

**Why 'science for all' is only an aspiration: staff views of science for learners with Special Educational Needs and Disabilities**

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## **Key words**

Science outreach; differentiation; inclusion; curriculum

## **Abstract**

Teacher and support staff perceptions of science learning, and specifically engagement with science outreach, by pupils with Special Educational Needs and Disabilities (SEND) were ascertained through questionnaires. The responses indicated that science is seen as serving distinctive learning purposes when undertaken by learners with SEND. Staff who accompanied SEND pupils to science outreach events expressed more positive views about separate outreach events for SEND pupils than other respondents, in line with current policy expectations of differentiated classroom practice. The desire for different provision for SEND learners also appeared to be associated with the staff's pastoral concerns about their pupils and their reluctance to let their pupils 'fail'. The data suggests that, despite policy and legislative reform in the UK, curriculum science is still viewed primarily as a means to career progression for an able minority, rather than as an educational and cultural entitlement for all.

## **The purposes of science education and science outreach**

Successive science curriculum developments have variously focused on either conveying the intrinsic value of science, or instilling the science knowledge required by future citizens, or the development of an elite group of science specialists (Wellington, 2001). The dominance of the tension between the latter two outcomes has reduced a complex, overlapping set of purposes to a dichotomy with the wider concept of science being popularly represented by Fensham's (1985) phrase 'science for all'. For example, the notion that had been advanced of the UK science curriculum for 14-16 year-olds as 'science for citizenship' (Millar and Osbourne, 1998) has been supplanted, twenty years on, by a government-driven rise in the demand of curricula and associated assessments (Gove, 2013). Neither the curriculum for the specialist or that for citizenship intentions corresponds exactly to the other major division in purpose, that between scientific knowledge and the means by which it is derived. These two functions have been manifest as the 'process based' curriculum of the 1980s and subsequent 'nature of science' strands in the National Curriculum, in contrast, the current push for a 'content rich' curriculum by the UK government (Hirsch, 2016; Wellington, 2001). The present return to science of a highly utilitarian nature, and a high status, academic subject, brings it back to the days of the so-called Sputnik curriculum (Bybee, 1997). The notion that science confers economic, political and military advantages necessarily carries expectations of elitism which appears to be at odds with the wider educational drive for inclusion.

Science outreach may meet a similar multiplicity of aims as the science curriculum, but these commonly remain obscure or poorly articulated, and may even be contradictory (Sadler et al, 2016). The predominant explicit purpose is utilitarian, namely the recruitment of future specialists, in the case of employers and universities to their provision. Archer, de Witt and Dillon (2014) found that changing attitudes towards choice of careers was difficult and that an outcome which is more susceptible to change is awareness of the career routes made available through science. Other, other, less frequently articulated, purposes include supporting schools by providing access to specialist opportunities (Sadler et al, 2016).

To illustrate this utilitarian focus, one educational group undertakes outreach which ‘inspires the next generation of globally responsible engineers’ (EWB-UK website), whilst a global security and aerospace company is committed to ‘develop programs that educate and inspire tomorrow’s scientists, engineers and mathematicians’ (Lockheed-Martin website). The consequence of this focus is that events are frequently targeted at the most academically able pupils, who are seen as having the greatest chance of becoming science professionals, whilst the content revolves around enhancing the desirability of science to these potential specialists. The same assumptions are likewise expressed by pupils, who report a sense of remoteness and very high intellectual ability when considering scientists, and this perception may also be reflected in the absence of reported impact of science enrichment upon low attaining pupils (Archer, DeWitt and Dillon, 2014).

### **Why science is a ‘hard’ subject**

Despite the introduction, in England and Wales, of a common National Curriculum in Science almost three decades ago, science continues to be far from universally accessible. Whilst a high conceptual demand is not an essential feature of science (Essex, 2017), the school curriculum tends to require a high level of abstract thinking (Taber, 2014). This has been illustrated by the mapping of the curriculum against the Piagetian levels of operation required to access the secondary chemistry curriculum and shown to be beyond over half of learners (Foster, Bookman and Whittington, 2010; Shayer and Adey, 1981). Beyond the high conceptual demand, much of the content also requires multiple cognitive processes to assimilate the concepts and this, in turn, overloads short-term memory (Fox, Park and Lang, 2007; Johnstone, 1991) and exceeds pupils’ attention span (Özgüç and Cavkaytar, 2015; Stavroussi, Papalexopoulos and Vavougiou, 2010). These barriers may be further exacerbated by the subject matter having multiple and competing aspects, many of which are distractions from the target concepts, what Johnstone (1991: 80) refers to as ‘signal and noise’.

The structure of the science curriculum also creates difficulties for learners with ID, because of the way in which understanding of science tends to be built up in a spiral manner. This means that pupils who

have failed to apprehend previous lessons, or have inaccurate prior understanding are likely to be further disadvantaged each time prior learning is relied upon (Taber, 2014). Poor recall in those with ID may compound this situation. Pupils may also struggle with science if they lack relevant background knowledge, a problem experienced more frequently in pupils with SEND (Villanueva et al, 2012). The facilitation of participation in group work has been found to help to counter these difficulties, possibly because group work fosters social constructivism but also because it enables peer support to occur, which seems to be especially helpful for learners with ID. Similarly, enquiry learning may help to redress this deficiency in prior learning and background knowledge (Villanueva, 2012; Özgüç and Cavkaytar, 2015; Watt et al, 2013) by enabling pupils to assimilate concepts at a rate which they can learn. However, these social constructivist learning strategies are vulnerable when a content-rich curriculum is being taught in a climate of high-stake assessments.

For similar contextual reasons has been a marked reduction in 'hands on' learning opportunities in science in recent years (N.F.E.R., 2008). No fewer than 74% of teachers surveyed attributed the reduction in practical work to pressure to cover the curriculum content (N.F.E.R., 2008) Such activities formerly offered the chance for haptic 'clasping' or 'hands on') or multi-sensory inputs, which benefit both pupils with ID and their peers (Anderson and Anderson, 2010; Shayer and Adey, 1981). A specific example of the erosion of practical work is the manner in which the design and implementation of practical science investigations has been diminished in recent times (Watt et al, 2013). Again, the loss of opportunities for practical science enquiry is especially disadvantageous to students with ID, (Villanueva et al, 2012). Moreover, practical work is offered at a literal as well as figurative price and this may not be seen as justified for learners who will not become future science specialists. An example of this is given by Özgüç and Cavkaytar (2015), who describe how limited resources for science teaching impacted adversely on the provision of high quality science lessons in the special schools they

surveyed. In their case study, they describe these resourcing constraints as time (for which other curriculum areas competed), lack of a laboratory access and limited digital resources.

### **Common curriculum, different outcomes?**

There is a canon of literature describing the obstacles which the subject presents to learners with Intellectual Disabilities (ID), and the following analysis is restricted to this sub-group of SEND learners. The underachievement by pupils with moderate learning difficulties relative to their peers remains below that which could be attributable to their assessed academic capacity, despite repeated policies to drive up their attainment (Department for Education, 2014). The remainder of the shortfall in attainment may be attributed both to the subject content and the ways in school science is taught and assessed (Cole and McLeskey, 1997; King-Sears, 2008; Villanueva, 2012). It appears that there are multiple factors interacting which make science an especially difficult subject for many pupils but that there are also distinct opportunities afforded by suitable teaching of the subject which are not presently being effectively exploited to drive up attainment. Not least of these opportunities is the stimulation of learners' curiosity,

*“Suitably adapted science activities might have much to offer children with SLD (severe learning difficulties) in terms of increasing their knowledge of the world around them and also their desire to explore it.” (Brooke and Solomon, 2001: 943)*

Arguably, one of the most corrosive legacies of science's elitist past is low teacher expectations of pupils with SEND (Özgüç and Cavkaytar, 2015). These low expectations, which commonly result in the delivery of a diluted version of the curriculum, may then engender still lower attainment (Rosenthal and Jacobson, 2003). The impact

of low expectation on achievement is acknowledged in the green paper 'Support and Aspiration', (Department for Education 2011 a): 4),

*"Everyone who works with disabled children and children with SEN should have high expectations of them....."*

A related concern could be raised about the fact that impact of interventions in science lessons for those with SEND is quite often described in terms of pupil enjoyment rather than attainment (Hodge and Chantler, 2010; Özgüç and Cavkaytar,2015). The implication is that the main purpose of their education is affective rather than cognitive gain.

In the face of a number of identified barriers to the learning of science by ID pupils, the empirical evidence on effective pedagogic strategies supports the notion that, rather than different teaching, what is needed by pupils with ID is effective teaching, of the sort that benefits all pupils. This understanding, referred to as a 'Universal Design for Learning' (Rose, Meyer and Hitchcock, 2005), challenges the assumption that there is, a pedagogy specific to ID. Nevertheless, the notion of a distinct pedagogy persists and may, inadvertently, contribute to low expectations. Ongoing confusion around the desirability of distinct pedagogies is reflected, for example in the Educational Excellence Everywhere white paper (2016: 102), in which the Department for Education undertakes to,

*"invest in supporting professionals in schools and colleges to achieve better outcomes for pupils with SEND, including by ensuring that they have access to training and **support on specific impairments** ..."(author's emphasis)*

## **Methodology and methods**

The research was undertaken with staff who had brought pupils to four chemistry 'festivals', held at three different universities between May 2015 and March 2016. The festivals were part of a number run in the UK

since 1991, hosted at 39 different universities. They aim to show teams of four pupils, aged between 11 and 13, the fun of practical chemistry (Salters' Institute website) and have an established format of two laboratory based competitions and a lecture demonstration. Three of the festivals at which questionnaires were distributed were termed 'special' festivals and had been modified, after consultation with teachers, to make them more suitable for pupils with SEND, specifically those with ID. The first 'special' festival was run in 2004, in response to a request by special schools whose pupils had attended one of the festivals. The adjustments made to ensure greater accessibility for schools and individual pupils were, firstly, that schools were permitted to bring more than one team and that teams could comprise up to 6 pupils; this enabled entire special school classes to attend and reduced the strain placed on the school's staffing arrangements. Secondly, staff were able to stay in with pupils, if they chose, rather than attending a separate session for teachers, as happens at the 'regular' festivals. The day was shortened to permit pupils to return to school in time for the provided transport from school to home. In addition, the literacy demands of the sheet were reduced and undergraduate helpers were briefed to assist with reading and writing in order not to impede pupils' full engagement with the practical activities.

The data gathering tool deployed was piloted during two previous chemistry festivals prior to its administration for the purposes of this study. The issuing of questionnaires to staff in attendance at the various outreach events early on in their visit, but their return was in no way enforced so respondents answered entirely voluntarily. One consequence of this was a low return rate, even by the accepted standards of return of around 40% on first request, of voluntary questionnaires. Because the questionnaires were anonymous, the gender, age and school type were unknown to the researcher. The questions (incorporated in Table 1.) were a mixture of open and closed responses, some of which permitted multiple responses, and care was taken to avoid bias in the wording of the questions. Although this is an oblique way of probing practice, it enabled the capture of indicative data without detracting directly from the pupils' access to the activities. It also avoided potential ethical difficulties relating to the gathering of data from pupils who were 'doubly vulnerable' on the grounds of age and disability

and whose parents or carers had not been asked in advance for their consent to participate in the research. Whilst recognising that interviews would have enabled further probing of staff perceptions and clarification of initial answers, questionnaires were practicable in the context of the event at which respondents were accessible and provided sufficient data to enable a scoping study to be undertaken. The data gathering needed to be done without compromising the primary purpose of the event, namely to offer an experience of practical science to pupils. Besides fulfilling this criterion, the other major advantage of the questionnaire was that it enabled staff to respond in their own time through the day (or afterwards, had they wished) and to talk to their pupils about it if they wished.

Respondents gave informed consent in a separate consent slip, although completion of the questionnaire could have been taken as consent. Respondents were aware that the research was being carried out to help understand whether the events offered were meeting the needs of schools and how they might be improved. Staff were not required to identify themselves or their schools, though they had the option to do so, and were made aware that the work guaranteed them both confidentiality and non-traceability, which it was hoped would improve their willingness to participate (Whelan, 2007). Despite these attempts to encourage staff to respond, the sampling was very far from representative, since the responses reflect the views of staff who are committed to science enrichment for learners with SEND and those who were willing to, or able to, spare the time to complete the questionnaire. Completion of the questionnaire may have been especially difficult for staff accompanying SEND learners, and may be reflected in the very low proportion of respondents at 'special' festivals.

The theoretical framework used was constructionism, focusing on the interface between staff perceptions and the wider structures within which these meanings are constructed (Braun and Clarke, 2006). Thematic analysis was undertaken on the explicit meaning in the free answer questions, an approach which adopted the data-driven, inductive approach described by Boyatzis (1998). The analytical approach accepted the validity of staff perceptions and their construction of meaning; this was felt to be important way of the capturing the

experiences of staff who have a pivotal role as 'gatekeepers' to pupils' access to both curriculum science and science enrichment activities (Luehmann and Marowitz, 2007).

Once the questionnaires had been returned, they were analysed by tallying the number of responses on the closed response questions and identifying common themes in the answers to open response questions. The thematic analysis of the free choice answers was executed in line with the stages described by Braun and Clarke (2006). The thematic analysis undertaken did not represent the prevalence of themes but rather to capture the meaning of all responses provided. However, a frequency tally was also undertaken to indicate the incidence of answers which corresponded to the themes identified, as well as of the frequency of responses to the fixed item answers. In this way, it was intended to describe the relative incidence of answers corresponding to each theme within the data set.

Before incorporating answers into the analysis, individual responses were checked to see if the responses to questions were internally consistent and, had any been found not to be, this would have been noted. Some researchers would contest that the non-answering of questions might reflect volunteer bias towards the questions (Belton, 1986) but, where questions had been omitted, this was taken as a reflection of the multiple demands placed on staff and the primacy of looking after their pupils.

Table 1. Questionnaire respondents

Type and number of events	1 non-differentiated chemistry festival	3 chemistry festivals explicitly aimed at pupils with SEND.
Number and role of respondents	10, all teachers	11 including 3 learning support assistants and 1 school technician plus teachers
Types of educational institutions attended by participants	Schools, which included one independent and one selective on the basis of ability ('grammar') school and one independent (fee paying) school	Schools, including 1 special school, plus 1 referral unit and 1 hospital school

## Discussion

### Science education is seen to have different purposes for different learners

The staff who attended the event for SEND expressed a very distinct account of what science could offer their pupils. There was a near absence of references (one response only) to career opportunities for the pupils themselves despite similar numbers referring to the fact that science helps pupils to understand other people's jobs. The implication of this data is that the employment opportunities of the sputnik curriculum are for people other than pupils with SEND. Similarly, no staff member working with SEND participants was able to identify

previous pupils, comparable to those attending the event, who were using science in their careers and very few thought that their pupils aspired to use science in their future work. Although the staff at the 'regular' event did not express very different views on how many pupils were aspiring to use science in their career, eight provided a response to question 13 on past pupils using science, compared to only four staff at the SEND events. This may also imply that career planning in STEM areas has not appeared relevant to pupils with SEND in the age range attending the festivals, despite it being an important age for decision-making (Kings College London, 2013) in contrast with the significant effort made to promote careers in STEM for the general student population. One comment noted that there had been no pupils aspiring to use science in the workplace since the removal of Rural Science as an examinable subject, suggesting that a prescribed common curriculum may have had an adverse impact. Nevertheless, it was encouraging, in the responses to question 10, shown in Figure 1, to see that staff saw the engagement of universities with their pupils as being of benefit to the host institution, irrespective of whether they were likely to attend as students in future.

Allied to the notion that science does not form part of a realistic career aspiration is the observed shift in staff perceptions of it, from being a subject worth pursuing in terms of supporting future career choices, to being a vehicle for the development of functional skills. This was indicated by the finding that 8 staff at the 'special' festival identified functional skills as a reason for pupils studying science, double the number of staff at the 'regular' festival who gave the same answer.

There was also a notably different response from the two groups of staff on the desire for their pupils to experience challenge and stimulation, which was the reason that 5 out of the 10 teacher respondents at the 'regular' event cited for bringing their pupils, compared to only one at the event targeted at SEND learners. This may imply that the challenge inherent in the subject is considered sufficient but it may also be symptomatic of a greater degree of understandable caution about giving learners challenge which may condemn them to recurrent failure. The tendency of schools to be averse to failure by pupils, is confirmed by anecdotal accounts of staff at 'special' festivals who quite commonly express surprise along the lines of, *'I didn't know (s)he could*

*that that!*' from which it would appear that SEND pupils are not often given the chance to undertake more challenging activities in their normal science lessons. The latter explanation is borne out by the suggestion in response to question 12 that outreach ought to *'give pupils a chance to excel'* and may be another consequence of risk averse teaching in a context of a high-stake assessment culture in which teaching occurs (King-Sears, 2008)

### **Educators share a common notion of what science is**

There was a broad agreement on the reasons that all pupils should learn science and the benefits of doing so, as indicated by the responses to question 2 (see Figure 2). Likewise, the reasons given for pupils liking science were similar in the two groups of staff which, again, suggests a common understanding of what school science offers. The benefits to pupils of science outreach was viewed as qualitatively similar for both sets of staff, as shown by the responses to question 6. (Figure 1.)

Both groups of staff saw experimentation as important, all 10 of the staff bringing pupils with SEND giving this as a reason for attending the outreach event in question 1, compared to 5 staff at regular festival (see Figure 3). Question 2 also demonstrated that there was also strong concurrence of the role of generating and analysing evidence, which suggests that the hypothetico-deductive, Eurocentric view of science is unchallenged in the curriculum or by school staff. This may be related to the fact that this is the only version of science which is presented in the curriculum, and is, therefore, the form of science which the 'subject expert' teachers have assimilated and to which non-science staff are exposed. Moreover, since this is the paradigm which is seen operating in school, it becomes by default the one which other staff aspire to.

Despite the commonality of views on what school science is, there was also evidence of slight differences. One of these was in the answers to question 2, which showed a notable clustering of views by staff at the 'special' festival, with 10 or 11 staff out of a possible 11 identifying the same three reasons why pupils should study science. These reasons were; to learn to generate ideas using evidence, for interest and excitement, and for the

practical work entailed. In contrast, staff at the 'regular' festival indicated a broader range of responses to the question about why pupils should study science, which may reflect a more nuanced understanding of science amongst staff at the regular festival due to the greater level of subject expertise.

### **Staff working with SEND pupils in science face additional barriers to access**

Two staff attending the events for SEND pupils said that the lack of opportunities for these pupils had led them to attend the event; this finding is further corroborated by the complete lack of knowledge about any other events which staff would consider suitable for pupils with SEND shown by answers to question 5, (see Figure 4) in contrast to the 7 other events known to staff at the regular festival. There is further circumstantial evidence about a paucity of inclusive science outreach in the very lengthy journeys, of up to 50 miles, which some staff have been prepared to make in order to attend such events. This high level of personal investment in their pupils' experience may also have contributed to the relatively low return rate of the questionnaires at 'special' festivals which could have been caused by a conflict of interest between their duty of care to pupils and their interest in completing the questionnaire.

Staff working with SEND learners may suffer because their schools do not invest in science for SEND because it is still seen as a subject for 'more able' learners, in line with the long tradition of its identity as an elitist subject (Jenkins, 1979). This may also be, which may be reflected in the staffing for outreach for SEND; two of the groups were accompanied only by a member of support staff, and they reported that their school would not sanction the release of a teacher for the event, whereas none of the staff at the 'regular' festival was anything other than a qualified teacher. The disparity in support reflects that documented previously (Villanueva, 2012). A further illustration of this 'educational triage' process (Booher-Jennings, 2005) is hinted at by the data on practical laboratory work. Conducting experiments was seen as being a reason for pupils to do science (question 2) by 10 of the 11 staff members at the 'special' festival, twice the number of respondents amongst the 'regular'

event staff. Similarly, four 'special' event staff saw laboratory work as a benefit of participating in science outreach, compared to only one staff member at the 'regular' event. One subtler distinct was that the 'special' event staff answers to question 1, on the reasons for bringing pupils to the event, stated that it was a chance to do practical work (3 respondents), rather than the 3 responses by the 'regular' event staff which specified that it was laboratory work out of school that had brought them to the event. This suggests that access to laboratory work is not made equally available to all pupils. The reasons for this inequity may be concerns over behaviour and safety, but it may also denote a preferential allocation of laboratory time to those whose attainment indicates a greater likelihood of academic success. (It should also be noted, however, that some pupils who have alternative educational provision, such as a special school, are automatically excluded from routine laboratory work through not having a specialist teacher or suitable facilities. This was the case in at least two of the schools attending 'special' events.) In contrast, practical work is an assumed entitlement by staff at the 'regular' festival, possibly associated with the education of pupils who will become future science specialists.

### **Staff support the notion of differentiated provision in science outreach**

The fact that they had brought pupils to a science event suggests that staff answering the questionnaire held positive expectations about the capacity of pupils with SEND to engage successfully with science. Nevertheless, they expressed divergent views about the format in which SEND pupils should be offered science outreach. These differing positions probably mirrors current expectations, articulated in the Standards for Qualified Teacher Status (Department for Education, 2011 b) about how to serve the needs of different learners. Staff responses to question 5, shown in Figure 4, on whether science outreach events should be differentiated (which appears to have been interpreted as separate, in line with the event attended) for pupils with SEND suggest a divergence of opinion. Likewise, the answers given to questions 6 and 7, shown in Figures 5 and 6, on the benefits of such events, show a disparity of views on science outreach events. Just over half of the respondents (5 out of 9 answers) who had attended the 'regular' event felt that separate science outreach events should not be offered, whereas a similar proportion (6 out of 11) 'special' event staff were of the opinion that a mixture of

separate and integrated events should be provided. In contrast, all responses by the 'special' event staff indicated that the benefits of attendance were common to all pupils, whereas 3 out of 10 of the 'regular' event staff thought the benefits were different for pupils with SEND. This position of supporting differentiated provision to achieve common outcomes is also reflected that a total of 7 responses to questions 11 and 12, which specified accessibility to all pupils as a feature of an ideal outreach event. These differing views mirrors the wider debate around whether common expectations and differentiated support is the way to engender learning or whether different expectations within a common learning experience is preferable. Implicit in this data is that staff accepted the notion that some events were 'not suitable' for their pupils but that designated ones would be. This in direct contravention of the requirements of the Equality Act to make 'reasonable adjustments for participants, the same piece of legislation which would make segregated provision unlawful. The apparent discrepancy between legal requirements and actual provision, exacerbated by staff's confidence in pressing for admission to existing provision, contributes to a persistent lack of opportunities in STEM to "*provide pupils with opportunities to develop social and academic identities*" (Alexiadou and Essex, 2015: 12).

The desire for events that are identified as being targeted at SEND pupils may arise from the very different approach to teaching that the data gathered alludes to. Staff at the 'special' event indicated that they held a distinct view of their role as educators. For example, in the responses to question 9, shown in Figure 7, two staff identified the development of better relationships with pupils as being a professional benefit associated with attendance at the event. Several pieces of data point to the fact that they are concerned with affective and relational outcomes as much as by progress in learning. Similarly, affective outcomes (interest and excitement) were cited as reasons for bringing the pupils by all 11 respondents attending the 'special' events, but only 6 out of 10 of the respondents at the 'regular' festival. This difference in desired outcomes might be related to the expressed desire of staff at the 'special festival' to ensure that pupils were not over-faced by unrealistic expectations or humiliated by being unable to carry out the tasks successfully; a designated event may be seen

as offering protection against these eventualities. In effect, staff appear to be seeking a form of educational 'asylum' where their pupils can be shielded from failure or humiliation, in the way that the institutions of previous ages physically protected the disabled from physical hardship and rejection (Pritchard, 1963).

## **Conclusion**

Science, both as a school subject and as a focus for outreach work appears to have retained its identity as a subject for the most academically able pupils, despite successive legal and policy frameworks promoting inclusion. Associated with this elite identity is the idea that those with SEND face marginalisation or humiliation if they engage with science outreach. For learners with SEND, science is widely perceived as a vehicle for the development of transferable skills and affective outcomes, rather than as a means to career development. Barriers created by low expectations persist, as do barriers to accessing experimental science, despite the deep commitment of the staff who work with SEND pupils to facilitate pupil engagement with the subject. The exclusionary effect appears to be rooted, not simply in the difficulties inherent in the curriculum subject, but in staff perceptions of people who go on to use science in their working lives. Staff who work with SEND learners support the idea of different provision for these learners, albeit in order to attain equivalent benefits. Although there was a surprisingly high level of consensus around what constitutes science, the findings suggest there might be benefits to adjusting the facets of science presented to different groups of learners in line with different intentions. The broadening of the aspects of science presented in the curriculum, for instance practical as well as theoretical approaches to knowledge creation, could afford meaningful access to authentic science for all learners. In the short term, science educators need to revise the hidden messages that they convey about the accessibility of the subject and to signal much more unequivocally that they are teaching 'science for all'.

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### Question about Science outreach and pupils with Special Educational Needs

Your name (if you are happy to be identified)

Your school and your role at the school (if you are happy to be identified)

If you are willing to be contacted at a later date, how can I reach you?

Please circle the answer that best matches your response to each of the questions below. If you wish to make additional comments, feel free to write on the form.

1. Why did you (or the colleague who entered the team) choose to bring your pupils to the Salter's Chemistry Festival?
2. How many Science outreach or enrichment events do Key Stage 3 pupils from your school attend (or have brought to them in school) each school year, would you estimate?
  - a) None
  - b) 1-3
  - c) 4 -6
  - d) 7 or more
3. How many Science outreach or enrichment events do Key Stage 3 pupils from your school **who have SEND** attend (or have brought to them in school) each school year, would you estimate?
  - a) None
  - b) 1-3
  - c) 4 -6
  - d) 7 or more
  - e) Not applicable, all my school's pupils have SEND
4. What Science outreach or enrichment opportunities for SEND pupils are available in your region, including those which are brought to the school? (These may be specifically targeted at these pupils or inclusive of a wide range of pupils.)
5. Do you think that outreach and enrichment events should be **differentiated** for pupils with SEND?
  - a) Yes, these pupils need a significantly different experience
  - b) No, all pupils should have a shared experience, but some pupils need more support at the events
  - c) There should be a mixture of shared and differentiated events available to pupils
  - d) Other (please expand)
6. Do you think that the **benefits** of Science outreach and enrichment events are the same for all pupils?
  - a) Yes, they all get similar benefits
  - b) No, the outcomes are very different for different group of pupils. (Please explain what the different outcomes you expect)
  - c) The outcomes are different for different pupils, but it isn't related to whether they are SEND or not

7. What do you think are the main benefits for the **pupils** of engaging with outreach and enrichment activities?
8. What do you think are the main benefits for the **school staff** of engaging with outreach and enrichment activities?
9. What do you think are the main benefits for the **host institutions** e.g. universities, of offering outreach and enrichment activities to SEND pupils?
10. How many of your SEND pupils would say that Science is one of their favourite school subjects, do you suppose?
  - a) None
  - b) A very few
  - c) Some, not many
  - d) Around half
  - e) Most of them
11. Why do you think your SEND pupils enjoy Science?
12. How many of your SEND pupils are considering doing a **job** which involves Science?
  - a) None
  - b) A very few
  - c) Some, not many
  - d) Around half
  - e) Most of them
13. Do you know of any former pupils with SEN who are working in a job which involves Science? Please describe them in the space below
14. What do you see as the main reasons why SEND pupils should engage with Science? Please circle as many options as you think are relevant.
  - a) To meet legal requirements relating to the curriculum
  - b) To teach content which will be useful in adult life
  - c) To teach pupils new ways of thinking about ideas and evidence
  - d) To give pupils experiences which are interesting or exciting
  - e) To provide a context in which to develop key literacy and numeracy skills
  - f) To give further opportunities for practical work
  - g) To give access to important qualifications

- h) To promote their awareness of different types of jobs done by other people
  - i) To promote their awareness of different types of jobs which they may wish to do later on
  - j) Other (please say what these are)
  - k)
15. Looking back at the ten reasons in Q14, put the top three into rank order. Write 1 next to the reason you consider the most important, 2 next to the second most important and 3 next to the third most important reason.
16. What 4 words capture your ideal Science outreach and enrichment event for SEND pupils?
17. If you could commission Science outreach and enrichment events for SEND pupils in the future, what would you like to see available?
18. Is there anything else that you would like to say about Science outreach for SEND pupils?