Under the Microscope

The State of Resourcing of Practical Science in Primary Schools in England

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Acknowledgements

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# Glossary

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<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academy</td>
<td>Publicly-funded school with freedom from Local Authority control</td>
</tr>
<tr>
<td>ASE</td>
<td>Association for Science Education</td>
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<tr>
<td>CLEAPSS</td>
<td>Advisory service providing support in science and technology</td>
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<tr>
<td>CPD</td>
<td>Continuing Professional Development</td>
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<tr>
<td>Edubase</td>
<td>Database of educational establishments across England and Wales</td>
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<tr>
<td>FSM</td>
<td>Free School Meals (one of the indicators of pupil deprivation)</td>
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<tr>
<td>IOP</td>
<td>Institute of Physics</td>
</tr>
<tr>
<td>NSLC</td>
<td>National Science Learning Centre</td>
</tr>
<tr>
<td>NQT</td>
<td>Newly Qualified Teacher</td>
</tr>
<tr>
<td>Ofsted</td>
<td>Inspection body for schools</td>
</tr>
<tr>
<td>PSQM</td>
<td>Primary Science Quality Mark (operated by the ASE)</td>
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<tr>
<td>PTA</td>
<td>Parent Teacher Association</td>
</tr>
<tr>
<td>Pupil Premium</td>
<td>Additional funding provided to schools by the Department for Education to support disadvantaged pupils</td>
</tr>
<tr>
<td>RS</td>
<td>Royal Society</td>
</tr>
<tr>
<td>RSC</td>
<td>Royal Society of Chemistry</td>
</tr>
<tr>
<td>SATs</td>
<td>Standard Assessment Tests given at the end of Years 2, 6 and 9</td>
</tr>
<tr>
<td>SCORE</td>
<td>Established in 2006 to together to tackle issues in science education</td>
</tr>
<tr>
<td>SDP/SIP</td>
<td>School Development Plan/School Improvement Plan</td>
</tr>
<tr>
<td>STEMNET</td>
<td>Science, Technology, Engineering and Mathematics Network providing resources for students, teachers and professionals</td>
</tr>
<tr>
<td>TA</td>
<td>Teaching Assistant</td>
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1. Executive Summary

This research has sought evidence about the nature of resourcing and funding of practical science in primary schools, in order to identify and understand the types of issues that may be encountered, and actions that may be taken to help remedy problems. This report presents the detailed findings of this research for primary schools in England. Findings in relation to secondary schools and sixth-form colleges in England are presented separately.

Evidence gathered from this research points to disparities between resourcing and funding levels between schools and within regions of England, contributing to variations in the practical science teaching and learning experience for pupils.

This report raises concerns about the levels of resourcing for practical science in comparison with the benchmark standards defined for the purpose of this research. In relation to schools surveyed for this research:

- The average primary school has only 46% of the equipment and consumables it needs to teach practical science;
- Less than 10% of primary schools have more than 80% of the science equipment and consumables they need to teach practical science;
- Almost three-quarters of primary schools have less than 60% of the science equipment and consumables they need;
- The average primary school rates its classroom facilities for teaching practical science at fractionally over 5 out of 10;
- Only 12% of schools would rate their classroom facilities for science at 8 out of 10 or higher;
- The average primary school rates its access to external learning environments at 6.6 out of 10;
- A fifth of primary schools rate their access to outside learning environments for teaching practical science at 8 out of 10 or higher.

Certain types of equipment appear harder to resource than others. Data loggers are by far the most sought after type of equipment, with 18% of respondents stating they would want these for their school. Maintaining sufficient stocks of items such as working batteries, torches, funnels, sieves, magnets and magnifiers are also issues for schools. Furthermore a lack of effective storage (cited as an issue by just over 19% of respondents) can act as a barrier for resourcing of science.

There is a lack of consistency between actual resourcing levels and teachers’ perceptions of what constitutes effective resourcing for practical science, suggesting that not all respondents have a clear understanding of what might be needed in their schools. For example respondents in the North East and West Midlands regions report high levels of satisfaction with resourcing levels – 70% are either very or quite satisfied in the North East and 79.2% are either very or quite satisfied...
in the West Midlands. However the average accessibility to equipment and consumables in full working order (37.9% of responses in the North East and 41.3% of responses in the West Midlands) does not reflect these relatively high levels of satisfaction.

Funding levels for resourcing practical science and the way in which monies are allocated to science also indicate that there are some issues. Over three-quarters of respondents (77%) do not currently allocate part of their science budget specifically to practical work. Schools can experience changes in funding levels from one year to another, which can act as an obstacle in relation to planning ahead for resourcing of practical science.

The average per capita spend on science for the academic year 2011/12 is £2.89. However there is considerable variation between schools, with per capita spend ranging from £0.04 to £19.08. Historically, budgets for science have increased from an average of £669.49 in 2009/10 to £856.82 in 2011/12. In spite of this overall increase, there are high degrees of variation between schools, with just over 40% of respondents reporting that their science budgets have either decreased or remained static over the past three academic years. In relation to schools surveyed for this research:

- Nearly a third of respondents (29.7%) report they are very or quite dissatisfied with the amount of funding available for science. Larger schools typically report higher levels of satisfaction with funding levels (over half of respondents that are very or quite satisfied compared with just over a third of respondents from medium-sized and smaller schools);

- The highest proportion of respondents that are very dissatisfied with funding levels come from small schools (38.7% of respondents are very dissatisfied compared with 29.6% of respondents from medium-sized schools and 20.4% of respondents in large schools);

- Qualitative feedback indicates that on average, teachers can spend approximately £20-25 per annum subsidising science resources, with less than 5% of respondents claiming this money back. A basic calculation indicates that in relation to this ‘hidden subsidy’, if 2 teachers per school in England each spent £20 of their own money per annum, this would equate to nearly three-quarters of a million pounds (£740,360).

Other drivers affecting resourcing of practical science include external factors such as diminishing support from Local Authorities (largely as a result of cuts to the Science Adviser role following the economic downturn) and the removal of science from the Standard Assessment Tests (SATs), both of which appear to have indirectly contributed to a reduction of status for science in some primary schools – with less time and money allocated to the subject in consequence.

Interestingly and perhaps most importantly, on the whole respondent schools appear to have become somewhat tolerant of the situation, predominantly accepting that lower funding (and therefore lower resourcing levels) have simply become ‘the new norm’. Over 90% of respondents report that they have issues of some kind with resourcing of practical science – and the small proportion of less than 10% of respondents that consider themselves well-resourced all describe themselves as ‘lucky’.
2. Introduction

2.1 About the research and why it was commissioned

“The importance of practical work in science is widely accepted and it is acknowledged that good quality practical work promotes the engagement and interest of students as well as developing a range of skills, science knowledge and conceptual understanding.”

SCORE, 2008

This document reports research into the resourcing of practical science in primary schools in England. It is part of a larger project that considers practical science resourcing across English schools and sixth form colleges that has been funded by SCORE, a collaborative partnership of some of the UK’s leading science organisations.

Science and technology undoubtedly play a crucial role in the UK, contributing directly and indirectly to economic growth, global competitiveness and the management of environmental change, as well as supporting individual quality of life through achievement and self-fulfilment. It is vital, therefore, that schools and colleges are able not only to develop their pupils’ knowledge and understanding of science, but also to engage and motivate them for long-term scientific study and employment.

It is widely agreed that hands-on, practical science experiences play a crucial role in developing pupils’ conceptual understanding and increasing their enjoyment of science lessons. However, recent research into provision of practical science in secondary schools and sixth-form colleges points to an uneven distribution of practical work between institutions, which may in part be explained by variations in resources. A report from the House of Commons Committee of Public Accounts in 2011 stated that the numbers of pupils studying triple science at GCSE rose by almost 150% between 2004-05 and 2009-10, yet concluded that science facilities in many schools were “unsatisfactory and unsafe”. Furthermore the Department for Education (DfE) had no plans at that time to collate or analyse information regarding the conditions of science facilities and had also abandoned facility improvement targets. Other research also conducted in 2011 highlighted that, in spite of a commitment to the provision of learning opportunities outside the classroom, these were not always taken up in practice.

1 SCORE (2008), *Practical work in science: a report and proposal for a strategic framework*
2 SCORE was established in 2006 to bring organisations together to tackle issues in science education. SCORE member organisations are the Association for Science Education, the Institute of Physics, the Royal Society, the Royal Society of Chemistry, and the Society of Biology [http://www.score-education.org/about-score](http://www.score-education.org/about-score)
3 SCORE (2008), *Practical work in science: a report and proposal for a strategic framework*
4 Ibid
5 House of Commons Committee of Public Accounts (2011), *Educating the next generation of scientists*
6 Royal Society of Chemistry (2011), *Outdoor Science*
SCORE therefore decided to commission research in response to concerns that there is a wide variation among schools and sixth-form colleges in the resourcing of practical science taught to pupils between the ages of 5 and 19, which Pye Tait Consulting was commissioned to carry out. SCORE considers that this variation is likely to affect the amount and quality of practical work taking place in schools. Practical work is integral to science education and should be intrinsic to the curriculum and, although adequate resourcing does not guarantee that high quality practical work will take place, insufficient resourcing could be a barrier to it happening at all. Moreover, the Government has a clear policy of increasing the number of pupils taking Triple Science and Science A-levels, yet SCORE is concerned this commitment is not being matched with the necessary increase in resource to ensure that all of these pupils have access to high quality practical work.

SCORE has already undertaken a series of important investigations of science practical work in schools, most notably Practical Work in Science: A Report and Proposal for a Strategic Framework (2008). This report demonstrated the high importance attached to practical work as a pedagogical tool and sought to identify obstacles to the effective provision of practical work in schools. It identified resourcing as a critical issue, showing that among teachers and technicians, resources and facilities were cited as the second most important obstacle to undertaking high quality practical science in schools, and were also the most cited factors among individuals who gave detailed responses to the research. It also found that ‘school science departments differ in their resourcing levels and this affects their ability to equally offer high-quality practical work’.

The SCORE report advocated a five-strand strategy for improving the quality and availability of science practical work, with “Strand C” aiming ‘to bring together the best advice on facilities and resources to support practical work in science’. More generally, the report suggested that SCORE should lobby policymakers to ‘ring-fence department funding’ for science subjects to ensure that schools are able to fund high quality science practical work.

SCORE’s current four-module research project, Resourcing School Science, has been designed to provide the first robust enquiry into the funding and resourcing of practical science work in schools and sixth-form colleges in England. The first module consisted of background research into the resourcing of practical science. The second module updated the Royal Society’s benchmark list of resources needed to deliver the national curriculum in science. The benchmarks are explicitly intended to provide schools with guidance on an ‘appropriate’, rather than a ‘minimum’ or ‘gold standard’ level of resourcing.

The aim of our research - the third module within the project - is to gather and analyse evidence that will enable SCORE to further understand the nature of resourcing of practical science in schools and sixth-form colleges, and in particular to ascertain the extent to which schools are able to meet the standard set out in the benchmark list; to understand the impacts of the approaches to resourcing taken by schools and colleges; and consider how any issues might be addressed.

Research findings are intended to inform local school policies as well as national Government policy. The evidence is intended to influence national policy in relation to: 1) the level of resourcing

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required to ensure that every pupil has the opportunity to experience appropriate practical work in science; and 2) the potential need to protect funding for science departments within a devolved funding model. In addition, the research findings will assist school science departments by providing them with the evidence they need to make the case for appropriate resources, budgets and technical support to deliver good quality practical work.

This report presents our findings in relation to primary schools. Findings for secondary schools and sixth-form colleges are presented separately.8

2.2 Research objectives

The objectives for this research were to:

- ascertain the availability, accessibility and scope of the resources used for practical science work in schools in comparison with a series of indicative items drawn from a comprehensive benchmark list developed as part of the previous module of SCORE’s research project (subsequently refined in conjunction with an expert Working Group9);

- use both the process and the findings of the research to test the robustness of the indicative items, suggesting revisions where appropriate;

- identify the amount and adequacy of historical, current, and likely future sources of funding for science practical work in schools;

- understand the relationship between funding and resource levels and the scope and adequacy of practical science provision.

Consideration of the purposes and definition of ‘high quality practical work’ was out of scope for this research. For the purposes of this research, SCORE10 defines practical science as:

Practical work to encompass learning activities in which students observe, investigate, and develop an understanding of the world around them through:

- having direct, often hands-on, experience of phenomena or manipulating real objects and materials; and
- where primary data/observations are not possible or appropriate, use secondary sources of data to examine experimental observations (for example: aerial photographs to examine lunar and earth geographic features; spectra to examine the nature of stars and atmosphere: sonar images to examine living systems).

In addition, SCORE considers practical work to include fieldwork, class demonstrations and any

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9 See Section 2.3.1 for more detail

10 Agreed in conjunction with a Task and Finish Group, see Section 2.3 for more detail
computer simulations that generate experimental data. Practical work does not include watching videos, attending educational visits (for example to the science museum or a science workplace) or use of computer simulation for illustrative purposes.

The resources that are used to support practical work are clearly defined for the purposes of the research as:

a) classroom facilities;
b) equipment and consumables;
c) technician support;
d) access to outside learning environments for learning outside the classroom.

Because few primary schools have specialist technician support, the research into primary schools specifically considered resourcing in areas a, b, and d only.

The geographical scope of this report is restricted to England; however similar research may be undertaken in the remaining UK nations in the future.

2.3 Research methodology

This research commenced in April 2012. Throughout the research Pye Tait Consulting remained in regular contact with the Task and Finish Group convened to provide oversight of the work. This Group comprised:

- SCORE’s Manager and Deputy Manager
- Representatives from all SCORE partner organisations: Association for Science Education; Royal Society of Chemistry; Royal Society; Society of Biology and Institute of Physics;
- Teachers representing both primary and secondary education.

All fieldwork data collection tools (quantitative and qualitative) were submitted to SCORE and the Task and Finish Group for review and approval before they were used.

This piece of social science research utilised a mixed methodology, combining quantitative and qualitative research tools as follows:

- Desk-based review of relevant literature, including national and local resourcing and funding policies;
- Selection of a set of indicative items (mapped to the relevant resource areas outlined above in Section 2.2) that could be used to assess the level of resources available to participant schools (see Section 2.3.1 for details);
- Design and facilitation of an online survey for primary schools with an objective of securing 400 respondents to gain evidence on a wide range of information relevant to the resourcing of practical science, including school characteristics, funding levels, and staff

11 Laboratory facilities for secondary schools and sixth-form colleges
attitudes, as well as the extent to which schools were able to access the indicative items;

- Follow up via in-depth qualitative telephone interviews and visits with a selected sample of schools to explore the resourcing of practical science in depth.

The research findings presented in this report are drawn from:

- quantitative data obtained from the online survey to define the current resourcing and funding levels for practical science in primary schools;
- qualitative data obtained from the interviews and schools visits to provide additional understanding of the impacts of current levels of funding and resourcing, and of the key drivers that shape them.

It should therefore be noted that the findings presented here are based on self-report from participating schools on the basis of selected indicative items; it is not an exhaustive audit. With this limitation, however, the research is the most comprehensive of its kind yet undertaken in England. Where feasible to do so, research data are presented by region; however it should be taken into consideration that there may be relatively low numbers of respondents per region and therefore these findings should be viewed as indicative only.

### 2.3.1 Development of list of indicative items used in the survey

The indicative items were drawn from a complete set of resourcing benchmarks developed by SCORE in the previous module of this research. The indicative items were selected from the benchmarks with the advice of an expert Working Group convened for this purpose. The Group comprised five representatives from primary schools; discussions about the benchmarks were facilitated by SCORE.

The workshop with the Working Group first identified a wide range of benchmark items as potential indicators. These were subsequently refined to a smaller set of indicative items that the Group considered would be necessary to deliver effective practical science. These lists (grouped into three: equipment and consumables; classroom facilities; and outside learning environments) were used for the purpose of the survey. The list of indicative items used in the survey is included as Appendix 1.

### 2.3.2 Quantitative online survey

The sample frame for the survey was established using official statistics published by the Department for Education\(^\text{12}\), to define a representative sample spanning all types of school and by a range of sizes and locations (urban/rural, regional). Given the large population and relatively straightforward institutional structure of primary schooling, there was little obvious rationale for using a stratified sample or for oversampling any specific subset of the population. A sample of 400 schools was chosen to provide a robust statistical basis for findings (Table 1).

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Table 1: Sample frame for the online survey of primary schools

<table>
<thead>
<tr>
<th>Population</th>
<th>Total Target Sample</th>
<th>Indicative Stratification</th>
<th>Number</th>
<th>Target Stratified Sample</th>
<th>Confidence level/interval (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18836</td>
<td>400</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>&gt;95/5</td>
</tr>
</tbody>
</table>

The online survey went live on Monday 3rd September, 2012 and was initially scheduled to remain open until mid-November 2012. A variety of publicity for the surveys was used to encourage respondents to become involved. A random sample of 1500 primary schools was initially mailed a formal invitation to participate from the chair of SCORE, Professor Graham Hutchings. In addition, SCORE and its partner organisations used their own media channels and contact, primarily websites, email lists and press releases, to promote the surveys. Finally direct email contact was made with head teachers of all primary schools in England to ask them to consider involving their schools in the research.

As the rate of which responses from primary schools to the survey proved to be slower than anticipated, the survey was extended by two months into the New Year (2013) while existing channels as well as two forms of additional promotion of the survey were implemented. The first was the use of direct telephone contact with randomly selected primary schools across England. The second was via SCORE’s session at the ASE conference in January 2013, where Pye Tait Consulting presented initial findings and SCORE distributed information to attendees at the primary science section of the conference. In combination, these additional methods substantially boosted the response rate.

The survey officially closed on Friday, 11th January, 2013. At this point a total of 410 responses had been received. Responses were then collated and data cleaned using a combination of automated and manual methods.

During data cleaning and cross-checking, the survey responses were found to contain a number of invalid submissions, which were subsequently excluded from the dataset. The final dataset was then defined, and the number of valid responses ascertained:

- 410 responses were submitted;
- 1 blank response was excluded;
- 1 response from outside England was excluded;
- 7 respondents submitted duplicate responses – these were manually cross-checked; in each case, the most complete survey response was retained and the less complete excluded;
- 4 schools submitted a total of 8 multiple responses.

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The final dataset therefore consisted of a total of 401 valid responses from 397 unique respondent schools.

Much of the analysis was concerned with determining the situation at the level of schools rather than individual respondents. This means that, if multiple responses from individual schools had been included in the dataset for these purposes, the effect would have been to over-represent that school in the dataset. For this type of analysis, therefore, multiple responses were consolidated to produce a single response per school.

2.3.3 Qualitative in-depth fieldwork

Qualitative telephone interviews and visits were undertaken, to explore emerging findings in more detail, with the following numbers of primary schools:

- 43 telephone interviews; and
- 9 visits.

These schools were selected based on the following criteria:
- Agreement to participate in further follow up research (question posed within the survey); and
- Spread by region, type and size; and
- Spread across spectrum of satisfaction levels with funding and resourcing of practical science.
3. Context of research findings

3.1 Background context

The research findings presented in this report should be considered in relation to the current context, which is characterised by changing curricula, an uncertain economic climate, and reforms to school funding.

Changes to the primary school curriculum for science are due to be introduced in September 2014, with the introduction of the revised national curriculum\(^{14}\). An initial draft curriculum was published and a consultation period opened in June 2012, with a further draft published in February 2013\(^ {15}\). The aim of the revised curriculum, according to the Department for Education (DfE), is to define the subject content for each curriculum area to ensure that ‘all pupils will leave primary school able to progress to more challenging study at secondary school, supporting greater breadth and depth of learning’\(^ {16}\). It now appears on the basis of the revised draft, published on 7 February 2013, that the curriculum at Key Stages 1 and 2 will retain much of the emphasis of the current National Curriculum. However, it must be borne in mind that the fieldwork for this research took place against the background of continuing uncertainty over curriculum change, before this revised draft was published.

The current economic and fiscal climate is also an important contextual factor. Sustained periods of modest economic growth or recession have placed considerable pressure on the public finances which are likely to impact on the education budget\(^ {17}\). At the same time, the Government is planning substantial reforms to the way that school funding is allocated, in order to address longstanding concerns that the funding received by otherwise similar schools varies unduly in different parts of the country. These proposals are designed to lead to a more equitable allocation of funding to schools, and to ensure that individual schools are able to allocate funds in line with their own priorities\(^ {18}\). Although a funding guarantee will ensure that in the short term cuts to individual schools are limited in the period up to 2014-15, over the longer term the reforms are expected to lead to potentially significant changes to the level of per capita funding available to some schools. Possible uncertainties among respondents over the potential impacts of such changes should be borne in mind when considering the research findings.

\(^{14}\) Zuncke, I. (2012), Primary School National Curriculum changes RM Education


\(^{17}\) Institute for Fiscal Studies, Briefing Note 121: Trends in Education and Schools Spending (October 2011) http://www.ifs.org.uk/bns/bn121.pdf

3.2 Breakdown of survey respondents

Valid responses to the online survey were received from 397 schools spanning all regions in England (Figure 1). The following sections are intended to give an overview of the key characteristics of the sample, including consideration of the regional distribution of the responses, the range of types and sizes of school that submitted responses, and the job roles of the respondents.

3.2.1 Respondents by region

The regional distribution of responses from individual schools was checked against the actual distribution of primary schools across England as reported in official statistics. The number of responses from all but two regions was within or very close to the actual proportions of schools in each of the nine Government regions, taking into account the expected margin of error. The exceptions were the East of England, where substantially more responses were obtained than a proportional sample; and the North West, where there were fewer; there was also some slight under-representation of responses from the Yorkshire and Humber region. Whilst the number of responses from the North East may appear low, this was almost exactly in proportion to the relatively small number of schools in this region.

Data were therefore weighted during the main analysis to equate to a theoretical ideal regional distribution in order to ensure the final statistics were as representative as possible of the overall national picture.

Figure 1: Breakdown of respondents to the online survey by region

3.2.2 Respondents by school type

The majority of respondents (56.10%) came from community schools, with approximately a third

Base: 397
(33.90%) from voluntary-aided or voluntary-controlled schools. Responses were received in smaller proportions from academies (6%), independent schools (1.10%), foundation schools (2.6%) and free schools (0.20%) (Figure 2). The data reported here are therefore drawn from the full range of types of English primary school.

**Figure 2: Breakdown of individual respondents to the online survey by school type**

<table>
<thead>
<tr>
<th>School Type</th>
<th>Percentage</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community school</td>
<td>56.10%</td>
<td>224</td>
</tr>
<tr>
<td>Independent school</td>
<td>33.90%</td>
<td>136</td>
</tr>
<tr>
<td>Academy</td>
<td>6.00%</td>
<td>24</td>
</tr>
<tr>
<td>Free School</td>
<td>0.20%</td>
<td>1</td>
</tr>
<tr>
<td>Voluntary-aided or voluntary-controlled school</td>
<td>2.60%</td>
<td>10</td>
</tr>
<tr>
<td>Foundation School</td>
<td>1.10%</td>
<td>5</td>
</tr>
</tbody>
</table>

**3.2.3 Respondents by school size**

Responses were received in approximately even distributions of different school sizes (Figure 3), which have been categorised for the purposes of this research as:

- Small – less than 200 pupils;
- Medium – between 200 and 349 pupils; and
- Large – over 350 pupils.

The range of pupil numbers across all schools and by school size is shown in Table 2.
Figure 3: Breakdown of individual respondents to the online survey by school size

Table 2: Respondent schools – range of pupil numbers

<table>
<thead>
<tr>
<th>Pupil numbers</th>
<th>Range</th>
<th>Mean</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>All respondent schools</td>
<td>7-960</td>
<td>277.24</td>
<td>420</td>
</tr>
<tr>
<td>Large schools (350+ pupils)</td>
<td>350-960</td>
<td>469.72</td>
<td>420</td>
</tr>
<tr>
<td>Medium schools (200-349 pupils)</td>
<td>200-348</td>
<td>248.96</td>
<td>240</td>
</tr>
<tr>
<td>Small schools (less than 200 pupils)</td>
<td>7-195</td>
<td>121.63</td>
<td>180</td>
</tr>
</tbody>
</table>

This distribution of the sample across schools of different sizes allowed the research to include consideration of relationships between schools size and levels of resourcing and funding levels.

3.2.4 Respondents by job role

A small majority of responses were received from a member of the Senior Leadership Team, typically the head teacher (51.60%) or from the member of staff with primary responsibility for science teaching, usually referred to as the science coordinator or science lead (42%). This is broadly in accordance with what might be expected, given the survey was distributed to head teachers who were asked to complete the survey themselves or ask their science coordinator or science lead to complete it. Not all schools have a science coordinator or science lead, and there are no available statistics to indicate the national proportion of schools that have this job role. A smaller proportion of responses were received from classroom teachers (6.20%) and a single further response was received from a primary school science technician (Figure 4). The relatively small proportion of responses received from classroom teachers should be borne in mind when considering findings relating to this group, which should be regarded as indicative only.
Figure 4: Breakdown of individual respondents to the online survey by job role
4. Funding for practical science

4.1 Key messages in relation to funding for practical science

The survey included specific sections on funding that asked respondents to disclose a range of budgetary, expenditure and other information connected with the funding of the science curriculum area in general and practical science in particular. The relevant questions were developed on the basis of background literature and qualitative research with primary teachers, and were refined on the basis of the pilot survey and the advice of the SCORE Task and Finish Group. The final questionnaire sought information on:

- Annual expenditure on science for the last four complete financial years;
- Whether spending on science was expected to increase or decrease in the current and future financial years;
- The way that science budgets are allocated to various types of expenditure, including key resources for practical science;
- The relative importance of various factors that might influence the allocation of funding to science;
- Whether the science budget had to be spent in full within the financial year, or whether unspent funds could be rolled into the following year’s budget;
- Whether any of the science budget was specifically allocated to science practical work;
- Any additional sources of funding used by the school;
- Levels of satisfaction with current science funding;
- The anticipated impact of future funding levels on the amount of science practical work that will be provided over the next two years.

Data gathered from these questions were used to build up a comprehensive picture of the funding of practical science in English primary schools on the basis of quantitative survey data. This was then supplemented by additional qualitative evidence drawn from literal comments in the surveys and from the in-depth interviews. Where findings are derived from qualitative data, this is specifically indicated.

Key messages in relation to this funding section are presented in the box below.

- The average per capita spend on science for the academic year 2011/12 is £2.89. However there is considerable variation between schools, with per capita spend ranging from 4 pence to £19.08;

- The average annual budget spent on science is £856.82 (for the academic year 2011/12). Historically, budgets have increased on average between 2009/10 and 2011/12 – from an average of £669.49 to an average of £856.82. However in spite of this overall increase,
there is again noticeable variation between schools, with just over 40% of respondents reporting that their science budgets have either decreased or remained static over the past three academic years;

- There can be high levels of variation in funding allocations for science from year to year, making it difficult for schools to plan ahead in relation to resourcing practical science;

- Over three-quarters of respondents (77%) do not formally allocate part of their science budget specifically to practical work;

- Holders of the Primary Science Quality Mark (PSQM) typically allocate higher average budgets to science (£1,288.78 compared with £713.59 among non-holders of the award);

- During the academic year 2011/12, the average annual budget for science for large schools (350+ pupils) was £1,352.79; for medium schools (200-349 pupils) £717.89; and for small schools (-200 pupils) it was £531.91;

- Nearly a third of respondents (29.7%) report they are very or quite dissatisfied with the amount of funding available for science. Larger schools typically report higher levels of satisfaction with funding levels (over half of respondents that are very or quite satisfied compared with just over a third of respondents from medium-sized and smaller schools);

- The highest proportion of respondents that are very dissatisfied with funding levels come from small schools (38.7% of respondents are very dissatisfied compared with 29.6% of respondents from medium-sized schools and 20.4% of respondents in large schools). However the average annual budget for science among small school respondents that are very dissatisfied is, at £482.07, considerably higher than the same respondents that are very dissatisfied in medium-sized schools (£266.92) and larger schools (£147.89) – again highlighting high degrees of variation between schools;

- There is a culture of ‘tolerance’ associated with funding levels, with respondents prepared to “make do and mend”. This is underpinned by ‘hidden’ expenditure on science that is provided by teachers to supplement the core budget. Qualitative feedback indicates that on average, teachers spend approximately £20-25 per annum subsidising science resources, with less than 5% of respondents claiming this money back. A basic calculation indicates that if 2 teachers per school in England spent £20 of their own money per annum, this would equate to nearly three-quarters of a million pounds (£740,360);

- Where respondents have experienced diminishing or static budgets, impacts on science teaching and learning have included an inability to maintain stock levels of all the equipment and consumables needed to teach practical science effectively, and a reduction of the amount of practical science experiences provided to pupils from external speakers.
4.2 Budgets for resourcing practical science

Data on the overall budget for science were requested from all respondents. Not all primary schools were able to quantify spend on science as in some cases the school works to an overall budget rather than segregating expenditure by subject. Where relevant data were available, they were used to calculate the per capita science spend at each of the participating schools. The average overall per capita spend on science in 2011/12 across all schools that responded (375) is £2.89. Across schools, the per capita spend ranges from as little as £0.04 up to as much as £19.08, indicating high levels of variation between schools. A very small proportion of respondents (1.6%) stated they had no budget at all for science.

There is very little difference between per capita spends on science between medium and large sized schools; however smaller schools appear to have a higher amount available (Table 3).

Table 3: Per capita spend on science (by school size), academic year 2011-12

<table>
<thead>
<tr>
<th>Year</th>
<th>Large (350+ pupils)</th>
<th>Medium (200-349 pupils)</th>
<th>Small (&lt;200 pupils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011/2012</td>
<td>£2.71</td>
<td>£2.66</td>
<td>£4.16</td>
</tr>
<tr>
<td>Bases</td>
<td>118</td>
<td>135</td>
<td>122</td>
</tr>
</tbody>
</table>

Table 4: Average spend on science (by school size), academic year 2011-12

<table>
<thead>
<tr>
<th>Year</th>
<th>Large (350+ pupils)</th>
<th>Medium (200-349 pupils)</th>
<th>Small (&lt;200 pupils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011/2012</td>
<td>£1352.79</td>
<td>£717.89</td>
<td>£531.91</td>
</tr>
<tr>
<td>Bases</td>
<td>118</td>
<td>135</td>
<td>122</td>
</tr>
</tbody>
</table>

4.3 Historical changes in funding for science

On average respondent schools experienced a decrease in the budget for science between 2008-09 and 2009-10 of approximately -8% (Table 5). This may be partly attributed to the immediate impacts of the economic recession.

In subsequent years the budget spent on science increased by 13.9% on average between 2009-2010 and 2010-2011; and by 9.4% on average between 2010-11 and 2011-12 (Table 5).

Table 5: Budget spent on science between academic years 2008-09 and 2011-12

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean (£)</th>
<th>Mode (£)</th>
<th>Median (£)</th>
<th>Change from previous academic year (+/- %)</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011/2012</td>
<td>856.82</td>
<td>500.00</td>
<td>500.00</td>
<td>+9.4%</td>
<td>375</td>
</tr>
<tr>
<td>2010/2011</td>
<td>776.78</td>
<td>500.00</td>
<td>500.00</td>
<td>+13.9%</td>
<td>353</td>
</tr>
<tr>
<td>2009/2010</td>
<td>669.49</td>
<td>500.00</td>
<td>400.00</td>
<td>-8%</td>
<td>327</td>
</tr>
<tr>
<td>2008/2009</td>
<td>725.38</td>
<td>500.00</td>
<td>400.00</td>
<td>N/A</td>
<td>308</td>
</tr>
</tbody>
</table>

Figure 5 shows the differences in average budget by school size – this again reflects the pattern of a
dip in the budget for the academic year 2009-10, although this was marginal for smaller schools. Again, qualitative feedback from respondent schools typically attributes this dip to the impacts of the economic recession.

**Figure 5: Average budget spent on science between academic years 2008-09 and 2011-12 (by school size)**

There appear to be widespread differences between historical trends in budget allocations for science by region as illustrated in Table 6. Although the relatively small bases for regional data mean that these findings must be treated with some caution, it nevertheless seems clear that the majority of regions (two-thirds) experienced a decline in the science budget between 2008-09 and 2009-10 – in some cases a sharp one (for example in London where the average budget reported by the survey respondents changed by 35.4% and in the West Midlands, where the average budget fell by 29.58%). However other regions, notably Yorkshire & the Humber and the East of England, seem to have fared more auspiciously in this academic year.

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19 Bases shown in the bottom row reflect the three years from 2011/12 downwards
Table 6: Differences in average budget spent on science by region (relative to the previous academic year)

<table>
<thead>
<tr>
<th>Region</th>
<th>2011/12</th>
<th>2010/11</th>
<th>2009/10</th>
<th>Bases</th>
</tr>
</thead>
<tbody>
<tr>
<td>East of England</td>
<td>10.52%</td>
<td>16.47%</td>
<td>17.97%</td>
<td>60;54;49</td>
</tr>
<tr>
<td>East Midlands</td>
<td>13.71%</td>
<td>23.23%</td>
<td>11.47%</td>
<td>38;37;36</td>
</tr>
<tr>
<td>London</td>
<td>16.95%</td>
<td>5.42%</td>
<td>-35.40%</td>
<td>54;48;56</td>
</tr>
<tr>
<td>North East</td>
<td>-10.60%</td>
<td>38.45%</td>
<td>-26.38%</td>
<td>54;48;56</td>
</tr>
<tr>
<td>North West</td>
<td>15.83%</td>
<td>11.86%</td>
<td>-9.52%</td>
<td>19;19;16</td>
</tr>
<tr>
<td>South East</td>
<td>-11.30%</td>
<td>17.38%</td>
<td>-4.89%</td>
<td>27;27;25</td>
</tr>
<tr>
<td>South West</td>
<td>4.63%</td>
<td>-0.89%</td>
<td>-2.44%</td>
<td>62;58;55</td>
</tr>
<tr>
<td>West Midlands</td>
<td>6.00%</td>
<td>23.56%</td>
<td>-29.58%</td>
<td>49;44;43</td>
</tr>
<tr>
<td>Yorkshire &amp; the Humber</td>
<td>14.40%</td>
<td>2.87%</td>
<td>16.49%</td>
<td>35;32;26</td>
</tr>
</tbody>
</table>

There is clearly no overall pattern of changes from year to year, but the data may be of more value as an indicator of the extreme variability of resourcing experienced by different schools, between different regions and in different academic years.

Indeed, it should be noted that the budgetary information given by individual schools often show high levels of variability from year to year. The result is that while on average funding levels may have increased, nearly a quarter of respondent schools (22.4%) have nevertheless experienced substantial decreases in science budgets. Furthermore nearly a fifth of respondents (17.7%) report their science budgets remained static between 2008/09 and 2011/12. Therefore in spite of an overall average increase in the science budget, just over 40% of all respondents experienced declining or static budgets.

This apparent variability is to some degree substantiated by qualitative feedback from respondent schools. Respondents that had experienced a reduction in funding for science tended to emphasise the difficulties involved in planning ahead due to a lack of transparency about available budgets, and often expressed fears that the situation may become worse in future years – particularly within schools that are experiencing increasing class sizes.

"The (financial) situation will continue to worsen and the next couple of years will be bad in terms of further cuts to deal with"

"Our science budget hasn’t changed at all but the size of the school has increased – 3 extra classes with an extra 90 children and 30 more every year until 2013. The budget is still the same as 5 years ago at £2,000 per year which equates to £2 per child"

"Our budget has halved over the past four years"

"Over the years, the budget (for science) has decreased. Since 2006 this has been a constant pattern. In 2006 the budget was £500 and in 2012 it is zero"
4.4 Factors impacting spend on practical science

4.4.1 Factors impacting on allocation of budgets

Respondents were asked to rate the importance of a series of different factors in the decision-making process relating to budget allocation for science. The most important factors relate to the size of the school budget as a whole, the perceived needs of other subject areas, and feedback from the science coordinator or lead (Figure 6).

Guidance from the Local Authority appears to play a lesser role. This links to more in-depth, qualitative feedback from respondent schools, stating that, in the past two to three years, the accessibility and impact of guidance from the Local Authority has diminished.

Other factors affecting decision-making about the budget allocation include:

- Priorities of the School Development or Improvement Plan;
- Whether science is a particular ‘feature’ i.e. Science Week;
- How much might be ‘found’ from other budgets.
Figure 6: Relative importance of factors influencing the amount and spend of the science budget

Base: 2918 responses
Qualitative data from respondent schools typically reports that the head teacher takes decisions about budgets, sometimes in conjunction with school governors, although in the latter case this tends to be an oversight role, as not all would have the expertise to comment in detail. Whilst in some schools teachers/science coordinators can input into the discussion, ultimately it appears that the decision rests with the head teacher.

It also appears that the profile, or status, of science in a particular school can impact on the amount of funding the subject is allocated. For example over four-fifths of all respondents (81.5%) do not hold or are currently working towards the Primary Science Quality Mark (PSQM)\(^20\) (Figure 7).

**Figure 7: Breakdown of respondents - holders of the PSQM or working towards it\(^21\)**

Of the respondent schools that hold or are working towards the PSQM, the budget allocated to science is discernibly higher, compared with those that are not engaged with the scheme (Figure 8). It should be noted that the Association of Science Education circulated the survey link to their contacts i.e. schools likely to hold the PSQM and of the 500 award holders\(^22\), 73 responded to this survey. This over-representation of PSQM holders may mean that feedback in relation to resourcing levels could imply a more positive perspective generally – given that PSQM holders clearly allocate a higher proportion of funds to resourcing practical science.

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\(^{21}\) ‘Yes’ responses indicate the school either holds the PSQM already or is working towards it; ‘no’ responses mean the school does not hold the PSQM and is not working towards it

\(^{22}\) Figures supplied by PSQM administration team and correct as at March 2013
Figure 8: Breakdown of average budget for science among respondents - holders of the PSQM or working towards it

A small majority of respondent schools (56.2%) is required to spend its budget in full during the course of the academic year – i.e. is unable to ‘roll over’ any surplus from under-spend to the following year or years. Just under a third of respondents (31.3%) are not subject to this requirement (Figure 9). However levels of flexibility appear greater within smaller schools, with similar proportions of respondents required to spend the budget in full (42.2%) compared with those that are not (46%).

23 Those that are (‘yes’ responses) and those that are not (‘no’ responses)
However qualitative feedback suggests that a protocol of being able to roll the budget over does not necessarily benefit schools – for example over 60% of those interviewed that operated this system state that leftover budget can be absorbed to pay for something else - so it is not in fact allocated to science. This frequently means that science coordinators seek to spend their budget quickly and in full to ensure their subject actually benefits. In effect this means that few schools are in a position to “save up” in order to fund more expensive pieces of science equipment.

The research also considered another dimension to the level of discretion that respondents have over the allocated budget – their freedom to choose the suppliers they believe offer the best value for money.

The vast majority of respondents (94.8%) report being free to choose whichever supplier of science equipment that offers the best value for money (Figure 10). However, some participants in the qualitative research suggested that this freedom may not in itself be enough to ensure that funding is spent as efficiently as possible. They noted that it takes time to ‘shop around’, with the result that many schools end up just using the core science education suppliers, as the ‘one-stop shop’ approach is the most time efficient.
4.5 Allocation of science budget to practical work

Over three-quarters of respondents (77%) do not formally allocate part of the science budget specifically for practical work. The average amount allocated is shown in Table 7. Comparisons of these figures with average budgets spent on science for schools by size indicates that medium-sized schools appear on average most committed to practical work, allocating 92.7% of the budget on this. Large schools commit less than half (43.7%), and smaller schools just over three-quarters (77.7%) of their science budget to practical work. Qualitative feedback from smaller and medium-sized schools suggests that they may have greater freedom in relation to the way they spend their budget – and thus may be more able to allocate a higher proportion of monies to practical work than is the case for larger schools.

Table 7: Amount within budget (£) allocated specifically to practical work (by school size) – academic year 2011-12

<table>
<thead>
<tr>
<th>Average (all sizes)</th>
<th>Large (350+ pupils)</th>
<th>Medium (200-349 pupils)</th>
<th>Small (&lt;200 pupils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>£568.45</td>
<td>£591.36</td>
<td>£665.13</td>
<td>£413.22</td>
</tr>
</tbody>
</table>

4.6 Breakdown of expenditure in science

Respondents were asked to give a detailed breakdown of their science expenditures, considering the amounts that were allocated to:

- ICT;
- Equipment;
- Consumables;
Under the Microscope: The State of Resourcing of Practical Science in Primary Schools in England
April 2013

- Fieldwork;
- Textbooks;
- Science talks and external events;
- Contingency funds.

Respondents were also asked to specify any other areas of expenditure not covered in this list.

Purchase of equipment accounts for the largest average amount of the budget spent on science, although proportionately it rarely constitutes the majority of the total expenditure (Table 8). Types of equipment that are owned and used by schools are discussed in more detail in Section 5.

**Table 8: Breakdown of average expenditure in the science budget (academic year 2011-12)**

<table>
<thead>
<tr>
<th></th>
<th>Average (all sizes)</th>
<th>Large (350+ pupils)</th>
<th>Medium (200-349 pupils)</th>
<th>Small (-200 pupils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>£376.92</td>
<td>£525.19</td>
<td>£352.22</td>
<td>£248.22</td>
</tr>
<tr>
<td>Consumables</td>
<td>£224.78</td>
<td>£289.19</td>
<td>£171.34</td>
<td>£214.04</td>
</tr>
<tr>
<td>Other</td>
<td>£236.99</td>
<td>£318.47</td>
<td>£203.55</td>
<td>£183.32</td>
</tr>
<tr>
<td>ICT</td>
<td>£164.01</td>
<td>£161.03</td>
<td>£98.31</td>
<td>£247.64</td>
</tr>
<tr>
<td>Science talks/external events</td>
<td>£192.75</td>
<td>£227.87</td>
<td>£191.78</td>
<td>£150.25</td>
</tr>
<tr>
<td>Fieldwork</td>
<td>£103.29</td>
<td>£175.64</td>
<td>£49.31</td>
<td>£75.67</td>
</tr>
<tr>
<td>Textbooks</td>
<td>£93.07</td>
<td>£134.81</td>
<td>£107.96</td>
<td>£24.70</td>
</tr>
<tr>
<td>Contingency</td>
<td>£46.87</td>
<td>£55.00</td>
<td>£58.35</td>
<td>£24.13</td>
</tr>
</tbody>
</table>

Spend on ‘other’ items includes:

- Gifted and talented programme (27.2% of respondents);
- Teacher training/CPD (21.8% of respondents);
- Costs of PSQM (19.5% of respondents);
- Subscriptions to educational software websites (17.2% of respondents);
- Membership of science societies e.g. ASE (14.3% of respondents).

So-called “big ticket items” of equipment and resourcing expenditure are typically one-off purchases or expenditure, such as creating a pond. As another large expense for primary schools consists of visits to science centres, zoos or similar destinations, and in most cases parents are asked to make a financial contribution to the cost.

**4.7 Additional sources of funding**

Of the respondent schools that receive additional sources of funding for practical science, most of the monies appear to be directed towards the delivery of the normal (core) school curriculum, rather than extra-curricular activities – with the exception of parental contributions. The latter can

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24 These figures refer to the percentages of the 79 respondents that reported spend on ‘other’ items
be in the form of financial support, for example money towards a science trip, or in the form of time such as spent helping in the school garden or acting as an extra assistant for fieldwork inside or outside of the classroom.

Around 37% of responses indicate that staff contributions from their own pockets are used to supplement the normal (core) school curriculum (Figure 11). Qualitative feedback indicates that when teachers and/or teaching assistants pay for contributions towards science lessons, they do not always get this money back. In some cases the individual chooses not to claim (typically stating that the process is too time-consuming or onerous, or that they simply believe they would not receive the payment); in other cases school policy prevents claims from being submitted. Items purchased tend to be consumables which often can be supplied from home store cupboards or from supermarkets.

Qualitative feedback points to a strongly held expectation among primary school teachers that buying their own items for use in school is “part of the job”; few were able to quantify their personal annual expenditure as they simply do not keep track of this. Among the very small proportion (less than 5%) that could provide a figure (as they claim the money back), the average spend would appear to be around £20-£25 per year, per teacher.

Even a very basic calculation based on this approximate figure implies there could be considerable ‘hidden’ expenditure on school science outside allocated budgets. If, within all primary schools in England (18,50925) 2 teachers in each institution spend £20 each per annum on consumables and small items of equipment, the primary science teaching budget would be subsidised to the extent of nearly three-quarters of a million pounds (£740,360) by staff every year. This accounts for around 7-10% of the average science budget for a small school.

“*It’s quite easy to spend a lot of money over time as it all adds up – as you go round the shops and pick up bits that you think will be useful to you at some point and you don’t realise how much you are spending*”

“*As ever teachers use their own money on practical resourcing and they don’t always ask for the money back*”

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25 Based on 2011 statistics
Other forms of contributions cited include:

- Support from middle and high schools – for example borrowing equipment;
- Gaining awards in science that offer financial rewards, for example Impact and Enthuse Awards offered by the National Science Learning Centres;
- Science prizes or competitions, with those run by Rolls Royce being most frequently cited;
- Use of supermarket vouchers (dedicated schemes to provide schools with equipment);
- Fundraising activities run by or in conjunction with the Parent Teacher Association (PTA).

Qualitative feedback indicates, in some cases, a heavy reliance on grants – for example those offered by local or nationally based science employers. These can range from less than a hundred to several thousand pounds, and can be instrumental in securing new or updated equipment, or funding external science trips that could not be financed through any other means.

“The school doesn’t have a specific budget set aside for science but we apply for grants and enter competitions to win money specifically for science activities. For example I attended a Saturday morning CPD hosted by the Association of Science Education which provides the school with a grant of £150 plus an additional £40 to cover travel expenses etc. for attending the course. We also take part in the Rolls Royce Science Prize each year. For the last four years we have got down to the last 50 and this has won us £100, this year we are in the last nine which means that we’ll be awarded at least £9,000”
However, qualitative feedback indicates that it is not an open field for schools seeking external sources of funding. A small proportion of respondents interviewed by telephone (18%) suggested that certain avenues are either closed or are very difficult to access, depending on the school’s situation (based on criteria such as the ethnic mix of pupils and proportion eligible for free school meals as an indicator of deprivation).

Examples (respondent opinions) include:

<table>
<thead>
<tr>
<th>Primary Science Quality Mark</th>
<th>At a cost of approximately £650 per year(^{26}), the PSQM has the potential to raise ambition yet may only be accessible to certain schools. One respondent has an aspiration to raise their PSQM from silver to gold, but would only be able to provide evidence for this by offering extra science activities, which would require funding the school does not have.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Million Ponds Project</td>
<td>One respondent talked of failing to secure funding because they are located in affluent area with few pupils eligible for free school meals – “there is not much money for schools like ours.”</td>
</tr>
</tbody>
</table>

Furthermore not all schools are in a position to apply for such grants or enter competitions because of pressures on time and staffing resources. It also appears that not all schools are aware of them. A very popular source of support is that offered via the STEM Ambassadors programme, whereby support is offered free of charge to schools. However this also takes a certain amount of time to organise and administer.

### 4.8 Satisfaction with funding available for practical science

Although nearly 45% of respondents indicate they are very or quite satisfied with the funding available for practical science, there is still nearly a third of respondent schools (29.7%) that suggest they are either quite or very dissatisfied with the level of funding currently available to them for science (Figure 12). More detailed qualitative feedback points to a strong sense of tolerance; respondents typically readily acknowledge that the challenging economic climate make it highly unlikely they will receive substantial budget increases. Many respondents suggested they have come to terms with the fact that there is a culture of “make do and mend”.

\(^{26}\) Figure current at the time of this report was finalised (February to March 2013); see [http://www.psqm.org.uk/](http://www.psqm.org.uk/). This represents around 48% of the average science budget for a large school, 91% for a medium-sized school and 122% for a small school.
Unsurprisingly, Figure 13 shows considerable disparity between the average budgets among respondents that report being very satisfied and those that say they are very dissatisfied with the amount for funding for practical science.
Figure 13: Average budget by level of satisfaction with funding available for resourcing practical science (all schools) – academic year 2011/12

![Average budget by level of satisfaction with funding available for resourcing practical science (all schools) – academic year 2011/12](image)

Base: 375

Figure 14 shows the levels of satisfaction with science funding reported by respondents in different job roles. It should be noted that the number of classroom teachers responding to the research was relatively small, meaning that the findings from this group should be regarded with caution. Nevertheless, it is of interest to note that members of the Senior Leadership Team and science coordinators are more likely to be satisfied with the level of funding available than classroom teachers, and this may relate to other feedback suggesting that teachers lack access to sufficient CPD in relation to teaching practical science and thus are less certain of what the funding and resourcing requirement should actually be.²⁷

In addition, the comparatively high proportion of classroom teachers that are neither satisfied nor dissatisfied also suggests that some teachers may lack a sufficiently clear sense of an appropriate benchmark level of expenditure to make a confident judgement. It may also reflect the fact that both Senior Leadership Team and science coordinators are likely to feel that they can influence the level of funding for science, and therefore more likely to feel that it is satisfactory given the overall financial situation of their school.

²⁷ Also see Section 5.6.3
Satisfaction with funding is closely related to school size - with larger schools being more likely to be very or quite satisfied with funding for science (over half of respondents) compared with those in medium-sized schools and small schools (just over a third of respondents) (Figure 15).
Among larger schools that are typically more satisfied with funding for science, there is a considerable difference in allocated funding between those that are quite satisfied (equating to an average annual budget of £1,260.13) and those that are very satisfied (equating to an average annual budget of £2,881.90). Those that report being very dissatisfied have a substantially lower budget by comparison, at £147.89 on average (Figure 16).
There is a similar divergence between the average annual budget among those that are very satisfied in medium-sized schools (£1,151.56) and those that report being quite satisfied (£846.16). Again, the average annual budget for those that are very dissatisfied is substantially lower at £266.92 (Figure 17).

It appears that smaller schools are more likely to be dissatisfied with the funding available for
resourcing science (38.7% of respondents state they are quite or very dissatisfied compared with 29.6% of respondents from medium-sized schools and 20.4% of larger schools that report the same level of dissatisfaction – as reported in Figure 15 above). Yet Figure 18 shows that the average annual budget among respondents from smaller schools that state they are very dissatisfied is £482.07 – which is nearly double the same average budget among those respondents that are very dissatisfied in medium-sized schools, and nearly two-thirds larger than the average budget among respondents that are very dissatisfied in larger schools. This also reinforces the generic finding in relation to high degrees of variation between schools.

**Figure 18: Average budget by level of satisfaction with funding available for resourcing practical science (small schools) – academic year 2011/12**

Regional differences are also apparent (although these findings must be treated with caution given the relatively low respondents per region) – for example a comparatively higher proportion of respondents in London (20.7%) report they are very satisfied with the funding available, compared with those that do in the South-West (2%) (Figure 19).
Figure 19: Satisfaction with funding available for resourcing practical science (by region)
4.9 Anticipated future change in funding for science

Respondents were asked to provide an indication of whether they expect to spend more, less or the same on resourcing science over the forthcoming two academic years. When considering these data the high levels of budget variation from year to year, as noted above, should be borne in mind – these changes, according to qualitative feedback, do impact on schools’ capacity to plan ahead and therefore it is perhaps unsurprising that the majority consider they will spend around the same amount on science in future years. As it is typically the head teacher that is the key decision-maker in relation to budgets, Figure 20 shows head teacher responses only, indicating that just over a quarter of respondents (26.7%) indicate an expectation to spend the same amount on science (relative to the previous academic year) in 2012-13, with just under a fifth (19.3%) indicating the same expectation for 2013-14. The majority of respondents expect to spend the same (53.5% of respondents for 2012/13 and 46.4% of respondents for 2013/14).

Figure 20: Anticipated changes in amount spent on science (academic years 2012-13 and 2013-14) by job role

There are no major differences in expected future spend by type of school – however it may be worth noting that of the 10 foundation schools that responded to the survey, none expected to spend more on science by 2013-14.

Respondents were also asked to provide an indication of how they anticipate funding levels will impact on the amount of practical science experiences they will be able to provide over the forthcoming two academic years. Around half of respondents (52%) expect that future funding levels will enable them to provide the same amount of science practical teaching and experiences as they do now. Just under a third of respondents (31%) believe that funding over the next two years will enable them to provide an increased amount of science practical experiences (Figure 21).
However it should be noted that these forecasts must be regarded as largely speculative given respondents do not yet know what their science budgets will be.

**Figure 21: How anticipated future funding levels are expected to affect the amount of science practical teaching/experiences provided over the next two years**

<table>
<thead>
<tr>
<th>Impact of Funding</th>
<th>Percentage</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>More</td>
<td>52.00%</td>
<td>(206)</td>
</tr>
<tr>
<td>Same</td>
<td>31.00%</td>
<td>(123)</td>
</tr>
<tr>
<td>Less</td>
<td>7.30%</td>
<td>(29)</td>
</tr>
<tr>
<td>Don't know</td>
<td>9.70%</td>
<td>(38)</td>
</tr>
</tbody>
</table>

**4.10 Impacts of funding levels on teaching and learning of practical science**

The impacts of the funding currently available for practical science in primary schools were explored in more detail during the qualitative phases of the research. Even though many participants often reported that current funding levels were tolerable, they nevertheless went on to identify a number of negative impacts on science teaching and learning from static or declining budgets. These respondents consider that it is inevitable that, where budgets had declined or remained static, this has affected the teaching and learning experience for primary school science – citing impacts upon the sufficiency of equipment and consumables; the amount of ‘experiences’ such as science speakers that can be afforded; the lack of money to train teachers how to use science equipment; and the capacity to ‘raise the bar’ in terms of the approach to practical science teaching. This can mean that schools are unable to buy new types of equipment or upgrade existing stock, a problem that, in many schools (as stated previously), is exacerbated by the inability to carry over unused budget from year to year in order to “save up” for more expensive equipment.

“Like all schools we sometimes find it hard to find the funds to buy the bigger, more expensive pieces of equipment”

“If I need extra funding, the head teacher usually manages to find it but it is always a case of robbing Peter to pay Paul”

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28 Discussed in more detail in section 3.5
“I can no longer afford to pay for external speakers and learning experiences are suffering as a result”

“Subject leaders can have a wish list but if the money runs out then you can’t have the extras. So there is a basic kit and usually all the nice things tend to fall off the list”

“There just is not enough money to properly maintain a good stock of everything that is needed to fulfil the requirements of the curriculum and to stimulate and excite children about science”

“A few years ago we purchased quite a lot of resources but with breakages we are starting to run out – it is more and more difficult to keep on top of what we need”
5. Resourcing of practical science

5.1 Key messages in relation to resourcing against SCORE indicative items

In addition to quantifying the levels of funding available for practical science in primary schools, the research sought to identify the availability of practical science resources in primary schools, considering the three main resourcing areas relevant to practical science in primary schools – equipment and consumables; classroom facilities; and access to outside learning environments.

The starting point for this part of the research was the full benchmark list of resources developed by SCORE in the previous phase of the Resourcing School Science project. The full benchmarks represent a full and comprehensive list of the items required to deliver the National Curriculum programme of study in science to an appropriate level. It was therefore not felt to be practicable to ask schools to report on the availability of all the various benchmark items.

For each of the three resourcing areas, a smaller list of ‘indicative’ items was therefore drawn from the full benchmark list by an expert Working Group convened by SCORE. These items were then incorporated within the main survey of primary schools.

For each of the indicative equipment and consumables items, survey respondents were asked to consider whether they have:

- Enough of each item in working order (‘enough’ in this context was clearly defined as either one per pupil, one between two pupils, one for small groups, or one for a class demonstration);
- Enough of each item but not all in full working order;
- Not enough to meet requirements;
- Not enough and respondents state they need items in question;
- Not enough, but respondents state they do not need items in question;
- Items not in use.

For each of the classroom facilities and outside learning environments, respondents were asked to state whether the facility or form of outside space is:

- Easy to access and used regularly;
- Easy to access, and used sometimes;
- Not easy to access;
- Not accessible, and needed;
- Not accessible, but not needed.

It should be noted that the evidence gathered in both the quantitative and qualitative phases of the
research strongly suggested that the indicative items represent an appropriate level of resource for primary schools. Very few schools reported that they had any of the items but did not need them. In addition, over 90% of respondents who took part in telephone or face-to-face interviews agreed that the indicative items outlined in the survey are fit for purpose and give an accurate picture of the items needed to offer an effective practical science learning experience.

Among the small proportion of respondents that disagreed with any of the items, the use of science clothing – ‘to feel like a scientist’ was questioned on the basis that this could be expensive to resource and could be considered a ‘nice to have’ item (and therefore harder to justify if there are financial constraints), rather than being essential. However this was a minority view, with a somewhat larger proportion of respondents stating that they did not have but needed access to science clothing.

In addition to the sections of the survey dealing with the accessibility and availability of the indicative resources, respondents were asked to consider their satisfaction with current levels of resourcing, and their confidence that future levels of resource would enable them to sustain current levels of practical science experiences. A small number of open response questions were included to allow respondents to raise additional issues that may not have been covered in the rest of the survey. Finally, the findings that emerged from the survey were discussed in detail during the subsequent phase of in-depth qualitative research.

Key messages that emerge from these findings include the following:

- The average primary school has sufficient quantities of only 46% of the equipment and consumables they need;
- Almost three-quarters of primary schools report having sufficient quantities of less than 60% of the science equipment and consumables they need, and fewer than 10% of schools have more than 80% of the indicative equipment;
- There are particular problems with resourcing certain key types of equipment, notably data loggers and supplies of working batteries;
- Teachers find it difficult to obtain supplies of some types of equipment – such as magnifiers, stopwatches, and magnets – that are both fit-for-purpose and sufficiently robust to withstand use by pupils;
- The average primary school has easy access to just over half the indicative classroom facilities needed;
- Only 12% of schools have easy access to 80% or more of the indicative classroom facilities;

29 The list of equipment and facilities in the survey summarised indicative items and was not intended to be an exhaustive list of everything required (for a more comprehensive list of all items required readers should refer to the SCORE benchmarks)
Access to outside learning environments – such as ponds, varied habitats, and environments with varied rock and soil types – appears to be less challenging than other resourcing areas; nevertheless, the average primary school still reports easy access to only two-thirds of the indicative outside learning environments and no schools were able to report easy access to all of them;

There are numerous indications from both the quantitative and qualitative research that current levels of resourcing are now taken for granted and regarded as the norm; for example, it is noteworthy that nearly half of respondents report being ‘quite satisfied’ with current levels and only just over a fifth report being ‘quite dissatisfied’ or ‘very dissatisfied’, in spite of the relatively low levels of reported resources relative to the indicative standard;

Lack of storage space for science equipment and consumables is an issue for nearly a fifth of respondents, and can mean that items are not purchased even if there is the money to buy them, as there is nowhere to store them safely;

Lack of confidence in using science equipment among teachers can also impact on practical science learning experiences – 16% of respondents cited the need for better access to Continuing Professional Development (CPD);

Insufficient resources for practical science can impact on the teaching and learning experience. For example it may lead to demonstrations of equipment rather than pupils experiencing it for themselves singly or in pairs; and the need for teachers to be creative in making equipment they cannot afford to buy, resulting in practical science experiences that may be less engaging for pupils in primary schools.

5.2 Equipment & consumables

The survey sought to ascertain the extent to which schools are well resourced or otherwise in comparison with the indicative list of equipment and consumables.

5.2.1 Availability of equipment & consumables

The results show that, on average, the indicative items are available in working order and in sufficient quantities to less than half (43.3%) of the respondent schools. Just under a third of all responses (30.9%) indicate there is not enough of the equipment that is needed (Figure 22).
Furthermore, it appears that only around 8% of the surveyed schools are able to access 80% or more of the indicative items of equipment and consumables in working order and in sufficient quantities, and only around 2% are able to access more than 90%. The majority of respondents (71%) report having less than 60% of the items in sufficient quantities, and a substantial number of respondents (42.4%) report having less than 40% of the items. Overall, the average primary school has only 46% of the equipment and consumables it needs to teach practical science in sufficient quantities (Figures 23 and 24 – please note, Figure 23 is scaled from 0-20% for ease of viewing).

This suggests that not only is the general availability of the indicative items relatively low but that the variation between individual schools is high, with only a tiny minority having sufficient quantities of all or most of the indicative items. There are therefore relatively few schools that can be considered well-resourced when measured against the indicative list and many that fall substantially short.
There is also some evidence of disparity on a regional level. Figure 25 highlights that surveyed schools from the South East report the highest levels of items in full working order, compared with the lowest in the North East. As with all the regional data, these findings must be treated with some degree of caution, given the small number of respondents from some regions. Nevertheless, it is of interest to note that reported levels of resourcing show a perceptible, if inexact, relationship to the relative economic prosperity of the various English regions as measured by Gross Disposable Income.
Household Income per head. There are high levels of resourcing reported in the prosperous South East and East of England, and relatively lower levels in the less prosperous North East, North West, and West Midlands. London is the major exception, with high levels of income but relatively poor reported resourcing levels; there are also some disparities in the South West, with somewhat worse resourcing levels than might be expected on economic grounds, and Yorkshire and Humber, where they are somewhat better (Table 9).

**Table 9: Regional household income levels by region (2012)**

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>5 Year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>11842</td>
<td>12126</td>
<td>12530</td>
<td>12972</td>
<td>13329</td>
<td>12560</td>
</tr>
<tr>
<td>Yorkshire and The Humber</td>
<td>12467</td>
<td>12760</td>
<td>13060</td>
<td>13236</td>
<td>13594</td>
<td>13023</td>
</tr>
<tr>
<td>West Midlands</td>
<td>12572</td>
<td>12872</td>
<td>13208</td>
<td>13601</td>
<td>14021</td>
<td>13255</td>
</tr>
<tr>
<td>North West</td>
<td>12624</td>
<td>12960</td>
<td>13383</td>
<td>13760</td>
<td>14176</td>
<td>13381</td>
</tr>
<tr>
<td>East Midlands</td>
<td>12947</td>
<td>13292</td>
<td>13608</td>
<td>13878</td>
<td>14267</td>
<td>13598</td>
</tr>
<tr>
<td>South West</td>
<td>13934</td>
<td>14280</td>
<td>14730</td>
<td>15156</td>
<td>15563</td>
<td>14751</td>
</tr>
<tr>
<td>East of England</td>
<td>14832</td>
<td>15240</td>
<td>15600</td>
<td>15932</td>
<td>16392</td>
<td>15599</td>
</tr>
<tr>
<td>South East</td>
<td>15851</td>
<td>16292</td>
<td>16698</td>
<td>17122</td>
<td>17610</td>
<td>16715</td>
</tr>
<tr>
<td>London</td>
<td>17614</td>
<td>18501</td>
<td>19198</td>
<td>19593</td>
<td>20238</td>
<td>19029</td>
</tr>
<tr>
<td><strong>England</strong></td>
<td><strong>14231</strong></td>
<td><strong>14668</strong></td>
<td><strong>15097</strong></td>
<td><strong>15464</strong></td>
<td><strong>15931</strong></td>
<td><strong>15078</strong></td>
</tr>
</tbody>
</table>

*Source: ONS 2012 ‘Regional Household Income, Spring 2012’, table 1.1*

Detailed data on the availability of the individual indicative items (Figure 26) show that there are particular issues associated with maintaining the equipment needed in sufficient quantities, in full working order at all times. It appears to be more difficult for schools to maintain sufficient quantities of certain specific items in full working order – notably data loggers, equipment to measure lung capacity, stethoscopes and bubble making equipment.

The qualitative research also suggests that being able to maintain a stock of working batteries is of particular importance, as they are needed to power other types of equipment – such as torches and stopwatches. Another concern is the extent to which equipment is ‘pupil-friendly’, with many pupils breaking equipment such as magnifiers (glass easily broken if dropped) and magnets (can be de-magnetised through ‘over-enthusiastic’ use).
Figure 25: Level of resourcing of equipment and consumables among surveyed primary schools (by region)

Base: 10985 responses
**Figure 26: Level of resourcing of equipment and consumables**

![Diagram showing the level of resourcing of equipment and consumables for various types of equipment. The diagram includes bars for % of responses ranging from 0% to 100% for each type of equipment.](image)

- **Type of equipment**
  - Magnets
  - Torches
  - Batteries
  - Buzzers and motors
  - Plants
  - Magnifiers
  - Tuning forks
  - Living animals
  - Springs
  - Graded sieves
  - Renewable energy equip
  - Dataloggers
  - Bubbles
  - Stethoscopes
  - Lung capacity equip

- **Legend**
  - Enough working
  - Enough not all working
  - Don’t have enough
  - Have, don’t use
  - Don’t have, need
  - Don’t have, don’t need
  - Don’t know
Under the Microscope: The State of Resourcing of Practical Science in Primary Schools in England
April 2013

Base: 4759 responses

Type of equipment

% of responses

Candles
Teeth model
Liquid measures
Mirrors
Rock/soil samples
Skeleton
Force meters
Microscope
Stopwatch
Ramps & Surfaces
Funnels
Balance scales
Thermometers

- Enough working
- Enough not all working
- Don't have enough
- Have, don't use
- Don't have, need
- Don't have, don't need
- Don't know

Base: 4759 responses
5.2.2 Satisfaction with equipment and consumables levels

Nearly half of all respondents (48.2%) state they are ‘quite satisfied’ that they have sufficient equipment and consumables to teach practical science. Nearly a fifth of respondents (18.9%) are ‘quite dissatisfied’ (Figure 38), and further 3.7% are ‘very dissatisfied’ (Figure 27). Just over a fifth of respondents evidence some degree of dissatisfaction with current levels of equipment and consumables, even though more than 40% of schools have less than 40% of the indicative items. This again reinforces the impression that teachers accept that it is normal to have relatively low levels of equipment and consumables.

This is strongly underpinned by qualitative feedback pointing to a culture of tolerance and ‘making do’ among respondents, with a sense that inadequate resourcing and underfunding have become the ‘new norm’. Schools appear to have begun to accept and adapt their own strategies to deal with the situation as best as they can. As previously stated, one of these strategies is for teachers to supplement resources by paying for equipment and consumables themselves.

There appear to be somewhat different perceptions about the level and sufficiency of resources among different respondent groups, with a higher proportion of Senior Leadership Team respondents reporting they are very satisfied (12.5%), compared with science coordinators (11%) and classroom teachers (6.4%). However just over a quarter of classroom teachers (26.7%) state they are neither satisfied nor dissatisfied with resourcing levels, compared with Senior Leadership Team members (17.3%) and science coordinators (17%) (Figure 28). The findings from classroom teachers must be treated with some caution, given the low base of respondents from this group, but may again reflect a lack of confidence among teachers in making confident judgments about what is needed in the classroom to teach practical science.
Figure 27: Satisfaction that there is sufficient equipment and consumables for practical science

![Bar chart showing satisfaction levels for practical science equipment and consumables](image)

Base: 394

Figure 28: Satisfaction that there is sufficient equipment and consumables for practical science (by job role)

![Bar chart showing satisfaction levels for practical science equipment and consumables by job role](image)

Base: 394
Larger schools appear slightly more likely to be satisfied with the level of resourcing in comparison with smaller schools (Figure 29) – even though the latter typically have higher per capita funding, as discussed in Section 4.1. This may suggest that there are economies of scale in larger schools. This could be the case, for example, if individual pieces of equipment are used relatively infrequently, as a single set would then be required for each school regardless of its overall size.

**Figure 29: Satisfaction that there is sufficient equipment and consumables for practical science (by school size)**

Regional data must again be treated with some caution due to the low bases of respondents from some regions. Nevertheless, it is of interest to note that some regions reporting relatively low levels of equipment and consumables resources nevertheless have relatively large proportions reporting that they are ‘quite satisfied’ with resourcing levels – notably in the North East and West Midlands (Figure 30). This again seems to point to a tendency to tolerate current conditions, rather than demand better resources.
Figure 30: Satisfaction that there is sufficient equipment and consumables for practical science (by region)

Base: 397
5.2.3 Anticipated future levels of resourcing for practical science

In addition to their current level of satisfaction, respondents were asked to consider whether they would have sufficient equipment and consumables to effectively deliver practical science work over the next two years. While these responses must be regarded as speculative, they do throw some light on teachers’ perceptions of how the resourcing of practical science is liable to evolve in the future. A small majority of respondents (57.2%) report they are ‘quite confident’ they would have sufficient equipment and consumables compared with 22.5% of respondents who report they are ‘not very confident’ (Figure 31). It is of some interest to compare these findings with those for the anticipated change in funding levels (Section 4.9), which shows that the majority of respondents expect science budgets to stay the same over the next two years. The expectation that sufficient equipment and consumables will be available is therefore likely to reflect this assessment of the likely funding situation, and may imply that any reductions to science funding would impact substantially on these expectations.

Figure 31: Confidence of having sufficient equipment and consumables over the next two academic years to enable effective delivery of practical science

![Bar chart showing confidence levels](chart.png)

*Base: 397*
Again there are discernible differences by region, although the low bases from which these data are derived mean that they should be treated with considerable caution. Even with this caveat, however, it is worth noting key differences – for example a relatively higher proportion of respondents from the West Midlands region report that they are very confident of sufficient resources in the future (25.6%), compared with only 6.9% of respondents in Yorkshire & the Humber (Figure 33).

There appears to be greater levels of confidence among larger schools compared with medium-sized and smaller schools (Figure 34).
Figure 33: Confidence of having sufficient equipment and consumables over the next two academic years to enable effective delivery of practical science (by region)
Figure 34: Confidence of having sufficient equipment and consumables over the next two academic years to enable effective delivery of practical science (by school size)

5.3 Classroom facilities

Respondents indicate that science is most often taught in ordinary classrooms within primary schools. The availability of appropriate facilities and science related items in school classrooms is therefore of considerable importance in understanding resourcing levels. Overall, the levels of resourcing in relation to classroom facilities appear to present cause for concern, with only around a quarter of responses (25.9%) indicating easy and regular access to the items listed in the survey and around a fifth of responses (21.2%) report having no access to the indicated items30 (Figure 35). More than a fifth of responses stated that the facilities could not be accessed and were needed, and approximately 15% of responses stated that the facilities were not easy to access.

30 See Figure 38 for the indicative classroom facility items
A similar picture emerged in relation to the proportion of respondent schools with easy access to varying proportions of the indicative classroom facilities (Figure 36 – please note this is scaled from 0-25% for ease of viewing). Only 11.9% of schools had easy access to 80% or more of the facilities, and less than a quarter of schools had easy access to 60-79% of the facilities. This means that nearly 60% of schools have easy access to 59% or fewer of the facilities.
Regional responses indicate some disparities - although again caution must be exercised given the relatively low bases in some regions. These regional variations seem less marked than in the case of equipment and consumables, but it is striking that the South East and the East of England regions again report the highest levels of access to and regular use of the indicative facilities. In addition, it may be noted that the highest proportions of responses that report having no access to the items needed are again to be found in the North West, North East and West Midlands.

Further evidence of variation is found in other aspects of the responses: for example responses reporting easy access to items are similar in the North West and Yorkshire & the Humber, yet responses in these two regions in relation to items they do not have but do not need, are considerably different (Figure 37). This suggests differing levels of expectation across schools about the facilities needed to teach practical science – in effect, one level of resourcing may seem ‘good’ to one school, but may not to another.
Figure 37: Level of resourcing of classroom facilities among surveyed primary schools (by region)

Base: 3144 responses
The most widely resourced facilities in classrooms are sinks and some form of resources area. By contrast, it is more difficult for schools to access a dark space within the classroom (Figure 38). In addition, it is notable that ‘creative items’ – which were defined as polymers, smart materials, heat sensitive toys, UV beads, puppets, and various science games – were often reported as being in short supply or inaccessible but needed. These kinds of items might be expected to play an important role in bringing science alive for primary school pupils, and the large number of schools reporting that they need such items suggests that this role is well understood by teachers. It is also worth noting that science clothing, although it was the most frequently disputed indicative item on the list – was also frequently reported as not being accessible but needed.
Figure 38: Level of resourcing of classroom facilities

Base: 3146 responses
5.3.1 Use of external science speakers in the classroom

The survey found that a majority of respondent schools (69.4%) make use of external speakers between one and three times per annum. By comparison, just over a fifth of respondents (21.5%) make no use at all of this type of resource (Figure 39).

During the qualitative research, it was found that some science coordinators report that equipment and resources to teach science at primary level is not, or need not, be particularly expensive and that in many cases the lion’s share of the school science budget is spent on bringing in external science speakers. When this happens the teachers maximise the resource by learning how to do certain practical activities themselves. For example one school described using an external resource to teach the children how perfume is made, and from what they had learned from this experience, the teachers went on subsequently to make soaps and bath bombs with their classes.

Figure 39: Frequency with which external speakers used to provide practical science experiences in the classroom

![Figure 39](image)

Base: 397

There appears to be greater emphasis on this type of resource in some regions compared with others, with 34.5% of respondents in Yorkshire & the Humber stating they never use external speakers, compared with just over 10% in the East of England (Figure 40) - although again caution must be exercised given the relatively low bases in some regions.

It is important to note that the cost of external speakers and events may make them vulnerable at times of budgetary constraint.
**Figure 40: Frequency with which external speakers used to provide practical science experiences in the classroom (by region)**

- **Region**: East of England, East Midlands, London, North East, North West, South East, South West, West Midlands, Yorkshire and the Humber

- **Frequency**:
  - Not at all
  - 1-3 times a year
  - 4-6 times a year
  - 7-9 times a year
  - 10 or more times a year

- **Base**: 395
5.4 Outside learning environments

5.4.1 Accessibility of outside learning environments

On the whole respondent schools report better levels of resourcing in relation to access to outside learning environments than for classroom facilities and equipment and consumables (Figure 41). On average, each of the indicative outside learning environments was accessible to more than 75% of the schools surveyed.

However, although many schools report they have easy access to certain types of outdoor learning, not all are making regular use of this – notably of access to a vegetable patch or allotment (Figure 44). Respondents note that it can be difficult to easily access a pond or similar environment if there is not one on-site or located close by. Qualitative feedback suggests that where schools have received an injection of funding, investment in building a pond is one of the most common uses for the extra money.

Figure 41: Level of resourcing of outside space among surveyed primary schools

Further analysis of the responses show nearly three quarters (72.8%) of all schools surveyed have access to 60% or more of the indicative outside learning environments. However, it should still be noted that only around a fifth of schools (21.1%) report having access to 80% or more of the indicative outside learning environments, and more than a quarter have access to less than 60% of them (Figure 42 – please note this is scaled from 0-35% for ease of viewing).
Figure 42: Spread of schools by percentage of ease of access to outside learning environments

More detailed regional data should again be treated with caution given the low bases of responses from some regions. Nevertheless, it is of interest to note that the South-East, South-West and East of England regions report the comparatively highest levels of access to outside space (Figure 43).
Figure 43: Level of resourcing of outside space among surveyed primary schools (by region)

Base: 2376 responses
Figure 44: Level of resourcing of outside learning environments

- **Day/night sky**: 
  - Easy/regular access: 40% 
  - Easy/sometimes access: 10% 
  - Not easy to access: 50% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

- **Varied surfaces/play equipment**: 
  - Easy/regular access: 60% 
  - Easy/sometimes access: 20% 
  - Not easy to access: 20% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

- **Outside space**: 
  - Easy/regular access: 70% 
  - Easy/sometimes access: 20% 
  - Not easy to access: 10% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

- **Varied rock & soil types**: 
  - Easy/regular access: 80% 
  - Easy/sometimes access: 10% 
  - Not easy to access: 10% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

- **Varied habitats**: 
  - Easy/regular access: 90% 
  - Easy/sometimes access: 5% 
  - Not easy to access: 5% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

- **Vegetable patch**: 
  - Easy/regular access: 85% 
  - Easy/sometimes access: 10% 
  - Not easy to access: 5% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

- **Pond**: 
  - Easy/regular access: 75% 
  - Easy/sometimes access: 15% 
  - Not easy to access: 10% 
  - No access but need: 0% 
  - No access but don't need: 0% 
  - Don't know: 0%

*Base: 2770 responses*
Nearly all respondents (96%) report that they have access to some form of outside learning environment – including a vegetable patch and varied types of habitats other than the school building or playground. Just over half of responses (53.4%) report having easy access to a pond – which appears to be one of the most sought-after types of facility (Figure 44). Indeed, ponds are reported to be the most difficult type of outside space to access, followed closely by access to varied rock and soil types.

5.4.2 Satisfaction with accessibility of outside learning environments

The generally good level of accessibility to outside learning environments (relative to other areas of resourcing) is paralleled in greater satisfaction with this area of resourcing than with equipment and consumables. The majority of respondents report that they are either very satisfied (47.9%) or quite satisfied (39.2%) with their access to outside learning environments (Figure 45), and only a very small minority report dissatisfaction (4.7%).

Figure 45: Satisfaction that there is sufficient access to outside space for practical science

Base: 398
5.5 Approaches to resourcing in new builds

The level and approach to resourcing practical science in new build primary schools was explored through qualitative research, on the basis of literal responses received to open questions in the survey and discussions with research participants during interviews and schools visits.

Key findings indicate that new builds typically benefit from:

- More space;
- More storage;
- Dedicated areas designed specifically for science.

“The new build allows room for setting up practicals which don’t need to be packed away at the end of lessons which is really useful and enhances the teaching and learning experience with practical work having its own designated area”

“(We now have) a space where people can be messy and the children will be able to get the most out of their experiences. The messy lessons are the wow lessons. With washable floors and proper benches it is not a problem having to clear up any mess because an English lesson follows”

“The different approach in the new build is that there are shared areas that can be used to carry out investigation work. We have new rooms that all teachers can use for inquiry work”

New builds typically offer a wider range of outdoor surfaces, for example cobbles and soft sponge, which are used to teach the effects of friction. Pupils are able to bring in skateboards or roller skates to enable experimentation with friction on different surfaces.

Another common theme is the inclusion of larger outdoor conservation areas, often with storage attached such as garages or sheds, which can be used to house bird boxes, seed, or gardening equipment for instance. These resources can accommodate dedicated garden days – in some examples pupils have been given their own space to grow plants and work on habitat-related science practical lessons out of doors.

Organisation of resources appears to be better within new build schools, with much more space enabling segregation and effective planning of the use of equipment. For example dedicated ICT suites have been used to set up virtual experiments which do not have to take place in a classroom.

There was no common source of guidance used among new builds seeking to resource science; respondents report using information such as the ASE and CLEAPSS31 websites, as well as their own knowledge of what they felt would be needed.

31 Advisory service providing support in science and technology
5.6 Issues relating to resourcing

Nearly 90% of respondents have experienced issues in relation to resourcing practical science. Only a small proportion - just over a tenth of all respondents (11.6%) stated that they have no issues with resourcing of practical science - all of these described themselves as ‘lucky’.

5.6.1 Common ‘missing’ items

Data loggers are by far the most sought after type of equipment, with 18% of respondents stating they would want these for their school.

Other items that respondent schools would want, but do not have, include:

- Microscopes;
- Living eggs/chicks;
- Renewable energy models; and
- Skeletons.

Problems with the availability of items can be as a result of breakages, ineffective organisation or simply not having the items in sufficient quantities. Discussions with teachers suggest that maintaining a regular supply of working batteries appears to be the biggest issue, because lack of batteries impacts directly on the usability of so much other equipment. Both the qualitative and quantitative data also highlighted issues in maintaining sufficient stocks of:

- Working torches;
- Funnels;
- Sieves;
- Magnifiers; and
- Magnets.

In all these cases, the qualitative research indicates that the main reason for this is the lack of availability of reasonably priced, ‘child-proof’ equipment. Around a third of respondents reported the need for more ‘child-friendly’ equipment for science, as if items were more robust, they would be less likely to break and thus be more economical in the longer-term. Certain types of equipment, however, do come in more robust form, but may be cost-prohibitive. An example of this is magnifiers, which in a (fit for purpose) glass/metal form cost around £6-7 each but are easily broken, whereas plastic magnifiers are much cheaper at around 20p each but are easily scratched and have extremely limited powers of magnification.
“We would like access to some digital and normal working microscopes that primary children can use at all ages. We currently have none, and pupil voice in our school has shown that children as young as 5 years old would like to be able to use microscopes and learn more about biology. However, it costs so much out of our small science budget and it wouldn’t be possible to buy them with our other demands.”

“Wish lists (for equipment) are produced and passed on but the funding does not arrive”

5.6.2 Storage

Just over 19% of respondents state that lack of storage space, and in particular a lack of dedicated storage for science, means that it can be difficult to not only find space for equipment and consumables, but also keep it organised and thus easy to use. In some cases resources are shared with other subjects, and either not always returned to the science storage area, or broken during other lessons. Health & safety policies can also prevent easy access to science items (for example, by requiring storage cupboards to be locked when pupils are at school, making science resources impossible to access during the lesson itself without careful pre-planning). In many cases, without advance planning, it would not be possible to source the appropriate item or items.

The time taken to organise resources can impact on the science coordinator by eating into time that could have been used to plan practical science lessons. Furthermore, a number of respondents acknowledge that even though they would want additional funding to purchase more (or better) equipment, the lack of appropriate storage would act as a major barrier for this, even if money was available.

“Poor organisation risks a misperception that equipment/consumables are not owned by the school, when they may just be elsewhere. Lockable storage controlled centrally appears to be the best solution”

“All schools are likely to have issues with storage”

Health and safety regulations dictate that the science cupboards must be locked at all times between 8am and 4pm so if items are forgotten they cannot be accessed during the course of a lesson

“The resources need sorting, checking, counting and need monitoring in terms of what is safe to use and in working order. Across all subjects, everyone shares the same resources cupboard – so things do get mixed up. People don’t always put things back, equipment gets lost or isn’t returned in its original condition”

“Storage of resources is the only barrier faced in our school with regards to resourcing practical science. Whilst the resources are very well organised there are certain items that can be difficult to store. I would always think about storage of items before ordering them, which of course could result in some excellent resources not being bought simply because of the space needed to store them”
5.6.2.1 A dedicated science ‘space’?

“Primary classrooms are not set up for practical work – it takes lots of organising beforehand and moving of furniture”

“Storage is a major issue in the school. Storing the science boxes in classes where the practical science (is) not taking place or in corridors is not ideal and does impact on teaching. Sometimes the science boxes in one class do not contain the right equipment for a planned lesson and this can delay/take time away from practical science planned for the lesson”

“Primary schools would benefit from dedicated lab space. This would encourage teachers to carry out more practical science and make children feel more like scientists”

Qualitative feedback (but only from approximately 5% of participants, as detailed in Section 7) indicates that the provision of a dedicated science space would be valued for the knock-on effect of helping to prepare pupils for work in laboratories at secondary schools, (i.e. to make this transition easier), as well as the benefits of being able to leave long-term experiments out and to teach a wider variety of practical science lessons. However the majority of respondents acknowledge that it appears unrealistic for schools to be able to find the space for a dedicated science area – or the time to use it effectively without support of dedicated assistants as secondary schools have.

“It (having a dedicated science space) would make a huge difference but it would be too costly to set up... we could never afford it”

“If we had a dedicated space, teachers would do so much more. At the moment we store equipment in big plastic boxes. Teachers have to go up and get these boxes down, get all the equipment out, set up then pack away again. Unlike secondary schools, teachers at primary level don’t get allocated prep time for this. You end up spending your whole lunchtime doing this. So a dedicated space would make a difference – we could leave things out”

“We are already so pushed for time. Even having a designated space would cause timetabling issues, although if we had a laboratory space it would enhance learning as children would know that they are going to learn about science. It is also more fun and exciting so they would engage more”

5.6.3 Teacher training and confidence in use of practical science resources

Nearly 40% of all respondents (38.4%) report they are ‘quite satisfied’ that they have sufficient training on the use of science equipment and consumables, compared with just over a fifth (21.1%), that report being ‘quite dissatisfied’ (Figure 46). In addition, more than a quarter of respondents state that they are ‘neither satisfied nor dissatisfied’, again perhaps reflecting a tendency to tolerate the current situation, even if it is perceived to be less than wholly satisfactory.
It appears that larger schools are slightly more likely to be satisfied with access to training, with 13.1% of respondents from large schools reporting they are very satisfied, compared with 8.7% of respondents from medium-sized schools and 8.5% of respondents in smaller schools (Figure 47).
It should be noted that it is not the intention of this research to evaluate teacher ability; however, a number of respondents have raised concerns about confidence in teaching practical science, and this feedback is included here as schools have noted these issues can impact on the types of practical experiences offered to pupils.

Where lack of confidence in teaching practical science has been raised, this appears to be for a number of reasons:

- Teachers do not always consider themselves “science specialists” so can feel daunted by some types of questions posed by pupils;
- Some teachers are cautious about using some types of equipment for example candles, knives, or glue guns, clearly because they consider them to be high risk, potentially dangerous items;
- In some schools there is limited classroom support from Teaching Assistants, which can act as an obstacle to teaching practical content;
- Some teachers report concerns about new techniques advocated in teaching science at primary school, such as the use of puppets.

In particular, it is worth noting that 16% of those giving literal responses to the survey cited the need for appropriate CPD as a particular issue. Moreover, some of those interviewed for the
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qualitative research emphasised that the amount and type of practical science taught can vary, even from one teacher to another within the same school, as a direct result of the level of confidence in teaching the subject, with teachers with a background/degree in science inevitably far more confident than those that do not. This can mean that not all teachers are able to maximise the resources that are available within the school, and, in some cases, do not have a clear understanding of what a “well-stocked science cupboard” should actually look like. For example approximately 10% of survey respondents state they do not know how to use a data logger – yet this is the most commonly reported ‘missing’ item that schools would like to own.

“Some teachers are quite creative with practicals whilst others prefer to play it safe – this is due to subject knowledge and confidence”

“Science in primary school will be as strong as teachers’ subject knowledge and confidence which varies. NQTs often don’t have sufficient knowledge (especially PGCE graduates who do not have a science degree)”

“(We have) very willing teachers who are often afraid of science, because they worry they do not know enough”

“I know how to go about resourcing as a science coordinator but I am not a scientist. I struggle with things like data loggers. We have got a beautiful set but I don’t know how to use them”

5.6.4 Classroom support

Another related issue that emerged during the qualitative phase of the research as being of particular importance was classroom support. Several respondents mentioned that support from a teaching assistant was particularly important for delivering practical experiences, which were often messier, more difficult to control, and more time consuming than ordinary classroom teaching.

“It’s not the resources that we have difficulties with - its having enough adults to ensure all children learn to their full potential. One teacher to thirty children all working at the same time makes it very difficult to stretch the more able whilst ensuring the less able can access the learning”

Approximately a fifth of respondents stated that classroom assistants could be considered an additional resource for teaching practical science, with a small proportion (5%) of participants in the qualitative research suggesting that a dedicated science teaching assistant would be beneficial.

“Employing a science technician/TA would be very useful as it would allow more time to teach practical science rather than spend time preparing, setting up and tidying up”

“To have a specialist teaching assistant would be much better as he/she would have that expert knowledge about safety aspects and general management of science”

“I do think that there is a need for extra support but not necessarily a dedicated assistant for science only. Most of the time you just require a second pair of hands”
5.7 Impacts of resourcing levels on teaching and learning of practical science

Feedback from qualitative fieldwork indicates that teaching and learning are clearly impacted by the level of resourcing within schools. Changes to approaches to practical work that respondents have had to introduce as a result of insufficient resources include:

- Demonstrations of equipment rather than the opportunity for pupils to experience it themselves (singly, in pairs, or in small groups);
- Teachers having to be creative in making their own equipment;
- Not being able to teach as much practical science as schools would like; and
- Providing pupils with science experience that may be less engaging and interesting.

“Children tend to work in larger groups for investigative work and that really does impact on the quality of teaching and learning. Ideally we would like to have enough sets of everything so children can experience more by working in pairs”

“Practical science in school takes a lot of planning and preparation and the fact that we don’t have everything (equipment) we need does put teachers off doing it as much”

“(when science was well-resourced) Children performed well in science and as a school we produced brilliant results in engaging children and providing good practical experiences”

“We would be more adventurous in our science teaching if we had all available resources”

“We need everything. I have just joined the school and it is grossly underequipped. Staff do not do practical work because there is either not enough apparatus or we just don’t have it. There is very little science teaching being done in general. The children are lucky to have 20 lessons per year”

“Pretty much everything is old and deficient in quantity. Teachers have to be very creative and often make practical work ‘work’ because of purchasing what’s needed themselves, but things are often cobbled together in a ‘make do and mend’ fashion. The pupil experience is good because of the creativity in teaching but a lot is begged, borrowed and bought by teachers. I would like to audit and bin much of our kit but there’s no money to replace, so we have to make do.”

“Even though we are still teaching practical work as part of science – we are modifying what we are doing. We don’t have enough for pair work so children work in groups of three”
6. Drivers influencing resourcing of practical science in primary schools

6.1 Identification of key drivers

The main focus of this research is the funding and resourcing of practical science; however, respondent feedback during the qualitative phases of the research has identified that it is important not to consider these factors in isolation. A wide range of drivers combine to influence the way and extent to which practical science is provided within primary schools – also contributing to considerable inequalities between schools. Drawing on the contributions made by respondents in literal comments and in the follow-up interviews, it has been possible to identify a series of key drivers that are perceived to have a particularly significant impact on the resourcing of practical science in primary schools. The following sections are therefore drawn from qualitative evidence.

6.2 Government and other external policies and impacts

6.2.1 Curriculum and proposed changes

Many respondents appear apprehensive about the (as yet unknown) impacts of the proposed changes to the primary science curriculum, notably because this may impact on the level of resourcing required to deliver it, yet a concern that budgets would not be increased to reflect this. Qualitative feedback also points to a great deal of uncertainty around planning for future resourcing because of planned changes to the curriculum for science. Proposed changes are preventing some schools from investing to upgrade or purchase new types of equipment, which can impact on provision of science experiences for pupils.

“It is difficult to know what will be necessary to resource primary science over the next few years as so much depends upon where the curriculum goes. From reading the draft curriculum, (it seems) there will be fewer opportunities for practical science, particularly in terms of open-ended investigations and those investigations children will carry out will be very prescriptive”

Where there is a prospect of increasing class sizes in some schools/regions (reported by approximately 14% of respondents), when combined with either static or declining budgets this is likely to mean that resourcing of practical science could become increasingly difficult over time.

6.2.2 Removal of science from Standard Assessment Tests (SATs)

Respondent schools report considerable negative impacts on science teaching as a direct consequence of policy changes to SATs. Just over 45% of respondents believe that the removal of SATs in science at Key Stage 2 has resulted in too much emphasis on literacy and numeracy at the expense of science, with many describing science now to be the “poor relation”, as demonstrated by the following respondent quotes:
“Science gets squeezed out by other curriculum areas”

“The budget (for science) has decreased again as the elimination of the SATs exam has meant less time and money is invested in science as a result”

“The removal of the SATs examination has meant that the school no longer has to achieve a science standard. Although science is still a core subject – it is not treated as such...science is absolutely being pushed aside”

“The removal of science from the SATs has meant that teachers, particularly those in year 6, view it as 'less important' and a subject that can be omitted in place of Literacy and Maths. As a consequence, results in our school have dropped significantly”

“The removal of SATs has had an effect – there is no longer an exam to prepare for, therefore science is not a priority at the moment”

“Time is another thing that has been down-graded since the removal of SATs. We used to teach 3 hours of science per week but now the Head teacher says not to bother with science too much as it’s not as important”

“Training to support teachers with their skills and knowledge is no longer available – the budget will not stretch and the school will not pay for staff to attend science courses. This is because Science is considered a non-core subject due to the removal of SATs”

“...even basic science facilities are not seen as a priority by Ofsted, who removed the science SATs and made it clear they had ceased taking an active interest in primary science or any other subject apart from reading/writing/maths. This makes it hard to prioritise science in the current climate”

Indirect impacts of the removal of science from the key stage 2 SATs can therefore include:

- Less time allocated to the teaching of practical science, with literacy and numeracy taking precedence;
- Less money available for resourcing science;
- Reduced status of science as a subject;
- More limited access to CPD in science for teachers.

It should be noted however, that while respondents raised this as a driver affecting resourcing of science, only a very small proportion (less than 3% of respondents) explicitly suggested that science should be restored to the SATs when specifically asked what would improve the resourcing of practical science.

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32 In one example a respondent reported a cut of two-thirds to the science budget as a direct result of the removal of science from SATs
6.2.3 Potential longer-term impacts

Respondents have expressed strong concerns about the longevity of practical science within primary schools, warning that science may become a minor, rather than a core, subject. This in turn has contributed to unease among respondents about the longer-term consequences - notably that the country as a whole will suffer if science is not treated as a priority.

“(Science needs to have) a higher priority at Government level. (I would like) a recognition that children learn much more than ‘just’ science when they carry out practical experiments. The thinking involved and knowledge of the world gained makes our students question the world about them and gives them a thirst for ‘finding out’. I am passionate about its value and saddened by its lower and lower status”

“There is a chance that science will once again disappear from the primary curriculum. Resourcing is variable in schools and whilst we replenish stock and have had a budget spend the last couple of years, we would need to continue this annually to ensure science is delivered to a high standard. We simply cannot do that”

“Practical work in science in primary schools is very much taking a back seat. It's such a shame”

“Science in primary schools is low on the agenda in many schools...I am shocked by how unimportant the science curriculum is”

“As someone who has a scientific background I feel very strongly that the lessened importance of the science curriculum will have a negative impact on the thinking and research skills of our young people and future generations”

“I feel quite strongly that science is being left to wither on the branch and as a country we will get all of our research from elsewhere, when what is needed is more support for science in this country”

6.3 Impact of economic drivers

6.3.1 Diminishing budgets for some schools

The impacts of the economic downturn continue to be felt within parts of the education system, with just over 40% of respondents reporting static or decreasing budgets. Furthermore there appears to be variations in the way in which schools are funded depending upon their region, and as such, there are differences within allocations offered by different Local Authorities.

“There is such a variety and range of school funding that poorer schools in poorer funded Local Authorities...cannot resource as they would like”

“My school stands to lose £42,000 under the new Government funding strategies”
6.3.2 Diminishing role of Local Authorities

Funding cuts have also contributed to a reduction of the science advisor role within Local Authorities. This has had noticeable consequences for some respondent schools, including:

- Removal of a loan system to provide certain types of science equipment to schools that do not have their own;
- Reduction or removal of Local Authority funded CPD for practical science;
- Absence of external ‘champion’ for science education in the locality, therefore less scope for influencing change such as the position of science on a School Development Plan and/or ring-fencing monies for science;
- No access to science purchasing via the Local Authority which saved schools time and money.

“In the past the Local Authority has funded advisory teachers to support and promote science in the Early Years and Key Stage 1; this was vital to maintain the growth and involvement in science and technology with young children. Due to changes in Government policy and funding this type of support to schools and Governing Bodies has gone”

“Since the Local Authority’s Science Support Team has been cut back, I don’t have anyone to turn to regarding science-related matters in school”

“Well there is support (now that the Local Authority science advisor has gone) but it is costly. For example for a specialist science advisor I would have to pay between £200 and £300 per session”

6.4 Variations in head teacher stance on practical science

Research findings suggest that the stance adopted by the Head teacher and/or Senior Leadership Team plays a crucial role in determining the profile of science within primary schools. This again is a key factor in contributing to widespread variation in the resourcing of practical science in primary schools, with some schools demonstrating strong commitment in the form of finances, time and expertise, and others allocating little or no money and time to its teaching and learning.

Aspects typically dependent on the Head teacher’s decisions include:

- Length of time allocated to science lessons;
- Whether or not Teaching Assistants support planning and/or delivery of practical science;
- Time allocated to teachers to enable them time to plan practical-based science lessons;
- Amount of funding allocated to science;
• Extent of focus given to science, for example in the form of ‘Science Week’, science fieldwork trips outside of school, grant applications, engagement with STEM ambassadors or application for the Primary Science Quality Mark.

33 However it should be noted that Head teachers must also take other factors into account when making these decisions, not just curriculum needs as already stated, but also socio-economic aspects such as extent of deprivation (which can impact on availability of funding that could be allocated to science)
7. What would improve the resourcing of practical science?

Respondents were asked to consider what would be needed in order to improve resourcing of practical science. The majority of respondents (40.6%) state that more money would make a real difference (Figure 48).

**Figure 48: Respondent views on what would improve the resourcing of practical science in primary schools**

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<table>
<thead>
<tr>
<th>What would improve resourcing</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>More money</td>
<td>40.6%</td>
</tr>
<tr>
<td>More/better storage for equipment</td>
<td>13.3%</td>
</tr>
<tr>
<td>More access to CPD</td>
<td>13.3%</td>
</tr>
<tr>
<td>More time</td>
<td>7.7%</td>
</tr>
<tr>
<td>Ring-fenced funding or dedicated science budget</td>
<td>7.7%</td>
</tr>
<tr>
<td>Dedicated science space</td>
<td>7.7%</td>
</tr>
<tr>
<td>Accessible information on external sources of funding</td>
<td>7.7%</td>
</tr>
<tr>
<td>Local loan system for science resources</td>
<td>7.7%</td>
</tr>
</tbody>
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Base: 339

“More training and guidance needed for ‘science on a shoe string ideas’ - there are plenty of them but not easily accessed and staff spend a lot of time making their own resources”

“It would be really helpful to have a guide outlining minimum resources for practical science. I am a nursery teacher so don’t always know what is needed or what I should be actively encouraging in the way of practical science”

“A list of suggested essential equipment so that we could check we had got all we need”

“A ring fenced yearly grant specifically for science. If this was for a regular amount I could plan and budget for equipment replacement and modernisation”

“Produce a minimum resources list for each school and have it part of the Ofsted inspection under the heading "equitable resources", as it is unfair that some schools have pupils with access to a great range of resources and others do not. There is not equal access for all pupils to the same
opportunities or quality and breadth of learning in science”

“Additional funding so that we can do more than just maintain what we have, so that we can push the boundaries of science teaching at primary level”

In relation to CPD, respondents are seeking more access to dedicated training about teaching practical science and the use of science equipment, but for this to work in practice, courses would need to be available during school hours and supply cover provided. Therefore this also links to the need for more money to be available.

Having more time would be for (based on qualitative feedback):

- Planning practical science lessons;
- Preparing equipment for practical science lessons;
- Being able to search for external sources of funding;
- Being able to attend CPD;
- Organising/stock-taking science resources; and
- More time actually on the timetable for delivering science.

The lack of time clearly has more wide-reaching impacts, as some respondents have tried to make links with secondary schools or make use of loan systems to share equipment – but these approaches have been ruled out on the basis that there would not be the time to facilitate them, as demonstrated in the examples below (based on qualitative feedback).

**Linking to local secondary schools to share equipment or use facilities**

A number of respondents suggested that closer links with local secondary schools might enable them to provide better practical science experience. In some cases this would be based on borrowing equipment that would be too costly or rarely used to be purchased by a primary school; in others schools hoped that their older pupils would be able to use proper lab facilities that were not available in primary schools, in order to improve practical science experience and smooth the transition to secondary schools. Moreover, several schools reported already having established such links, either on their own initiative or in responses to approaches from secondary schools to their feeder primary schools. There can be obstacles to such links, however. Where secondary schools are not within walking distance, arrangements need to be made to organise transport, which can be problematic from a budgetary as well as a time perspective.

“We don’t have links with secondary schools to use their facilities. There would be too much work in organising transport, getting children there and arranging supervision. It’s also an extra job to add to the arm-long list of things that already need doing”

**Use of a loan system to share science equipment**

This can be complex and time-consuming to transport items from one school to another. It also requires an individual/organisation to manage and oversee the system. Even where such systems
exist they do not always work in practice:

“The school does make use of a borrowing/loaning policy, but it is a difficult issue, especially working out logistics and moving equipment around different schools. The school has found that there have been times when it has not worked. For example, one teacher required a full-size skeleton but found that she needed to drive 5 miles in her own time to obtain the use of one. She only has an hour for lunch, however, in practice this is really only 20 minutes as the remainder of the time is taken up preparing for the teaching of lessons in the afternoon”

The Science Learning Centres do a Kit Club. This is an independently evaluated science equipment loaning scheme with resources suitable for KS 1-5. Our school subscribe to this and it covers borrowing. However, the problem is the picking up and returning of items - it is a 25-30 minute drive. It’s difficult to fit in the time to do this.
8. Conclusions and recommendations

8.1 Conclusions

1. There is a great deal of disparity in primary schools’ spend on science resourcing. It varies on the basis of the annual expenditure budget, per capita spend, size of school and between different regions. Section 4 discusses the findings in more detail with section 4.1 summarising the specific findings.

2. Primary schools do not handle their school or science budget in a uniform way. A minority do not allocate the annual budget to specific subjects, a significant majority (77%) do not ‘formally’ allocate a part of their science budget specifically to practical work, whilst just over half (56.2%) are required to spend the science budget in full from year to year.

3. Fluctuations reported from year to year in the annual science budget make it difficult for schools to plan ahead on resourcing practical science. This is a concern in spite of an average increase in the annual budget over the last four years and that nearly 45% of respondents are quite or very satisfied with their levels of funding.

4. Schools and teachers have become, perhaps by necessity, creative with practical science resourcing sometimes on the ‘hidden’ expenditure on science provided voluntarily by teachers to supplement the core budget. These contributions to their schools science spend, often added to with parental contributions, are not inconsequential. Added to this, qualitative findings point to a culture of ‘tolerance’ associated with funding levels with respondents prepared to “make do and mend”.

5. Fluctuations in the science budget and insufficient quantities of the SCORE benchmark standard of indicative items for equipment and consumables needed, lead to difficulties in maintaining stock levels of all the equipment and consumables needed to teach practical science effectively. It also impacts on science teaching and learning meaning practical science experiences are all the poorer, as a result, for example of a reduction in the amount provided to pupils from external speakers.

6. Extra funding, better storage for science equipment and consumables, and time to develop teacher expertise via CPD are the key overall requirements for schools to improve the situation. Innovative ideas such as loans and sharing equipment have been considered by some schools but do not always work effectively in practice.
7. The variations in responses by school size points to small primary schools (less than 200 pupils) having a mixed level of expectations on school science resourcing. Those dissatisfied with their level of funding have a higher than average budget compared with the same group in medium-sized and larger schools; their higher per capita spend than other sized schools and their greater levels of freedom in how they spend their budget are just some examples.

8. The Primary Science Quality Mark (PSQM) appears to be having an impact for science resourcing and raising the bar. However, it is not an open field for all schools, whilst those awarded the PSQM typically allocate higher average budgets to science than those that are not, there is a requirement for investment which may be a prohibitive barrier for schools with smaller budgets.

9. Evidence points to a relatively high level of respondents that do not possess a sufficiently clear sense of an appropriate benchmark level of expenditure to confidently judge whether their school’s level of funding is satisfactory.

10. It is apparent that the level and variability of funding is not the only factor to impact on school science resourcing; substantial qualitative evidence points to other, multiple factors:

   - Lack of effective storage space for science equipment and consumables;
   - Lack of confidence among some teachers in relation to using science equipment, and also an associated lack of knowledge about what items are actually needed i.e. what does ‘good’ resourcing look like (particularly among those that do not have a first degree or equivalent qualification in a science subject);
   - Removal of science from the SATs, indirectly contributing to a diminished focus on science (in relation to time spent teaching practical science, lower funding and resourcing levels for science and more limited access to CPD for teachers specifically in relation to teaching practical science;
   - Variations in the head teacher stance – which can mean high degrees of variation between schools, with some giving science very high prominence and others considerably less focus;
   - The impacts of the economic recession – notably in the form of funding constraints, budget cuts and a reduction in the number of Local Authority science advisers – have also helped to create more challenging circumstances for primary schools when it comes to resourcing science.

11. In spite of these issues, primary respondents are, on the whole, remarkably tolerant of the situation. Nearly half of respondents report being ‘quite satisfied’ with current levels of science equipment and consumables, and only just over a fifth of respondents report being ‘quite dissatisfied’ or ‘very dissatisfied’, in spite of the relatively low levels of reported resources relative to the indicative standard. In short, respondents appear to feel that there is little hope that the situation can be changed, leading to what we might call a ‘culture of tolerance’ of low funding and patchy resourcing, with those in relatively well
resourced schools (less than 10% of respondents) being very clear that they are ‘lucky’.

12. It is nevertheless telling that an overwhelming conviction of respondents, in both the qualitative and quantitative research, was that an increase in funding would have a major impact in improving the resources needed for practical science experiences.

8.2 Recommendations

Recommendations for SCORE – information for primary schools:

- Develop and disseminate among primary schools detailed guidance and protocols about best practice in storage and resource management of practical science equipment and consumables, with recommendations specific to dealing with smaller spaces;

- Develop and disseminate among primary schools the list of benchmark items required to effectively resource a practical science department in primary schools, including information about expected costs per item;

- Develop and make available to primary schools (for example on SCORE and partner organisation websites) information about sources of external funding for science, such as grants, competitions and award schemes and keep this regularly updated;

- Develop make available to primary schools (for example on SCORE and partner organisation websites) information about CPD in relation to resourcing and delivery of practical science and keep this regularly updated;

- Consider whether there is a need to develop information and guidance designed specifically for smaller primary schools (less than 200 pupils);

- There may also be a specific need - especially while science remains outside the SAT process – to provide guidance on ways that practical science experiences can be used to support the development of literacy and numeracy.

Recommendations for SCORE – influencing policy:

- Consider lobbying for stronger emphasis on inspection of science resources within Ofsted inspections;

- Consider lobbying Government for the creation of a national funding formula which may help to address the needs of particularly disadvantaged schools, especially the significant minority with very poor levels of resourcing;

- Consider ways in which to influence the design and delivery of teacher training for new teachers, so that teaching and resourcing of practical science is adequately represented.
Recommendations for SCORE – general:

- Seek to influence the development of dedicated CPD for practical science in primary schools, including how to make best use of benchmark items; consider the development of a training DVD on the use of equipment that could be easily disseminated and used by schools that have limited time/resources to attend external training courses;

- Repeat this research in approximately two years’ time, to maintain a clear understanding of the level and sufficiency of funding and resourcing for practical science in primary schools, and to understand the impact of any changes, for example to policy, that have taken place in the interim.
Appendix 1: List of indicative items used in the survey

Equipment and consumables

- Variety of magnets (including magnetic toys) 
  *(for every student)*
- Mirror 
  *(for every student)*
- Magnifiers (of at least 6cm in diameter) 
  *(for every student)*
- Funnels – bought or made 
  *(pair work)*
- Working buzzers and motors with different types of switches 
  *(pair work)*
- Working batteries in constant stock 
  *(pair work)*
- Variety of springs 
  *(pair work)*
- Bubbles (with wires/equipment to make different shapes) and balloons 
  *(pair work)*
- Variety of (liquid) capacity measuring tools (cylinders, jugs, syringes, beakers) 
  *(pair work)*
- Working stopwatch 
  *(small group work)*
- Range of thermometers with and without minus degrees, in single units and units of 5, 10 etc. 
  *(small group work)*
- Range of push and pull force metres (e.g. 0-5N, 0-50N) 
  *(small group work)*
- Range of balance scales (kitchen scales, balance scales using a range of masses) 
  *(small group work)*
- Working torches 
  *(small group work)*
- Selection of labelled materials including rocks, soils and metals 
  *(small group work)*
- Selection of graded sieves 
  *(small group work)*
- Access to tuning forks 
  *(small group work)*
- Ramps with access to different types of surfaces 
  *(small group work)*
• Stethoscopes  
  *(small group work)*
• Candles/tea lights  
  *(small group work)*
• Indoor plants  
  *(small group work)*
• Data loggers  
  *(one between 5-6 pupils)*
• Equipment to measure lung capacity  
  *(demo/large group)*
• Access to some form of microscope (e.g. digital, USB, light)  
  *(demo/large group)*
• Access to a skeleton  
  *(demo/large group)*
• Access to teeth model  
  *(demo/large group)*
• Some form of equipment using renewable energy e.g. solar powered, wind-up  
  *(demo/large group)*
• Access to living animals - for care and observation  
  *(demo/large group)*

**Classroom facilities**

• Ability to create dark space
• Teaching space with a sink
• Safely equipment (tongs, sand trays, heat mats and goggles)
• Ownership of the 4th edition of ‘Be Safe’
• Use/membership of learned societies, teaching associations such as the Association for Science Education (ASE)
• A well organised and regularly replenished resources area
• Science clothing (to “feel like a scientist” e.g. lab coats)
• Creative items (polymers, smart materials, heat sensitive toys, UV beads, puppets, electronic/handmade science games etc.)

**Outside space**

• Access to a pond or other natural water habitat
• Access to a vegetable patch, planters (e.g. boxes/tyres) or allotment
• Access to variety of habitats including grassland
• Access to a variety of rock types and soil types
• Access to an outside space to measure temperature, observe weather patterns and seasons
• Access to a range of surfaces and play equipment
• Access to observe day/night sky