it more"



agree  disagree  neither agree or disagree

---

c) "If your grades keep slipping down you get annoyed with science and can't be bothered anymore"

agree  disagree  neither agree or disagree

---

d) "Sometimes you're frustrated doing assessments but then when you do well you feel proud and want to learn more"

agree  disagree  neither agree or disagree

---

e) Do science assessments in school help you enjoy science?

yes  
 no  
 not sure

---

f) Do your science assessments in school make you want to learn more about science?

yes  
 no  
 not sure

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**BRAINTASTIC  
SCIENCE SURVEY**

We asked some children about how doing science assessments in primary school affects their friendships and family life.



Here's some of the things they said.

"It can get really competitive, some people want to do better than their friends"

"If you get a lower mark than your friend it can make you feel sad"

"It makes no difference to my life at all"

"Revising for assessments means you have less time to play or even talk to your family"

"Sometimes parents put pressure on you to do well in science"


---

g) How do science assessments affect your **friendships** and **home life**?


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### 5. Usefulness of primary science assessment



**We asked some children about how useful it is to be assessed in primary science. Read what they said and for each one click whether you agree or disagree with their view.**

**a) "Science assessments help you see how good you are at science"**

agree  disagree  neither agree or disagree

---

**b) "The assessments can motivate you - make you want to try to do better"**

agree  disagree  neither agree or disagree

---

**c) "Too much money is being used for assessments, it would be better used for teaching"**

agree  disagree  neither agree or disagree

---

**d) "Doing assessments in school gets you used to doing them for secondary school"**

agree  disagree  neither agree or disagree

---

**e) How useful do you think science assessments are for children?**

Very useful  Useful  A little useful  Not useful at all

You can explain your answer in the box below

---

The Government has recently decided that there will be no more SATs in science.

**f) Do you think this is a good idea?**

yes  no  not sure

You can explain your answer in the box below

---

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**BRAINTASTIC  
SCIENCE SURVEY****6. Your ideas**

We asked some children to imagine they were a primary school teacher and to tell us how they would assess science, now that SATs are gone. Read their ideas below.



**Sam:** "You should get assessments at the end of each topic. It's too hard to remember everything for one big test."

**Kim:** "I find it hard to write things down. You should be able to just say your answers out loud to your teacher instead."

**Alex:** "It would be good if you could do an investigation and then present your work and then get asked questions about it."

**Jo:** "You should be able to invent things- make it more like a science competition."

**Pat:** "I'd like to do research for a project and get marks for that."

Now imagine you are a primary school teacher. How would you assess science?

Write your ideas in the box below. You can use some of the ideas from the children above, or your own ideas or a mixture of both!



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**7. About the questionnaire**




**a) What do you think is the best way to do questionnaires with children?**

in an online questionnaire like this one  
 in a paper questionnaire that you fill in  
 someone reads the questions and fills it in for you

---

**b) In this questionnaire you got to read some other children's views on the issues. Did you find this.....**


very useful?  
 quite useful?  
 not useful?

---

**c) Have you any other comments about the questionnaire? Please tell us below.**

94 % completed

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You can now hit **"Send"** and your ideas will be sent to the university research team who will put them together in a report for Hannah at the Wellcome Trust.

**Remember, your answers are anonymous** - that is, your name is not on this questionnaire. No one will know how you answered.

We will send summaries of the questionnaire results to all the schools who have taken part in July.

100 % completed

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PREVIEW

\*\*\*\*\*Thank you, well done!!!\*\*\*\*\*

Your answers have been sent ;)

You can **log off** your computer now

**OR**

if you're finished early you can click on the link below to play some science games:

<http://www.bbc.co.uk/schools/ks2bitesize/science/>

Powered by QuestBack - <http://www.questback.com> - "Ask & Act"  
[Tip & Trick](#) about QuestBack

## 9.2 Appendix 2: Parent Questionnaire



### Parent questionnaire (England)

# Attitudes of Parents and Pupils to Science Assessment

#### Background Information:

##### Please tick:

1. Male  Female
2. Number of children who are aged 12 or older:
3. Number of children who attend primary school:
4. Are you a teacher? Yes  No

#### Science in primary school:

5. Do you think science should be a core subject in primary school?  
Yes  No  Not sure
6. Do you think children will enjoy science more since the SATs have just been abolished?  
Yes  No  Not sure
7. Do you think children are learning more of less science since the abolition of SATs?  
More  Less  Same  Not sure

#### Impact of science assessment:

8. How do you think science SATs at the end of primary school impact(ed) on your child's school life?

9. How do you think science SATs at the end of primary school impact(ed) on your child's home life?

10. Do you think the abolition of SATs will change how science is taught?

Yes  No  Not sure

If so, will this be better?

Yes  No  Not sure

**Key Stage 2 science assessment – feedback:**

11. When you get feedback about how your child is doing in science, what type do you prefer?

Both a mark and a comment about their science work

Just a mark (without a comment)

Just a comment about their science work (no mark)

**Key Stage 2 science assessment – criteria for school choice**

12. To what extent did you use the SATs results (league tables) for particular schools when deciding which secondary school you would like to send your child to?

I based my decision solely on the secondary school's SATs results

I used the SATs results as one of my criteria

I did not use the school's SATs results

If you did not use the secondary school's SATs results when deciding what school to send your child to, what criteria did you use?

13. What criteria will you use in the future, now that SATs have been abolished?

14. How do you think children should be assessed in year 6?

15. Any other comment?

© Thank you for completing this questionnaire ©

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