Phase 4 Diploma Development:

Capturing the Learner Voice

SCIENCE

Pye Tait Consulting

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Acknowledgements

This report, written by Pye Tait Consulting, is the presentation of findings based on a combination of on-line surveys and focus groups organised and promoted in conjunction with a number of partners:

- The Schools, Colleges, Learners and Parents Working Group set up by the Science Diploma Development Partnership (SDDP)
- Newcastle College
- Royton and Crompton School, Oldham
- BSix Brooke House Sixth Form College, and
- Citizenship Foundation

1. Introduction

As part of the Phase 4 Diploma Development process, Pye Tait Consulting was commissioned by the Qualifications and Curriculum Authority (QCA) to create a series of tools to capture the views of learners on key areas such as:

- Their experiences of the three Phase 4 subject areas (science, languages, and humanities and social science) and how they value these subjects
- Learning outcomes they would want, or feel they need, to achieve in these subject areas, and
- Their views on the draft content for the Line of Learning Statements of Content produced by the three Phase 4 Diploma Development Partnerships

This report brings together the results of two online surveys of learners, an online survey of parents, focus groups conducted by Pye Tait with learners, as well as the findings from focus group discussions carried out by the Citizenship Foundation on behalf of Pye Tait Consulting.

1.1 Methodology

To capture the learner voice and help inform the development of the Diploma in Science, a variety of activities have been carried out. In summary these have been:

- Secondary research carried out by Pye Tait Consulting, including collating the views and experiences of learners from existing resources (the detailed methodology and results for which can be found in the QD7 Secondary Research reports for the Line of Learning)
- Three online surveys:

1. Survey of Learners: Science Education Today
2. Survey of Parents: Science Education Today
3. Your Learning: Science, Languages, Humanities and Social Sciences

- Five focus groups with young people conducted at three schools on behalf of the Diploma in Science Schools, Colleges, Learner and Parent Voice Working Group

- A series of twelve focus groups, carried out by the Citizenship Foundation on behalf of Pye Tait Consulting, with young people currently undertaking qualifications in science, languages, and humanities and social science subjects (4 of these groups focused on science specifically)

Online surveys

The first two online surveys listed above (*Science Education Today* for learners and parents) were developed by Pye Tait Consulting on behalf of the Diploma in Science Schools, Colleges, Learner and Parent Voice Working Group.

The third survey – *Your Learning* – was created by Pye Tait Consulting in partnership with the researchers from the Languages and International Communication and Humanities and Social Sciences Diploma Lines of Learning. A representative from Citizenship Foundation also reviewed the *Your Learning* survey questionnaire to ensure that the language and style used throughout was appropriate for use with a younger audience.

All three surveys were hosted on Pye Tait Consulting's dedicated SurveyZone™ (www.pyetait.com/surveyzone) with the links to the surveys then promoted and distributed in a variety of different ways.

The *Science Education Today* surveys were promoted by the members of the Diploma in Science Schools, Colleges, Learner and Parent Voice Working Group – providing links via school and college websites, marketing the link in school

newsletters and requesting science teaching staff to spend a few minutes during one of their lessons to allow their learners to complete the questionnaire. The link to the parents' survey was also distributed by schools, particularly making use of avenues such as parent committees.

Promotional activities for the *Your Learning* survey were the responsibility of the Citizenship Foundation, drawing upon established relationships with national youth networks. Marketing activities for the Your Learning Survey included:

- Direct email to over 1,300 members of UK Youth Parliament (and particularly active members of its Participation Workers network)
- Direct email to approx 6,000 young subscribers to Citizenship Foundation's 'Giving Nation' e-newsletter
- Direct email to 250 young people via Youth Act e-news, with postings regarding the survey also available via the Youth Act Facebook and Bebo websites
- Information about the survey made available on the Association for Citizenship Teaching teachers' network website

All three surveys were available for parents and learners to complete for some 7 weeks between the end of November 2008 and beginning of January 2009. In total, they attracted over 1,000 responses.

Five focus groups (Diploma in Science Schools, Colleges, Parents and Students Voice Working Group)

As part of the wider development of the Diploma in Science, the Schools, Colleges, Learner and Parent Voice Working Group organised a series of focus groups with young people aged 14-19 to capture their views on current science education.

Schools and colleges that hosted the focus groups were:

- A Further and Higher Education college in Newcastle (two groups)
- A Specialist Science College (11-16 year olds) in Oldham (two groups)
- A comprehensive Sixth Form College in London (one group).

The focus groups in Newcastle and Oldham were facilitated by Pye Tait Consulting, with a college member of staff present throughout. In London the focus group was facilitated by the college Head of Science.

A total of 56 learners taking a range of qualifications attended the focus groups. This included:

- 15 GCSE science learners
- 19 taking 'vocational' science courses such as BTECs
- 13 thirteen taking AS or A Level science
- 4 on the International Baccalaureate, and
- 5 'non-science' learners.

Each focus group lasted one hour and was recorded for full transcription purposes, with the permission of the learners and staff present.

Four focus groups (Citizenship Foundation)

In addition, four focus group discussions were also conducted with young learners by Citizenship Foundation, relating to their experiences of current science provision. These focus groups took place during January 2009, at the following locations:

- Comprehensive Foundation school in Birmingham (ages 11-18)
- Girls Community School in Manchester (11-18)
- Foundation School in London (Humanities specialist, 11-18)
- Comprehensive school in Leeds (11-18)

Between 10 and 15 students attended each focus group discussion – comprising a mix of GCSE, A level and BTEC students (aged 14-18).

Each focus group lasted between 35 and 50 minutes, depending on the timetabling at the school concerned, and again these discussions were recorded and transcribed.

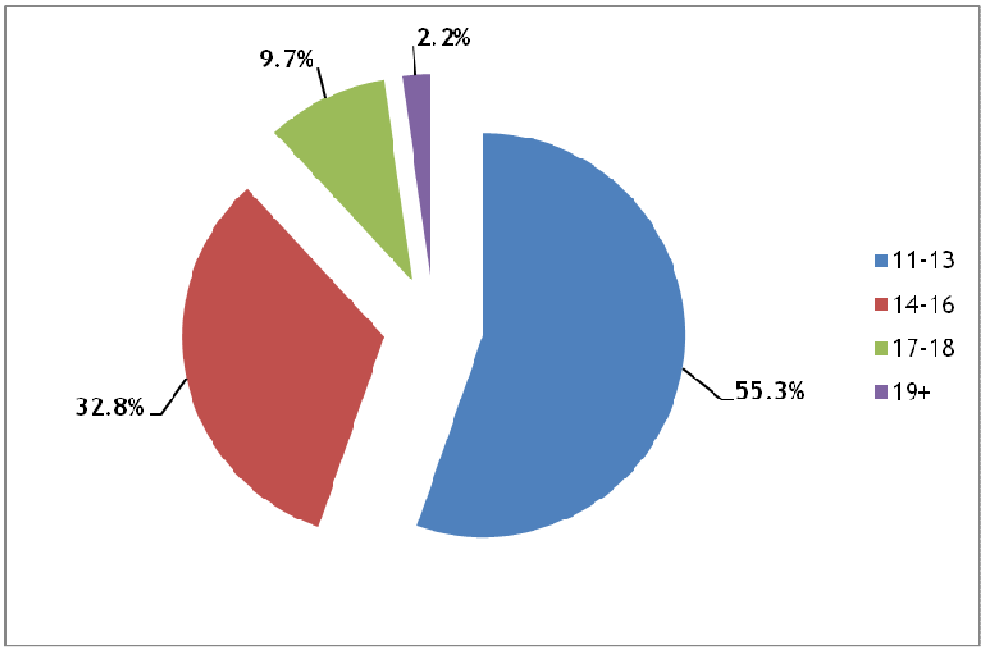
1.2 Survey respondents

Surveys of Learners

The *Science Education Today* survey for learners attracted 646 responses, and the *Your Learning* survey covering all three Phase 4 Lines of Learning received 375 completions. In total, 1,021 individuals responded to the two surveys for learners. A breakdown of respondents by age and gender is given below.[1]

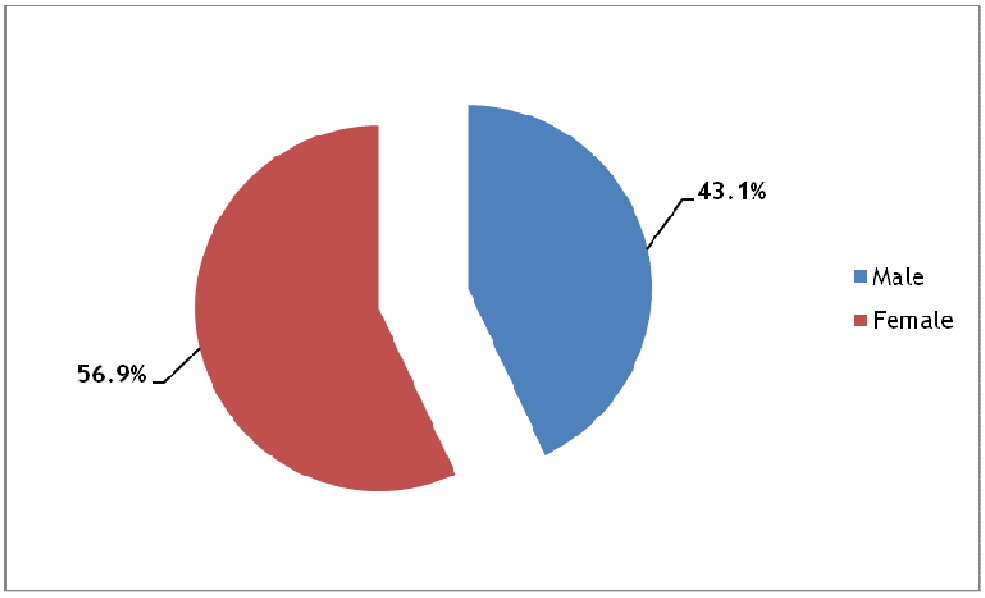
[1] An additional 37 responses were received following the deadline, but the results from these have not been included in this report.

Figure 1: Respondents to all learner surveys - by age



Source: Pye Tait Consulting learner surveys 2008

Figure 2: Respondents to all learner surveys - by gender

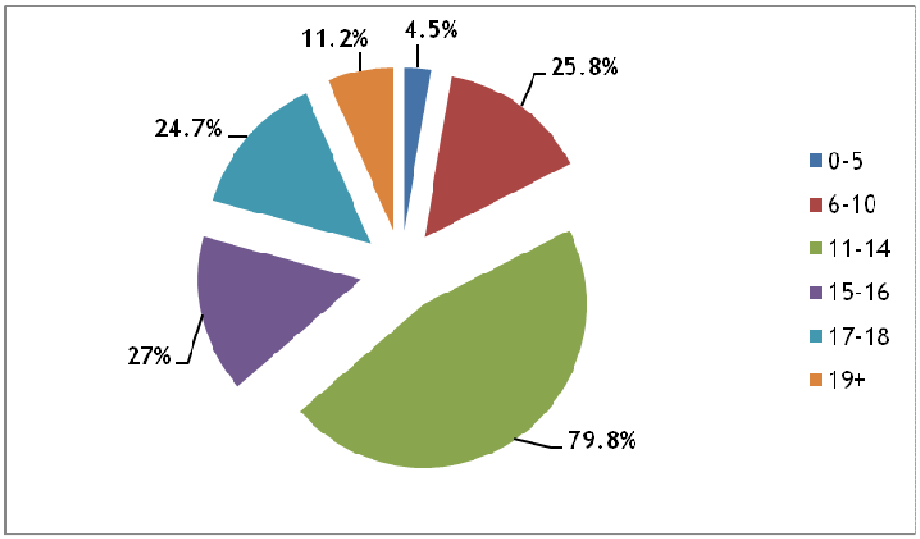


Source: Pye Tait Consulting learner surveys 2008

Survey of parents

The *Science Education Today* survey of parents received 89 responses - – over three quarters of whom (79.8%) said that they had children aged between 11 and 14.

Figure 3: Age of children cared for by parents responding to survey

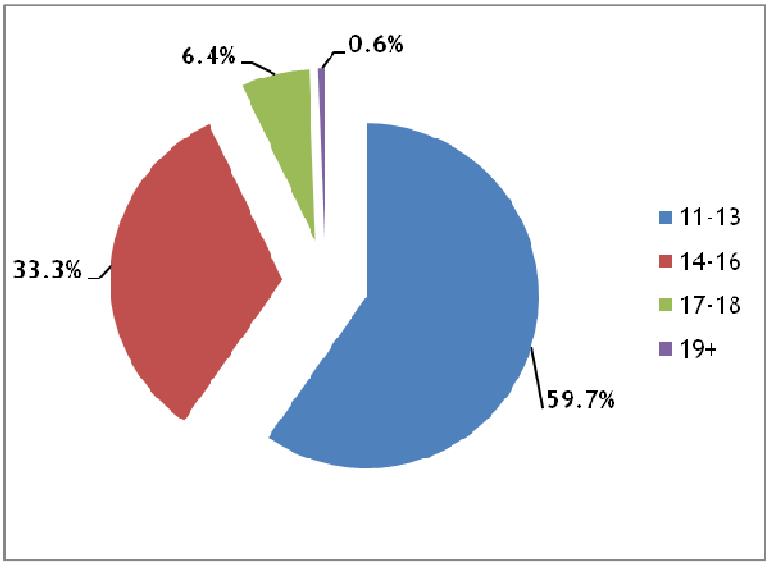


Source: Pye Tait Consulting survey of parents 2008

2. Science

A total of 858 learners responded to questions relating to science subjects across the *Your Learning* and *Science Education Today* surveys – the large majority of whom were aged between 11 and 16 (93.0%), with just over half of respondents (54.8%) being female (see Figures 4 and 5).

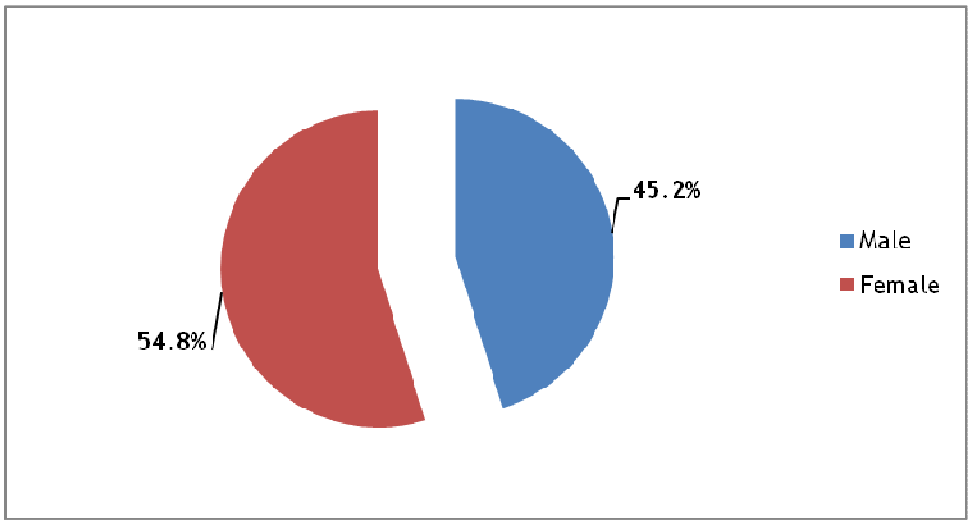
Figure 4: Learners studying science subjects – by age



Source: Pye Tait Consulting learner surveys 2008

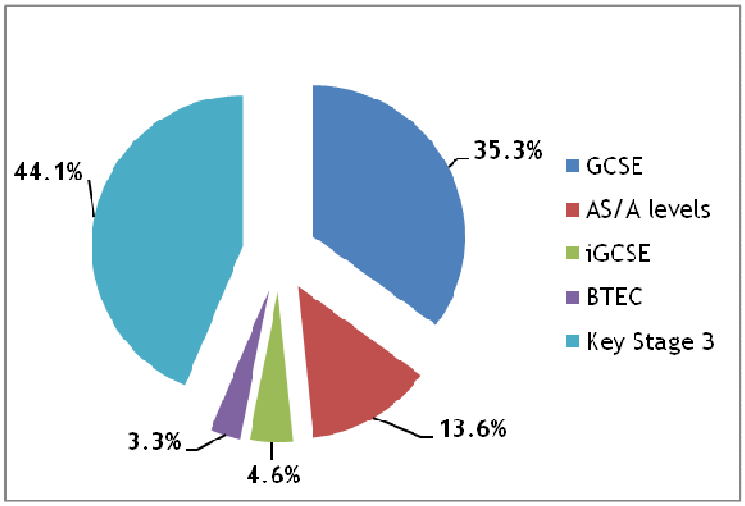
Over one-third of science learners (35.3%) who responded to the survey were taking GCSEs, with a further 13.6% taking AS or A levels. Smaller proportions of respondents said they were studying towards the iGCSE (4.6%), BTEC science qualifications (3.3%). Ten respondents were taking the International Baccalaureate, and one an Advanced Extension Award. The remainder (44.1%) said that they were studying towards Key Stage 3 science.

Figure 5: Learners studying science subjects – by gender



Source: Pye Tait Consulting learner surveys 2008

Figure 6: Courses being taken by science respondents



Source: Pye Tait Consulting learner surveys 2008

2.1 Ways of learning science

Learners participating in the online surveys were asked to score a range of ways of learning about science on a scale of 1 to 5, where 1 meant they did not like the suggested way of learning science at all, and 5 meant they like that way of learning science very much.

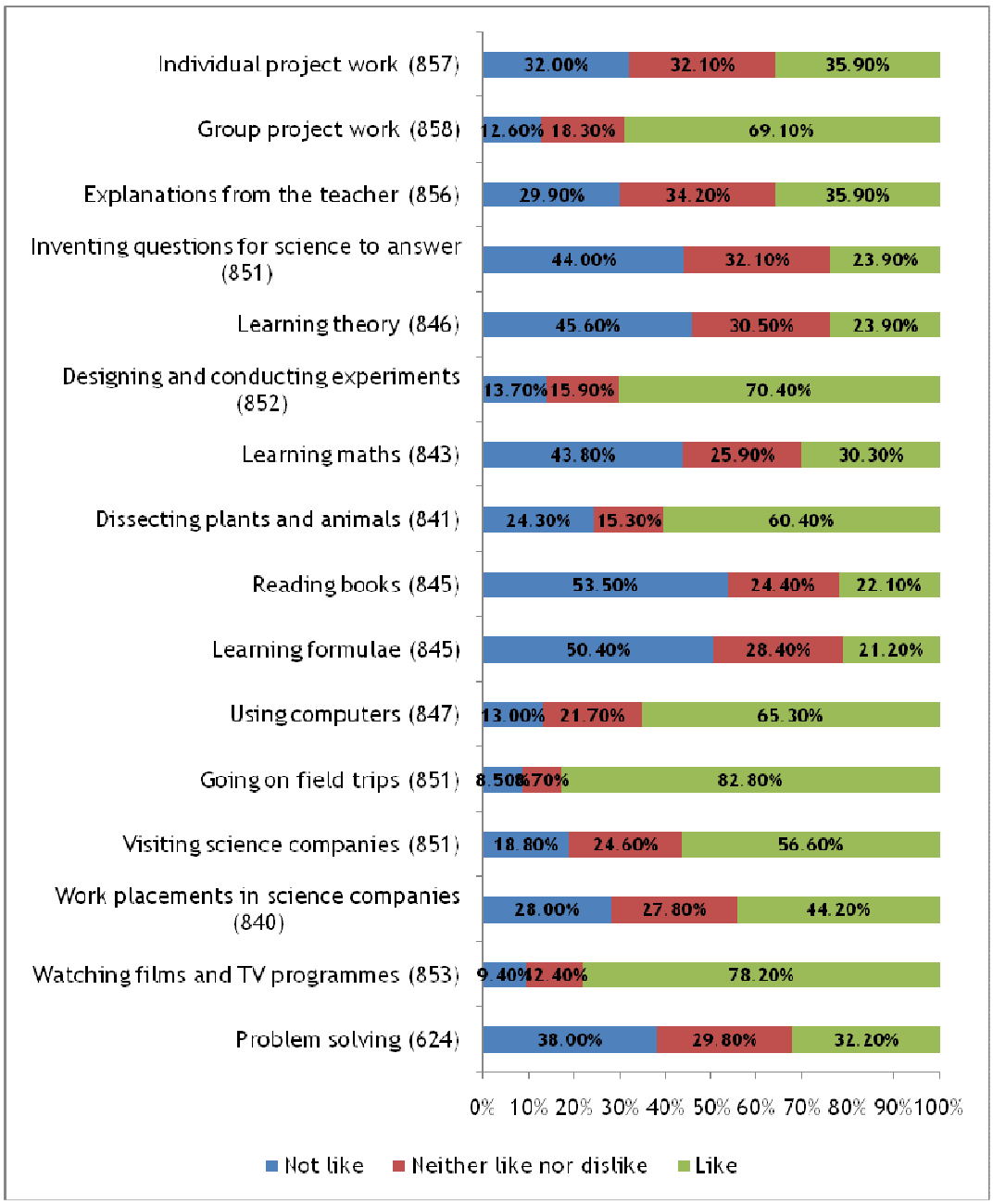
As Figure 7 shows, the top five ways in which learners said that they like to learn about science were all practical, interactive activities:

1. Going on field trips (82.8%)
2. Watching films and TV programmes (78.2%)
3. Designing and conducting experiments in the laboratory (70.4%)
4. Group project work (69.1%)
5. Using computers (65.3%)

The five least favoured ways in which young people said that they like to learn about science were theoretical, 'academic' approaches to a topic:

1. Reading books (53.3%)
2. Learning formulae (50.3%)
3. Learning theory (45.5%)
4. Inventing questions that scientists can help to answer (43.9%)
5. Learning maths (43.7%)

Figure 7: Ways in which learners like to learn about science



Source: Pye Tait Consulting learner surveys 2008

There were however, some slight differences between the genders in terms of how learners prefer to learn about science.

Throughout the surveys, female respondents were particularly keen to see more in the way of 'group work' during science lessons, such as being able to conduct group discussions, projects and experiments. Male respondents, on the other hand, were focused on carrying out practical activities, 'lots more experiments', and 'more explosions and other exciting stuff' (Table 1).

Table 1: Ways in which learners like to learn about science – by gender

Male	Female
Ways most like to learn about science	**Ways most like to learn about science**
- Watching films and TV programmes (81.2%) - Going on field trips (81.0%) - Designing and conducting experiments in the laboratory (73.9%)	- Going on field trips (84.7%) - Watching films and TV programmes (75.9%) - Group project work (69.2%)
Ways boys least like to learn about science	**Ways girls least like to learn about science**
- Reading books (57.0%) - Learning formulae (45.4%) - Learning theory (44.9%)	- Learning formulae (54.6%) - Reading books (50.9%) - Learning maths (48.7%)

Source: Pye Tait Consulting learner surveys 2008

Approaches to learning science that were less well-liked among learners were fairly similar across the genders – namely learning theory and developing mathematical knowledge - but slightly older learners (aged 14 – 18) were also more likely to say that they did not enjoy inventing questions that science can help to answer (Table 2).

Table 2: Ways in which learners like to learn about science – by age

11-13	14-16	17-18
Most like to learn about science by • Going on field trips (87.0%) • Watching films and TV programmes (84.1%) • Designing and conducting experiments in the laboratory (78.1%)	**Most like to learn about science by** • Going on field trips (76.1%) • Watching films and TV programmes (70.5%) • Using computers (i.e. interactive learning) (62.2%)	**Most like to learn about science by** • Going on field trips (85.1%) • Visiting science companies (74.1%) • Watching films and TV programmes (64.8%)
Least like to learn about science by • Reading books (55.6%) • Learning formulae (53.3%) • Learning theory (50.5%)	**Least like to learn about science by** • Reading books (53.1%) • Inventing questions that science can help to answer (48.2%) • Learning formulae (46.8%)	**Least like to learn about science by** • Learning formulae (47.2%) • Reading books (46.3%) • Inventing questions that science can help to answer (37.0%)

Source: Pye Tait Consulting learner surveys 2008; please note that science results for learners aged 19+ are not reported as these are only based on 5 survey respondents

Whereas younger learners were very enthusiastic about field trips, designing and conducting experiments, learners aged 17 and above reported that they found visiting science companies to be beneficial to them, suggesting a greater awareness or interest by this stage in the applications of science in the workplace (Table 2).

Multidisciplinary approach to learning

During the focus groups led by Citizenship Foundation, learners were also asked what they thought about following an integrated ('multidisciplinary') approach to learning the different science subjects. There appeared to be, in the three discussions covering the issue, a general wariness among learners about this approach.

It was acknowledged by one student that it can be useful when subjects 'talk to each other to help all-round learning' and several were able to identify links between subjects such as Geography and Earth Sciences, and Physics and Mathematics. However, learners seemed to feel that they would prefer science courses where they had been able to make a choice about specialising in specific disciplines. For example:

'When you are doing Physics you think 'I could be spending more time on Chemistry' and concentrate more on what I am interested in rather than what you have to do.'

'It would be better if you could choose two out of the three science subjects to study. This would allow you to do well in two topics and not average in three. It's a shame when one topic you don't really enjoy - it brings the rest of your grade down.'

Older learners attending the Birmingham and London focus groups showed particular support for studying separate sciences so as to maintain their interest in specialist areas:

"I prefer more specialist courses - that makes you more of an expert in

certain areas."

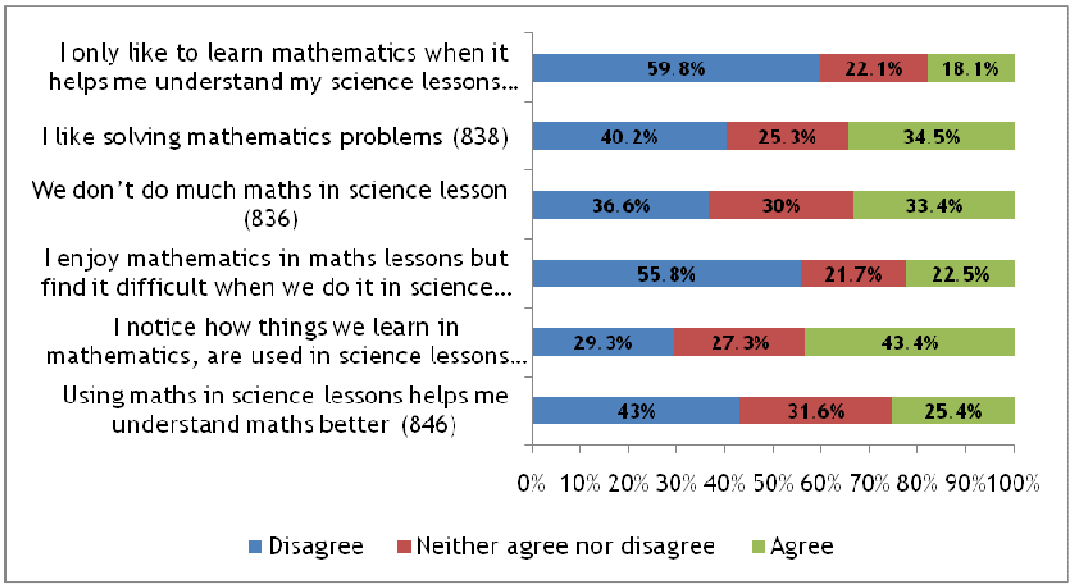
"Most people prefer one…and I don't want to do something I don't want to do..I'd rather do one subject than a range…You would prefer to specialise in the topic that interests you."

2.2 The use of mathematics in science

Survey respondents were offered a range of statements relating to how mathematics is used in science, and how best they learn mathematics.

Overall, the highest proportion of respondents agreeing to a statement (43.4%) said that they did notice how things learnt during mathematics lessons are also used in science. Just 18% agreed that they only like to learn mathematics when it helps them to understand science (see Figure 8).

Figure 8: Learners' views of using mathematics in science



Source: Pye Tait Consulting learner surveys 2008

As with learners' preferred approaches to learning science, responses by gender to the question of mathematics in science were similar. However, girls were less positive about the suggestion that using maths in science lessons

might help them to understand maths better (Table 3).

Table 3: Learners' views of using mathematics in science – by gender

Male	Female
Boys most <u>agree with:</u>	**Girls most <u>agree with:</u>**
• I notice how things we learn in mathematics, are used in science lessons (45.0%)	• I notice how things we learn in mathematics, are used in science lessons (43.0%)
• I like solving mathematics problems (39.8%)	• We don't do much maths in science lesson (34.5%)
• We don't do much maths in science lesson (31.9%)	• I like solving mathematics problems (31.6%)
Boys most <u>disagree with:</u>	**Girls most <u>disagree with:</u>**
• I only like to learn mathematics when it helps me understand my science lessons (55.7%)	• I only like to learn mathematics when it helps me understand my science lessons (63.2%)
• I enjoy mathematics in maths lessons but find it difficult when we do it in science (52.4%)	• I enjoy mathematics in maths lessons but find it difficult when we do it in science (58.7%)
• We don't do much maths in science lesson (38.8%)	• Using maths in science lessons helps me understand maths better (45.4%)

Learners aged 14 and above were more likely to agree that using maths in science does indeed help them understand maths better, and those aged between 17 and 18 were the only age group to particularly disagree with the

suggestion that they do not cover much maths during science lessons (Table 4).

During the focus groups facilitated by Pye Tait Consulting, learners undertaking Level 3 science qualifications recognised the importance and relevance of the mathematics content within their science courses. Younger learners at Level 2 were also able to identify the importance of mathematics in science, but, across the age groups, enjoyment of this subject matter was varied. It became apparent that learners' enjoyment of the mathematical aspects of science was generally linked to their relative ability in the subject – i.e. enjoying it more where they felt proficient in maths.

This was supported during one focus group discussion in Leeds led by Citizenship Foundation where a student suggested that, given the choice, they would stop studying maths altogether because they felt they had less ability in the subject:

"The relevance of it [maths] *depends on university – if you are thinking about studying sciences. If I could get away with never doing Maths again after this year I would, as I am useless at it, but I want to do medicine so I know it is important, but so many people drop out* [of science] *because of it* [maths]*."*

Table 4: Learners' views of using mathematics in science - by age

11-13	14-16	17-18
Agree with: • I notice how things we learn in mathematics, are used in science lessons (40.2%) • We don't do much maths in science lessons (36.4%) • I like solving mathematics problems (31.7%)	**Agree with:** • I notice how things we learn in mathematics, are used in science lessons (46.3%) • I like solving mathematics problems (38.4%) • Using maths in science lessons helps me understand maths better (32.0%)	**Agree with:** • I notice how things we learn in mathematics, are used in science lessons (57.7%) • Using maths in science lessons helps me understand maths better (45.3%) • I like solving mathematics problems (37.7%)

(table continues overleaf)

11-13	14-16	17-18
Disagree with:	**Disagree with:**	**Disagree with:**
- I only like to learn mathematics when it helps me understand my science lessons (60.2%)	- I only like to learn mathematics when it helps me understand my science lessons (58.9%)	- I enjoy mathematics in maths lessons but find it difficult when we do it in science (69.8%)
- I enjoy mathematics in maths lessons but find it difficult when we do it in science (57.4%)	- I enjoy mathematics in maths lessons but find it difficult when we do it in science (50.2%)	- I only like to learn mathematics when it helps me understand my science lessons (62.3%)
- I like solving mathematics problems (44.6%)	- Using maths in science lessons helps me understand maths better (43.1%)	- We don't do much maths in science lesson (58.5%)

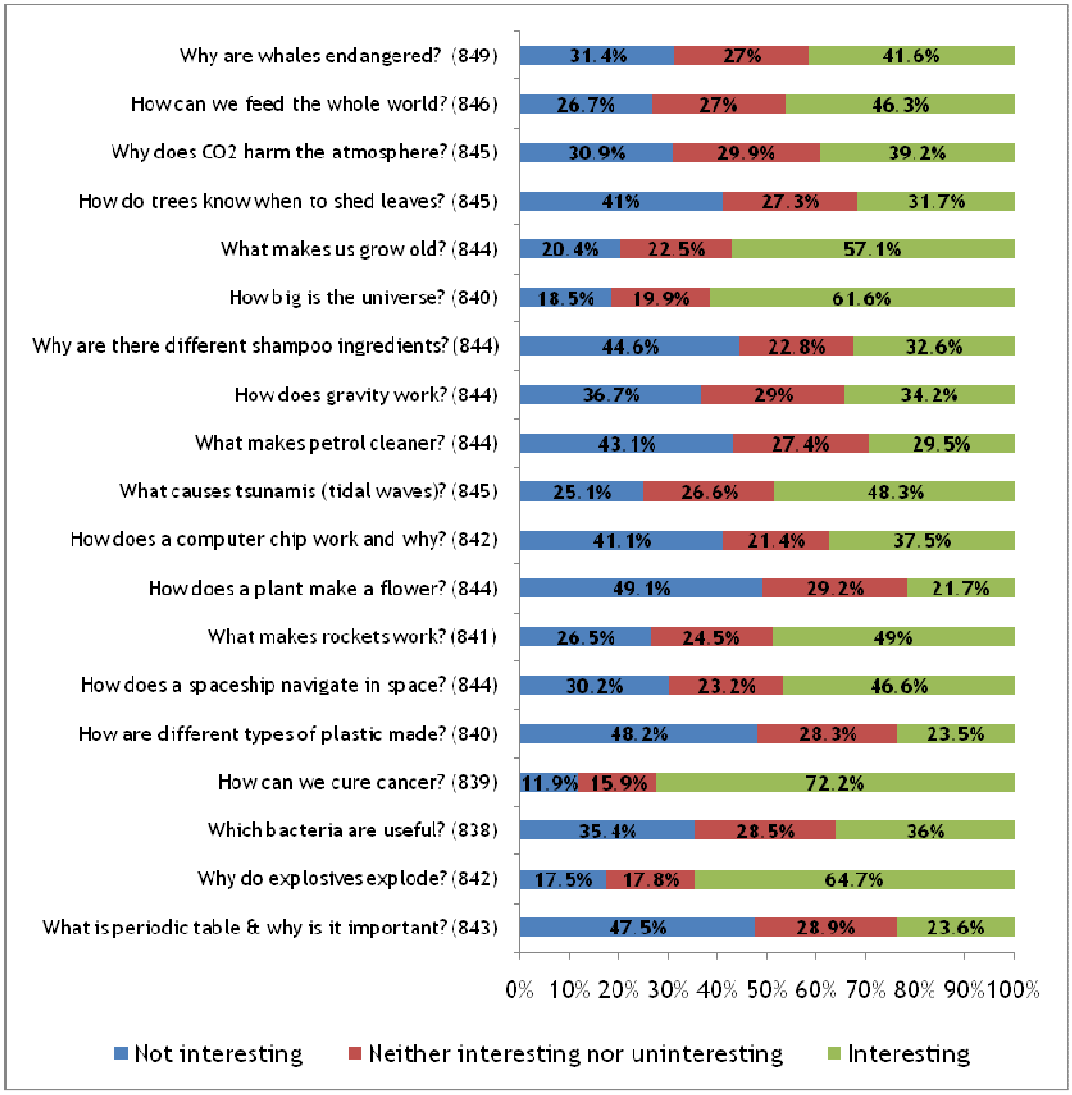
Source: Pye Tait Consulting learner surveys 2008; please note that science results for learners aged 19+ are not reported as these are only based on 5 survey respondents

2.3 Issues learners would like to cover in science lessons

When asked how much they would like a series of suggested topics to become part of their science courses, survey respondents were particularly in favour of physics and chemistry topics dealing with space exploration and explosions, and human biology topics dealing with curing disease and understanding the ageing process. The topics they said would be most interesting were (see Figure 9):

1. How can we cure cancer? (72.2%)
2. Why do explosives explode? (64.7%)
3. How big is the universe? (61.6%)
4. What makes us grow old? (57.1%)
5. What makes rockets work? (49.0%)

Figure 9: Topics science learners would like to study in their courses



Source: Pye Tait Consulting learner surveys 2008 (Base for each answer in brackets).

Topics that learners reported as being the least interesting propositions for their science courses were focused on areas such as how different materials are produced, the theory of the periodic table and plant biology. Overall, the topics learners said would be the least interesting to them were:

1. How does a plant make a flower from just being planted in the soil? (49.1%)

2. How are all the different types of plastic made? (48.2%)

3. What is the periodic table and why is it important? (47.5%)

4. Why are there all those different ingredients in shampoo? (44.6%)

5. How does a computer chip work and why? (41.1%)

Nearly all respondent types selected curing cancer as the most interesting topic from those available, apart from boys - who put this topic third after explosives and the size of the universe - and older learners, who placed it second, again after the size of the universe (see Tables 5 and 6).

The main differences between genders appear among the topics that learners said that they would find least interesting (Tables 5 and 6).

Boys mainly said that they would find aspects of plant biology least interesting, whereas girls were least interested in chemistry topics such as the periodic table and the make-up of different plastics. In addition, during the focus group discussions carried out by Pye Tait Consulting, most male learners indicated a preference for chemistry and physics, whilst female learners generally said they preferred biology. However, boys at Level 2 (aged 14 – 16) also showed a preference for biology. Both genders said that they found chemistry topics the most difficult to relate to their everyday lives.

There were fewer differences between the preferences of learners according to age (Table 6).

Table 5: Topics science learners would like to study in their courses – by gender

Male	Female
Boys find most interesting:	**Girls find most interesting:**
• Why do explosives explode? (76.4%)	• How can we cure cancer? (79.5%)
• How big is the universe? (65.4%)	• What makes us grow old? (62.8%)
• How can we cure cancer? (64.3%)	• How big is the universe? (58.9%)
Boys find least interesting:	**Girls find least interesting:**
• How does a plant make a flower from just being planted in the soil? (51.7%)	• How are all the different types of plastic made? (50.8%)
• Why are there all those different ingredients in shampoo? (50.7%)	• How does a computer chip work and why? (50.7%)
• How does a tree know when to shed its leaves in autumn? (45.8%)	• What is the periodic table and why is it important? (49.9%)

Source: Pye Tait Consulting learner surveys 2008

Table 6: Topics science learners would like to study in their courses – by age

11-13	14-16	17-18
Find most interesting: • How can we cure cancer? (74.1%) • Why do explosives explode? (71.4%) • How big is the universe? (63.2%)	**Find most interesting:** • How can we cure cancer? (68.4%) • What makes us grow old? (59.0%) • How big is the universe? (55.6%)	**Find most interesting:** • How big is the universe? (78.4%) • How can we cure cancer? (73.1%) • What makes us grow old? (66.7%)
Find least interesting: • How does a plant make a flower from just being planted in the soil? (50.6%) • What is the periodic table and why is it important? (49.3%) • How are all the different types of plastic made? (47.9%)	**Find least interesting:** • How are all the different types of plastic made? (49.5%) • How does a plant make a flower from just being planted in the soil? (48.9%) • Why are there all those different ingredients in shampoo? (45.9%)	**Find least interesting** • How are all the different types of plastic made? (48.1%) • How does a computer chip work and why? (48.1%) • What is the periodic table and why is it important? (44.2%)

Source: Pye Tait Consulting learner surveys 2008; please note that science results for learners aged 19+ are not reported as these are only based on 5 survey respondents

When asked whether there were any other topics that they would like to cover during their science lessons, 362 survey respondents were able to suggest a range of issues. The most common are listed below:

1. **Human life** – 35.9% - e.g. anatomy, illness and disease, cures, evolution, why and how humans die

2. **The universe** – 25.4% - e.g. Earth's formation, other planets, extraterrestrial life

3. **Animal life** – 16.5% - e.g. why animals become ill, differences between humans and animals, animal experimentation (ethics)

4. **Environment** – 13.3% - e.g. climate change, deforestation, endangered species, alternative fuels

5. **Chemical reactions** – 12.1% - e.g. fireworks, guns, bombs, explosions

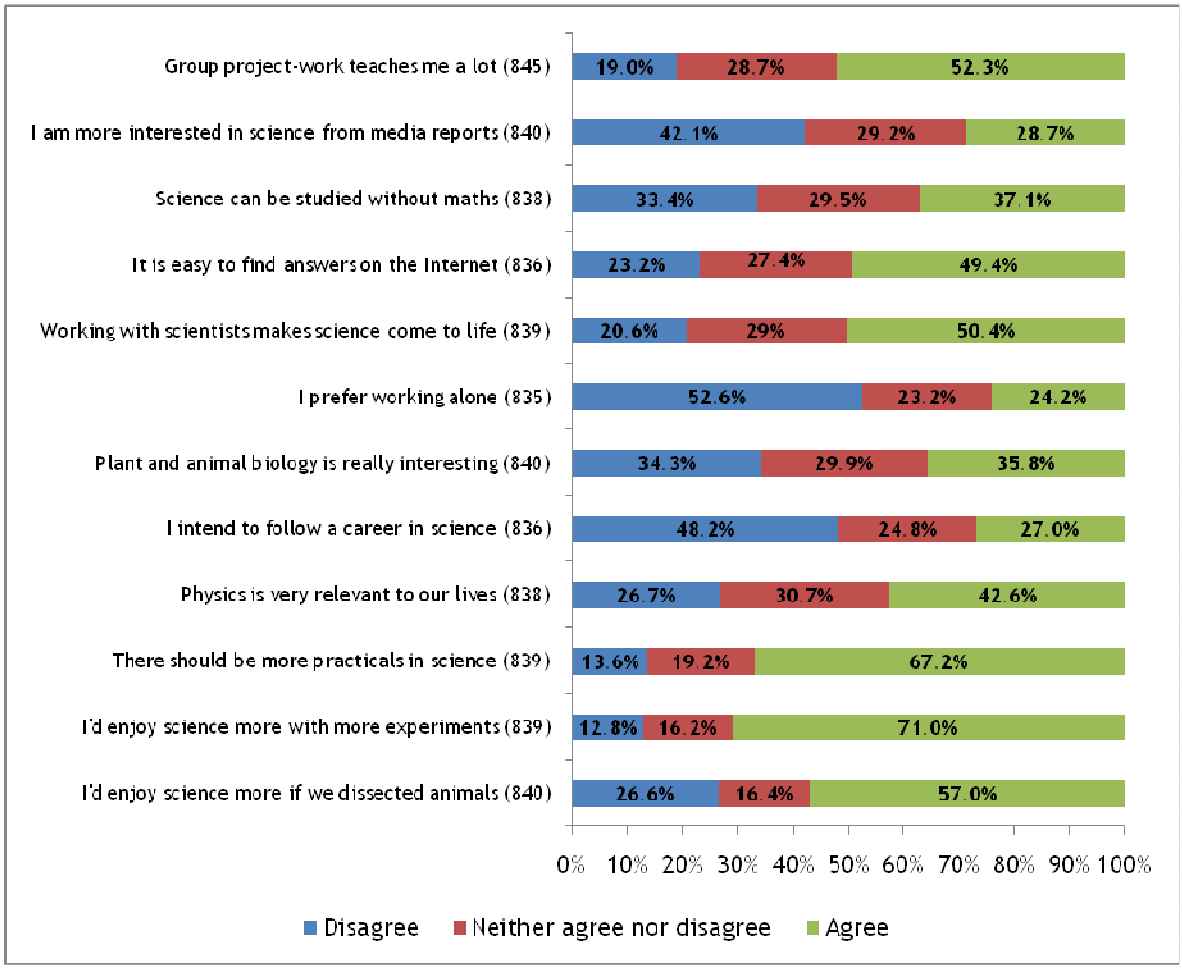
6. **Practical work** – 9.3% - e.g. field trips, experiments, dissection

7. **How things work** – 4.8% - e.g. computers, telephones, touch-screen gadgets, games consoles, engines

2.4 Learning about science

As part of both surveys, learners were provided with a range of statements related to learning science and asked to indicate to what extent they agreed with each of the statements. As Figure 10 shows, the statement receiving the highest level of agreement was that learners would enjoy science more if they carried out more experiments (71.0%). Further emphasising their enjoyment of applied approaches to learning science, over two-thirds (67.2%) were also in agreement that there should be more practical work in their science lessons.

Figure 10: Learners' responses to various statements about learning science



Source: Pye Tait Consulting learner surveys 2008 (Base in brackets)

Learners currently undertaking GCSE Science were slightly more likely to suggest that they would enjoy science more if there were increased opportunities for experiments, compared to those taking science BTEC qualifications or GCSE Applied Science (see Table 7). However, there was no difference in the request for more practical work in science lessons between those already undertaking applied science courses, and those who were not (48% of learners making this request regardless of the type of qualification being studied towards).

Table 7: Requests for more practical work according to qualifications currently being undertaken

	Type of qualification being studied towards	
	GCSE Science (65)	BTEC/ GCSE Applied Science (40)
There should be more practical work in science	48%	48%
Enjoy science more if could do more experiments	54%	45%
Enjoy science more if could dissect animals	54%	55%

Source: Pye Tait Consulting learner surveys 2008; please note that the results for Table 7 were derived from the Science Education Today survey only, as the Your Learning survey did not ask respondents to differentiate between the various GCSE courses they might have been undertaking.

When it came to the statements learners most disagreed with, 'I prefer working alone to working in teams or groups' was disputed by a slight majority of respondents (52.6%). Nearly half (48.2%) of the learners responding to the survey also could not say that they intended to follow a career in science once they left full-time education. This being said, Table 8 indicates that any lack of motivation to follow a career in science decreased among older learners, with exactly half of 17-18 year olds stating that they did in fact intend to work in a science-related occupation.

This was corroborated during the focus groups led by Pye Tait, which highlighted that the main influence on a learner's decision to undertake a science subject at Level 3 (ahead of personal enjoyment of a subject) was the potential opportunity to then progress into Higher Education or employment.

During the focus groups facilitated by Citizenship Foundation, there was also some suggestion from learners that they may feel more motivated to choose courses where they have been able to make a choice about subject coverage – rather than feeling that all of their learning is compulsory:

'When you have a compulsory subject you are actually less motivated to do it.'

'You feel more motivated when you pick an option instead of being told to do it. So people may perform better in that science because they chose it and are most likely to enjoy it and work harder. You want to feel enthusiastic to learn it and not be forced to do it.'

Furthermore, the opportunity to progress to Higher Education appeared to be a key influence on some students in terms of the subject and qualification choices they made – regardless of the type of approach to learning they might prefer.

"It [an applied approach such as the Diploma] *would be more interesting because you wouldn't just be putting pen to paper writing all day, because you get experience and do a lot of stuff outside. Practicals can help learning about written things. It's a different approach. But we wouldn't study it if universities didn't acknowledge it."*

Table 8: Learners' responses to various statements about learning science – by gender

Male	Female
Boys most agree with: • I'd enjoy science more if we could do more experiments (72.5%) • There should be much more practical work in our science lessons (69.2%) • I'd enjoy science more if we could dissect animals (65.7%)	**Girls most agree with:** • I'd enjoy science more if we could do more experiments (70.1%) • There should be much more practical work in our science lessons (66.2%) • Working with real scientists makes the science we learn come to life (52.3%)
Boys most disagree with: • I prefer working alone to working in teams or groups (54.1%) • I intend to follow a career in science when I leave full-time education (47.0%) • Learning about the biology of plants and animals is really interesting (38.8%)	**Girls most disagree with:** • I prefer working alone to working in teams or groups (51.1%) • I intend to follow a career in science when I leave full-time education (47.4%) • I get more interested in science when I read reports about science in the media (44.5%)

Source: Pye Tait Consulting learner surveys 2008

The most notable difference among survey respondents about approaches to learning science, was that girls said they were more enthused by science 'brought to life' through working with real scientists, whereas boys said they would enjoy science more if they could undertake more practical dissection work.

Across the focus groups carried out by Pye Tait, learners undertaking GCSE and BTEC science courses commonly suggested that practical work was very important to their understanding of the subject. However, it was thought –

especially by those in the second year of their GCSE courses – that practical sessions could be improved. It was put forward that the relevance of experiments to 'everyday life' needed to be linked more to the skills being developed. Learners said that they would like teachers to more fully explain the reasons and applications for an experiment, rather than just showing them *how* that experiment is carried out.

Students in Leeds attending a Citizenship Foundation focus group agreed that if science was made *"more relevant to everyday life then we would listen more"* and that it *"would help if teachers explained why you are doing it."*

Media reports about science do not appear to motivate learners' interests in the subject, with all age groups disagreeing fairly strongly with the suggestion that they might.

However, the strongest reaction to the statements in the online survey came among the older learners in relation to their coverage of mathematics in their study of science. By the age of 17, a large majority of learners (70.5%) do not believe that science can be studied without having to learn maths. This further corroborates their earlier disagreement (section 2.2) that they do not cover much maths within their science lessons, emphasising their acknowledgement in the surveys and focus groups – especially at higher levels – of the value and importance of mathematics in science.

Table 9: Learners' responses to various statements about learning science – by age

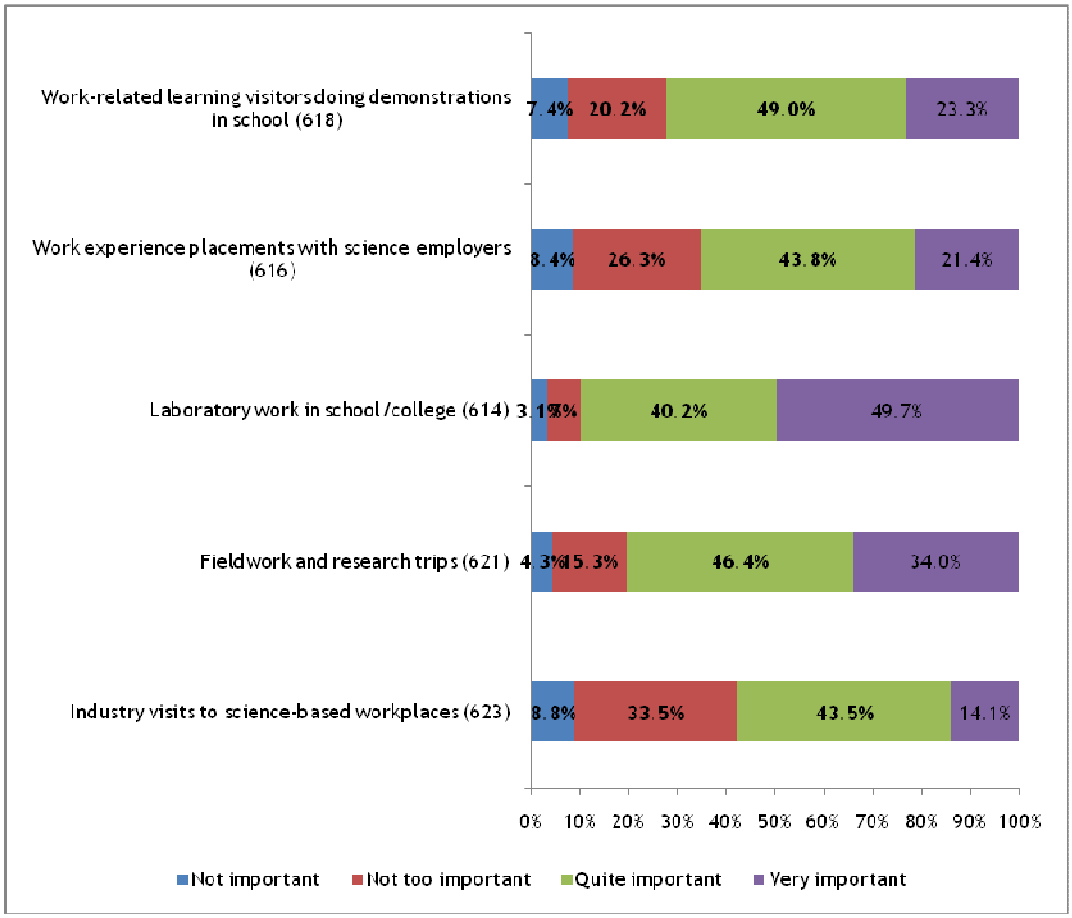
11-13	14-16	17-18
Most agree with: • I'd enjoy science more if we could do more experiments (80.0%) • There should be much more practical work in our science lessons (76.0%) • I'd enjoy science more if we could dissect animals (61.5%)	**Most agree with:** • I'd enjoy science more if we could do more experiments (57.5%) • There should be much more practical work in our science lessons (54.1%) • I'd enjoy science more if we could dissect animals (48.9%)	**Most agree with:** • I'd enjoy science more if we could dissect animals (53.9%) • I intend to follow a career in science when I leave full-time education (50.0%) • I'd enjoy science more if we could do more experiments (49.1%)
Most disagree with: • I prefer working alone to working in teams or groups (58.8%) • I intend to follow a career in science when I leave full-time education (48.9%) • I get more interested in science when I read reports about science in the media (45.0%)	**Most disagree with:** • I intend to follow a career in science when I leave full-time education (52.3%) • I prefer working alone to working in teams or groups (43.8%) • I get more interested in science when I read reports about science in the media (38.8%)	**Most disagree with:** • Science can be studied without having to learn maths (70.6%) • It is easy to find answers on the Internet when writing essays and projects (35.9%) • I get more interested in science when I read reports about science in the media (32.1%)

Source: Pye Tait Consulting learner surveys 2008; please note that science results for learners aged 19+ are not reported as these are only based on 5 survey respondents

2.5 Work-related learning

When asked whether work-related learning is important to their science education, just less than half of all survey respondents (49.7%) said that they thought laboratory work in their school or college was very important. Industry visits to science-based workplaces were reported as being least valuable to learners – although were still important to some extent to over half of all respondents (see Figure 11).

Figure 11: Learner's perceptions of work-related learning in science education



Source: Pye Tait Consulting learner surveys 2008

Table 10 shows how the various work-related learning activities were ranked by learners by gender and age. Figures in bold **RED** highlight where a specific group of respondents rated the activity **higher** than the overall average.

Table 10: Proportion of learners viewing work-related learning as very or quite important by age and gender

		GENDER		AGE		
	All	**Male**	**Female**	**11-13**	**14-16**	**17-18**
Work-related learning visitors doing demonstrations	72.3	70.3	**76.4**	**73.3**	67.1	**78.1**
Work experience placements	65.2	62.9	**68.4**	**67.1**	57.5	**72.5**
Laboratory work	89.9	88.9	**91.8**	**93.0**	79.6	**95.1**
Fieldwork and trips	80.4	77.8	**83.0**	**85.9**	63.7	**82.9**
Industry visits	57.6	53.2	**62.1**	**61.0**	44.9	**66.7**

(Source: Pye Tait Consulting learner surveys 2008; please note that science results for learners aged 19+ are not reported as these are only based on 5 survey respondents)

Table 10 clearly indicates that female learners, as well as the youngest and the oldest groups of learners, were particularly enthusiastic about the importance of all types of work-related learning activities.

For both genders and for the younger and older age groups, the most highly rated aspects of work-related learning were laboratory work and field trips. Those aged 14-16 also rated laboratory work highly.

Industry visits and work experience placements were regarded (relatively) as

the least important types of work-related learning.

During the focus group discussions facilitated by Pye Tait, learners generally agreed that they did not recognise work-related learning as being a part of their science courses – apart from those learners undertaking Applied Science. This may help explain why those aged 14-16 were fairly negative about the importance of work-related learning experiences when responding to the online survey. If they do not perceive themselves to be carrying out work-related learning as part of their science courses, it would be very difficult for them to know whether it would be important or valuable to their learning.

During the Citizenship Foundation focus group in Manchester, one learner also pointed out that it could be difficult to find relevant, informative work experience placements:

"I wanted to try and do work experience as a veterinarian but they give those positions to people studying veterinarian studies. It's hard to find experience as you need to be qualified to do it. You need to be over 16. I went to do it at a GPs, but instead of doing some work with patients, I did office work. There should be more choice in work experience…It's supposed to be an indicator of if you want to do the job, but instead you don't get to do anything."

However, from the results of the focus groups and the surveys it is certainly clear that many young science learners would greatly appreciate a more practical, applied and work-related focus to their learning (see section 2.6 below).

2.6 Making science more interesting

Survey respondents were asked to suggest three things that should be done to create more interest in science for those between the ages of 14 and 19. Nearly 700 learners were able to offer suggestions, with over one-third stating the need for more experiments and practical 'hands on' work during science lessons. The five most popular requests were as follows:

1. **More experiments and practical work** (36.9%) - e.g. dissection, explosions, creating posters so as to engage with 'arty' learners

2. **Making science lessons more fun or relevant to young people** (14.7%) – e.g. using examples of 'real life scenarios' or 'lessons from our point of view', covering subjects such as 'space' or 'what chemical can do', learning about jobs that use science

3. **More field trips** (13.9%) – e.g. to science workplaces, factories, laboratories, museums

4. **Changes in delivery style** (10.8%) – e.g. less listening to the teacher and dictation/copying notes from the board, more projects, teachers being more open to questions

5. **More opportunities for group work** (5.1%) – e.g. interactive games, working in pairs to solve a problem

The majority of learners at the focus groups facilitated by Pye Tait said that they would appreciate the opportunity to complete a work experience placement with a science employer, and were most appreciative of teachers who delivered science using interactive approaches rather than copying from the board or from textbooks. Focus group attendees said that a lack of group work and activities made their science lessons 'boring'.

Assessment methods were also criticised by focus group learners – with those in the second year of their GCSE courses saying that having to experience a range of assessment methods would improve their science courses (e.g. longer essay-style exams, short-answer question papers and coursework assignments). They were particularly critical of multiple-choice exams, viewing them as being 'unfair' assessment of knowledge as 'answers are too easy to guess'.

Students attending the Citizenship Foundation focus groups in Birmingham and Leeds were positive about coursework-based assignments, which were thought to be *"independent"* and enabled them to *"get a more in-depth understanding of* [science]." However, they were critical of the percentage of overall grade

the coursework counts towards:

"You get chance to change your work and put a lot of effort into it and you get to change it again and again…but it's not really worth a lot."

2.7 Views from parents

As potentially key influencers on the decisions young people make regarding their course and qualification choices, the views of parents about the current science curriculum were also gathered via an online survey. A total of 89 parents responded to the survey.

Over half of them had children currently undertaking GCSE science qualifications.

Table 11: Qualifications parents report their children studying

	Percentage of respondents
GCSE	60.5%
International Baccalaureate	19.8%
AS level	12.3%
A level (A2)	12.3%
Advanced Extension Award	1.2%
Don't know/not sure	1.2%

Source: Pye Tait Consulting survey of parents 2008

Ten respondents to the survey said that their child was not currently studying

any science – with the reason given by 8 of these as being that the young person did not have any interest in pursuing a science-based career. Other reasons given were that the learner is more interested in other subjects (3 parents), science is thought to be too difficult (1 parent) and the child does not enjoy science (1 parent).

2.7.1 Inspiring young people to study science

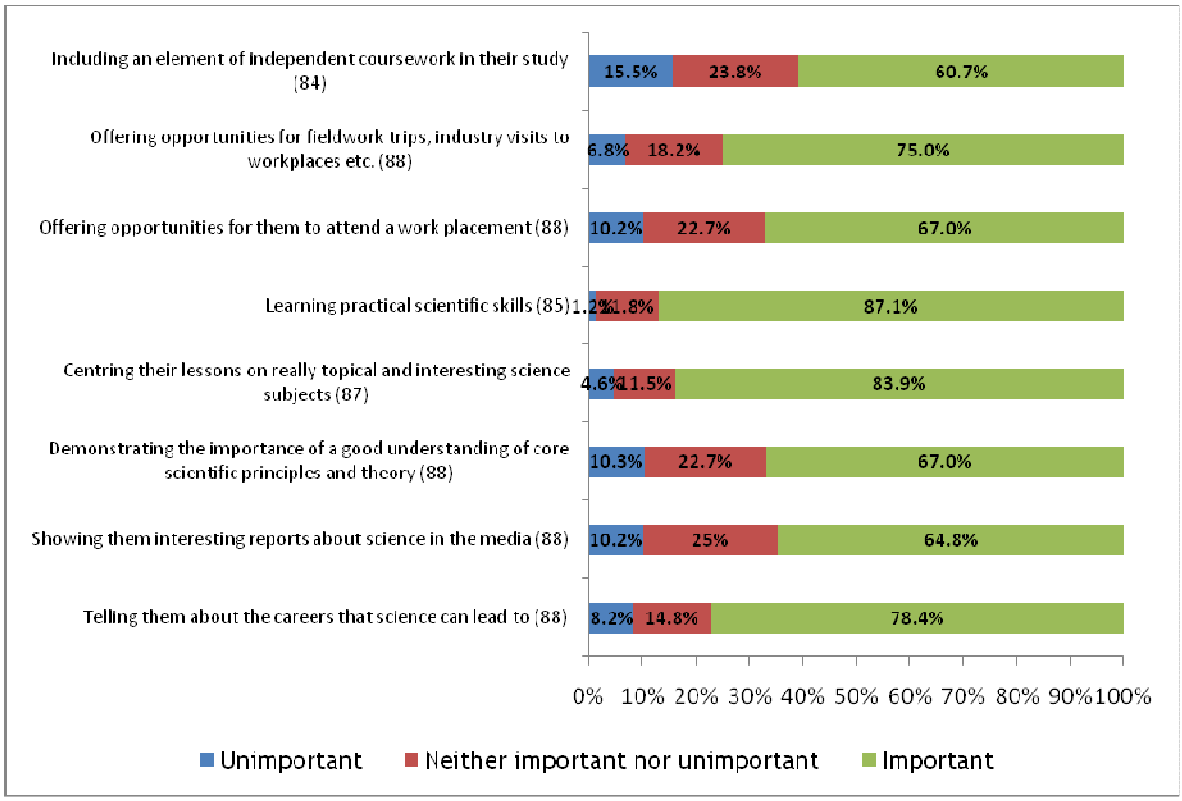
When asked what they thought were the most important factors in inspiring young people to study science, parents viewed the following as being especially valuable:

1. Learning practical scientific skills (87.1%)

2. Centring their lessons on really topical and interesting science subjects (83.9%)

3. Telling them about the careers that science can lead to (78.4%)

Figure 12: Elements parents view as being important in engaging young people in science



Source: Pye Tait Consulting survey of parents 2008

Five parents offered additional ways in which young people might be inspired to study science. These were:

1. 'Visits to school by science-based professionals'

2. 'Enthusiastic and well-motivated teachers'

3. 'More practical lessons' and coverage of subjects that will 'encourage a sense of wonder and develop pleasure in discovery'

Another suggested that inspiring young people was 'only half the battle' and that the development of knowledge in relevant scientific and mathematical principles was also important. Overall, parents' suggestions seem to be in

concordance with learners own wishes for increased practical experiences, coverage of 'everyday' or relevant topics, and increased opportunities for work-related experience.

2.7.2 Factors that make science qualifications valuable

When asked what the most important factors would be in making them believe that a science qualification is valuable to a young person and their future prospects, the most important factors for parents were focused on enabling learners to progress to further education and training, or lead to a career:

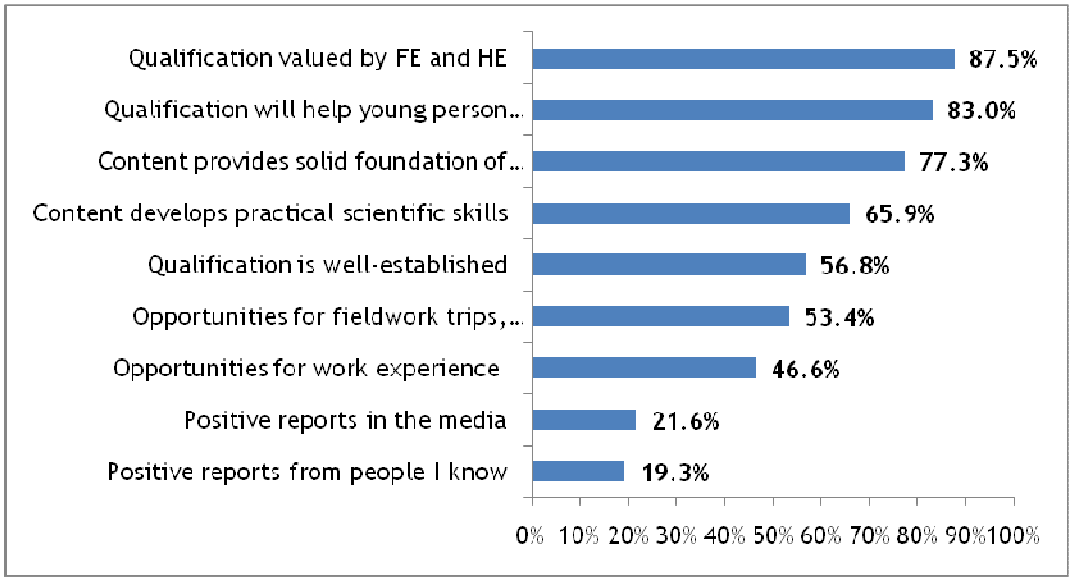
1. The qualification is valued by Further and Higher Education institutions (87.5%)

2. The qualification will help a young person achieve their chosen career (83.0%)

3. The content provides a solid foundation of knowledge in scientific theory (77.3%)

Overall, parents suggested that they would regard a science qualification to be valuable if it was recognised as being such by employers and universities (Figure 13).

Figure 13: Factors important to parents' perceptions of the value of science qualifications



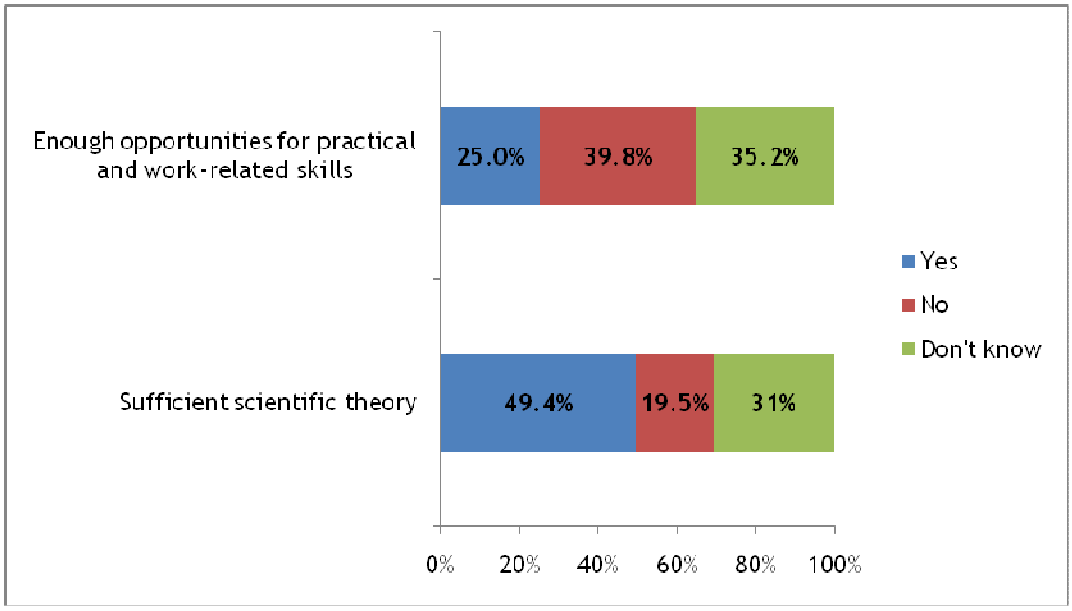
Source: Pye Tait Consulting survey of parents 2008

2.7.3 Current science curriculum

While parents were relatively positive about the current science curriculum as offering sufficient theoretical content to learners, they were less so in terms of it providing opportunities for young people to develop practical and work-related skills (Figure 14).

Despite the agreement by approximately half of respondents that there is sufficient scientific theory in the current curriculum, some parents added further comments that current science qualifications appeared to them to be too broad, or that young people were able to submit a project and then 'forget everything the next day'. Two reported that there appeared to be a 'gap between theory and practice' in the current curriculum, with little in-depth coverage of a subject but 'skimming the surface to enable them [learners] to answer multiple choice exam papers'.

Figure 14: Parents' views on the current science curriculum



Source: Pye Tait Consulting survey of parents 2008

2.7.4 Making science more interesting

Parents made nearly 130 suggestions about what should be done to create more interest in science for those between the ages of 14 and 19. Most commonly, and in agreement with the views of learners, parents were keen to see science made more topical and relevant to young people and for learners to be given more opportunities to carry out practical work and experiments as part of their learning.

The most common suggestions from parents were:

1. **Make science more topical, relevant and accessible** (27.3%) - e.g. relating to everyday scientific practice or current affairs, such as fighting infections in hospitals, learning to wire plugs or change fuses as part of lessons about electricity, learning why tyre pressure affects

vehicle performance, linking science to other subjects such as art

2. **Increase opportunities for practical work and experiments** (14.8%) – e.g. demonstrations, practical projects, lots of 'hands on' work

3. **Provide more information about careers in science** (8.5%) – e.g. also highlighting careers where a science background is useful but not the only factor

4. **More field trips** (7.0%) – e.g. to museums, 'science environments', residential courses

Other suggestions made by six or less parents included improving the 'image' of science among younger people, devoting more time to science within the curriculum, merging the three sciences or making it possible for learners to cover specific aspects that really interest them in greater depth.

2.8 Key issues for the Science DDP to consider

1. **Gender.** It is clear that there are some potentially important differences between boys and girls in terms of the topics and subjects they enjoy learning during their science education. There also appear to be differences in their preferred approaches to learning about science.

2. **Mathematics**. Younger learners (below age 17) do not appear to be as aware of the value and importance of mathematics in science as those currently undertaking Level 3 courses. From the focus groups it is clear that, perhaps not surprisingly, enjoyment of mathematical elements of science is linked to the way learners perceive their own level of ability in this subject.

3. **Practical work.** One of the clearest messages to come out of the surveys and focus groups was the enjoyment young learners experience in practical science sessions, and the value they place on these for helping them to develop their knowledge and skills. Parents also see it as important that any experiments, field trips or other practical activities are relevant to young learners – i.e. that they understand the reasons for carrying out a piece of work or learning a particular theory, as well as developing the knowledge or skill linked to it.

4. **Work-related learning.** Increasing opportunities for work-related learning, particularly at Higher level (ages 14-16) may help to improve enthusiasm for learning science. This would appear particularly important since choices made at 16 about progressing into science-based Further or Higher education appear to be based upon learners' awareness of the relevance a subject may have on their future career potential.

5. **Careers** - Linked to the above is the need to further emphasise the range of careers and opportunities available to people with a science

background, and, perhaps, to emphasise more readily the role that scientific knowledge and understanding plays in almost every aspect of our lives.

6. **Multidisciplinary approach to learning.** There was some wariness among focus group participants about the idea of learning science in a multidisciplinary way, although some were able to identify the benefits of linking subjects or seeing how subjects complement one another (such as Physics and Maths). The main concern among students appeared to be that they would prefer to be able to choose to specialise in specific scientific disciplines, rather than finding it necessary to cover subjects they did not find as interesting or enjoyable through an integrated curriculum.