

IET STEM Research

Summary Report : Pupils Research

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Background and Research Approach

- By way of background, interest in Sciences and an aptitude for these subjects is a necessary lead in for ultimate entry into Engineering specialisations.
- As such, focussed activity by organisations such as the IET among secondary school age pupils could help stimulate interest in Sciences at an early age and therefore generate additional numbers of students embarking on Science/Engineering courses in the future.

Background and Research Approach

- We have carried out 3 separate, but complementary studies: firstly among a sample of **Educationalists**, secondly one among **STEM Teachers**, followed by the most recent one among **Year 9 and Year 10 STEM pupils**
- The first two studies have been completed and reported on separately. This document covers the most recent research among **Year 9 and Year 10 STEM Pupils**.
- In addition, we plan to carry out a longitudinal study of Pupil responses looking at tracking the same cohort of pupils to assess any changes in behaviour and attitude towards STEM subjects that may arise.

Background and Research Approach

- In September 2007, a sample of 732 STEM pupils from 13 secondary schools across the country completed a self completion questionnaire highlighting their behaviour and attitudes towards Science and Engineering.
- Pupils were from years 9 and 10. A Classification analysis is included at the end of this document and highlights sample size broken down by school type, school year, gender and Triple/Double/Single science GCSEs planned.
- This report is detailed in section 2 of this document

Background and Research Approach

- In addition, we carried out 8 in depth focus group discussions with some 85 mixed ability pupils from year 9 and year 10 across a selection of these schools .
- These detailed discussions served to complement the self completion questionnaires by providing us with an opportunity to probe deeper into areas of interest.
- This qualitative report is detailed separately in section 3 of this document.

Section :1

Executive Summary :

Quantified Self Completion Study and
Qualitative Focus Group Study.

Key Conclusions:

.....Pupils want more engaging, real world application lessons in Sciences, and more specific knowledge of careers in the STEM sector.

Summary of Pupils key Requirements:

- More exciting, engaging lessons in STEM subjects
- More real life application of learning across all subjects, including STEM
- More understanding of specific careers including Engineering, covered within ongoing lesson formats.

What Pupils Want.....

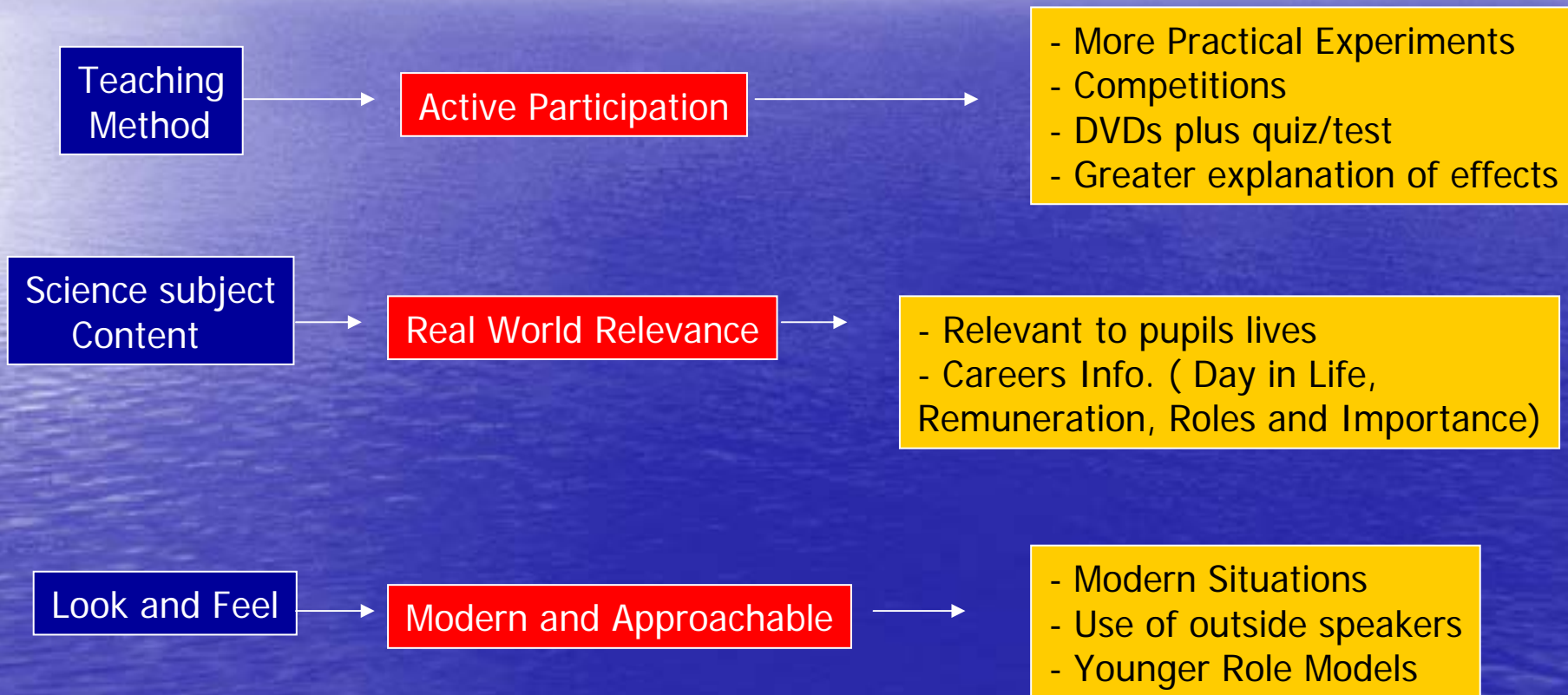
- Subjects that have some relevance to real life
- More active participation in their lessons.
- Quality of teacher was very high on the list of factors influencing subject preference , particularly those teachers that employed more active participation in their lessons

Continued.....

What Pupils Want.....(continued)

- Outside speakers, fun experiments, educational games were all seen as important components of exciting and engaging science lessons.
- It is more than just visual entertainment: the accompanying explanation is essential.
- More detailed knowledge of science based careers

Summary of upgrade areas for Science Lessons



A selection of Pupils comments..

' Schools should explain how science is useful to you in your life'

' It's better when you find out for yourself rather than just copy it from a book'

' Maths is great. She hasn't used the text book once this term.'

Continued....

A selection of Pupils comments..

' We have more experiments in chemistry, it's self discovery'

' We had an outside company to do science experiments, but they didn't spend enough time explaining WHY things happened'

' Teachers need to be able to give careers advice- they can see your strengths better than anyone'

Some Facts and Figures.....

- Some 15% of Pupils claim to enjoy **all** science lessons, although this was less so for year 10 pupils(11% year 10 vs 19% year 9)
- 90% claim to Know a Little or Know Nothing about jobs and careers in Engineering.
- Engineering is seen as Important to Society by 64% of pupils, Interesting Work 48%, Good Wages 41%

Continued.....

Some Facts and Figures.....

- There is still a perception of manual work for some pupils, with '**Dirty working environment**' featuring for 30% of pupils. (35% girls vs 24% boys).
- Girls are less positive and less knowledgeable about Engineering overall.

Continued.....

Some Facts and Figures.....

- 29% of pupils claimed that they might consider a Science based career
- 17% of pupils said they might consider a career in Engineering, with 5% saying they would be Very Likely to do so.
- However, Engineering was only chosen as one of top 2 career choice by 7%.

Continued.....

Some Facts and Figures.....

- Top 2 career choices:

1. Lawyer
2. Teacher
3. Professional sportsperson
- 4.= Doctor, Vet, Armed Forces, Accountant, Police

11th Professional Engineer.

Some Facts and Figures.....

- No girl chose Engineering as one of top 2 choices
- Improved Knowledge is key: 66% of those who knew a lot about Engineering are considering it as a career

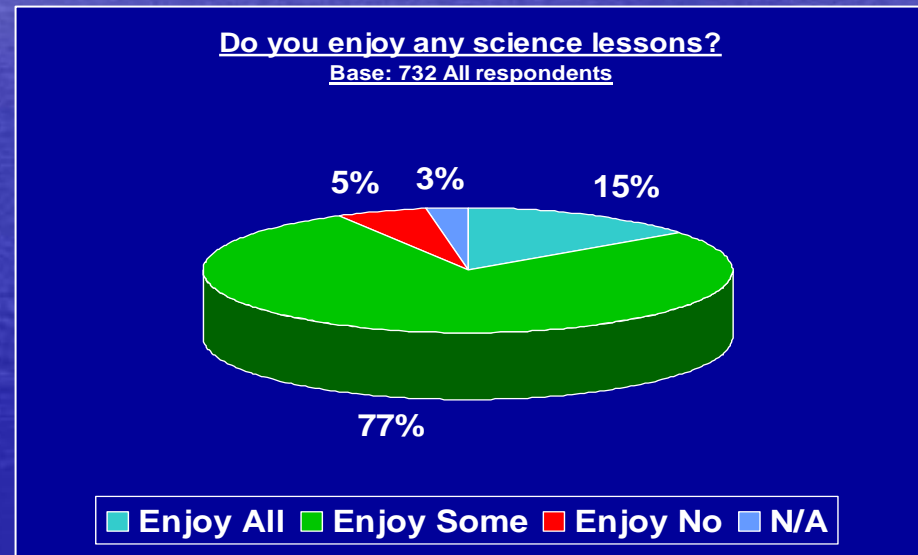
Section : 2

Quantified Self Completion Questionnaire Study

Key Findings:

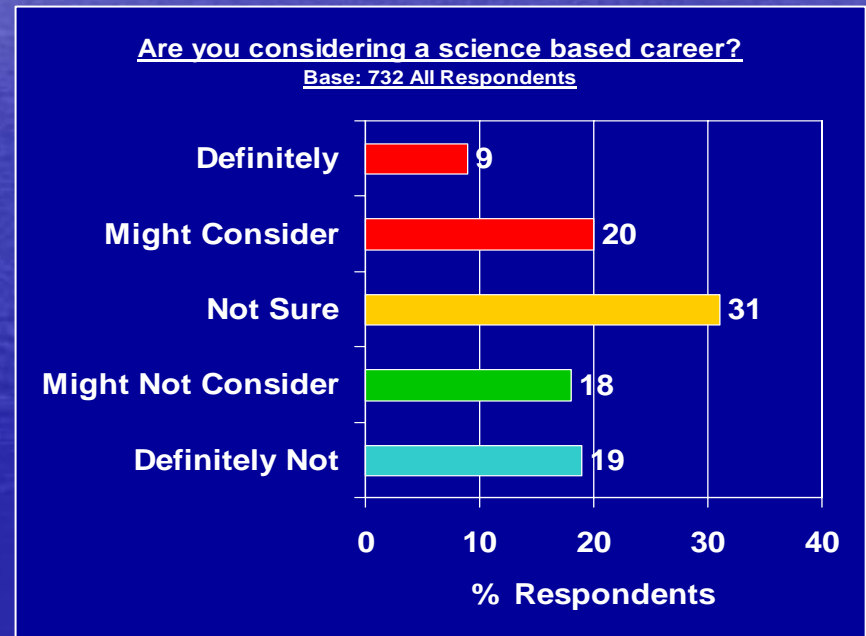
Enjoyment of Science lessons

- Only 15% of year 9 and year 10 pupils enjoyed all science lessons.
- This was higher for year 9 pupils, 19% vs 11% for year 10, with some indication that interest wanes as pupils get older.
- This was also higher for selective school pupils, with 21% enjoying all science lessons



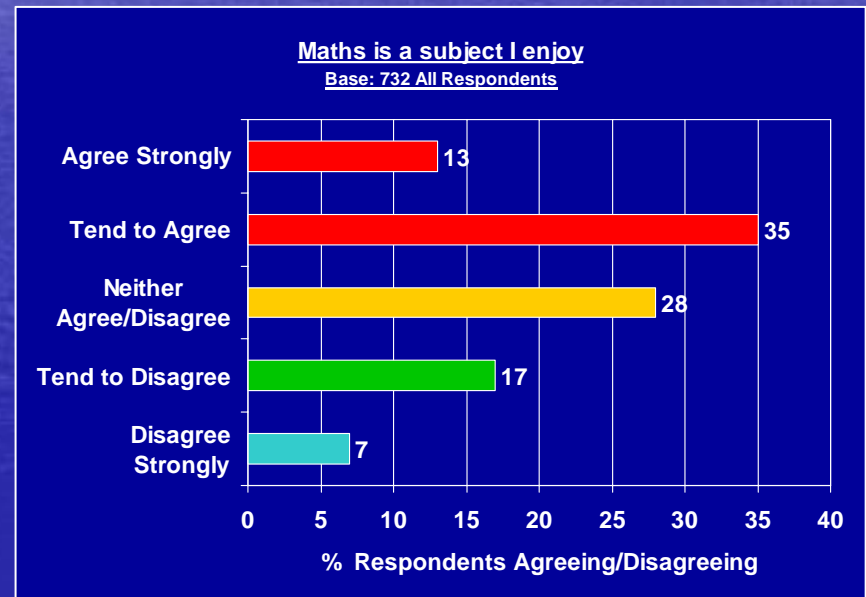
Science based Career

- Only 29% of year 9 and year 10 students were considering a Science based career.
- This was much higher for those taking Triple science (44%) and those in selective schools (43%)
- Some 19% of year 9 and year 10 pupils were definitely not considering a science based career



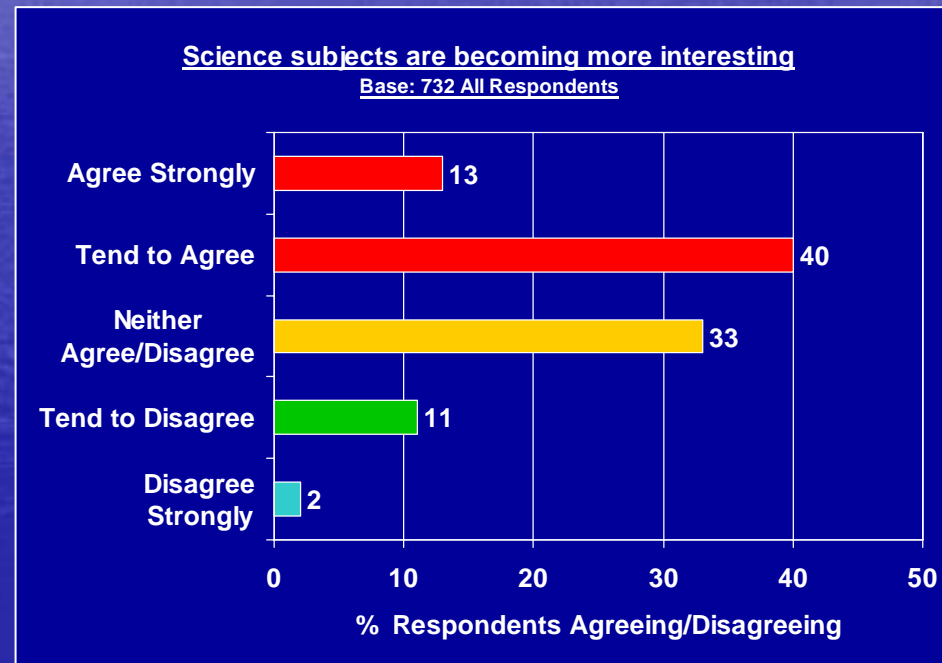
Enjoyment of.....Maths

- Nearly half of all pupils (48%) claimed to enjoy Maths.
- Looking at those pupils who are considering a career in Engineering, some 62% claimed to enjoy the subject.



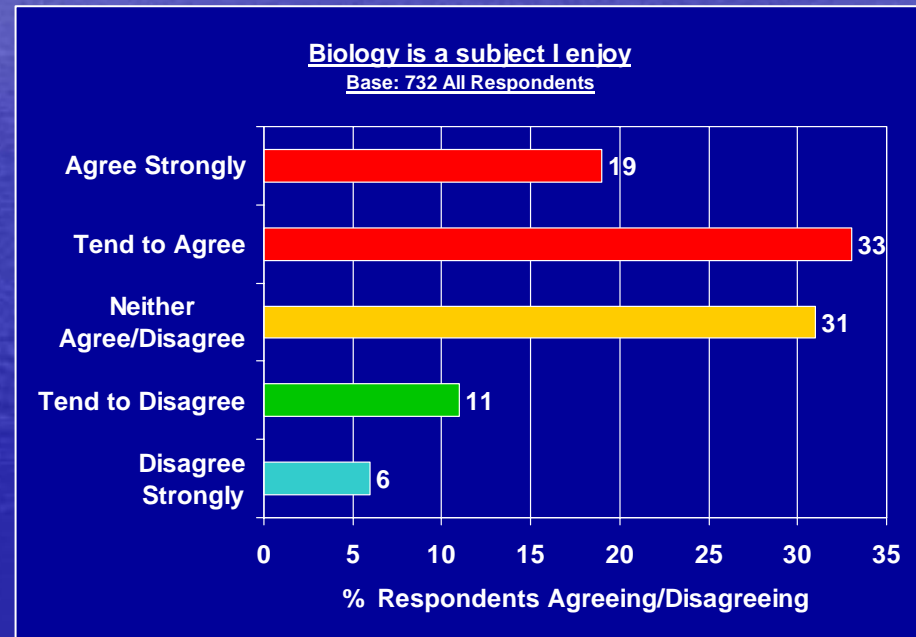
Science subjects becoming more interesting.

- Over half the sample agreed that science subjects are becoming more interesting. Again, year 9 showed much higher ratings (62%) than year 10 pupils (45%).
- There were also higher levels for boys (58%) vs girls (49%)



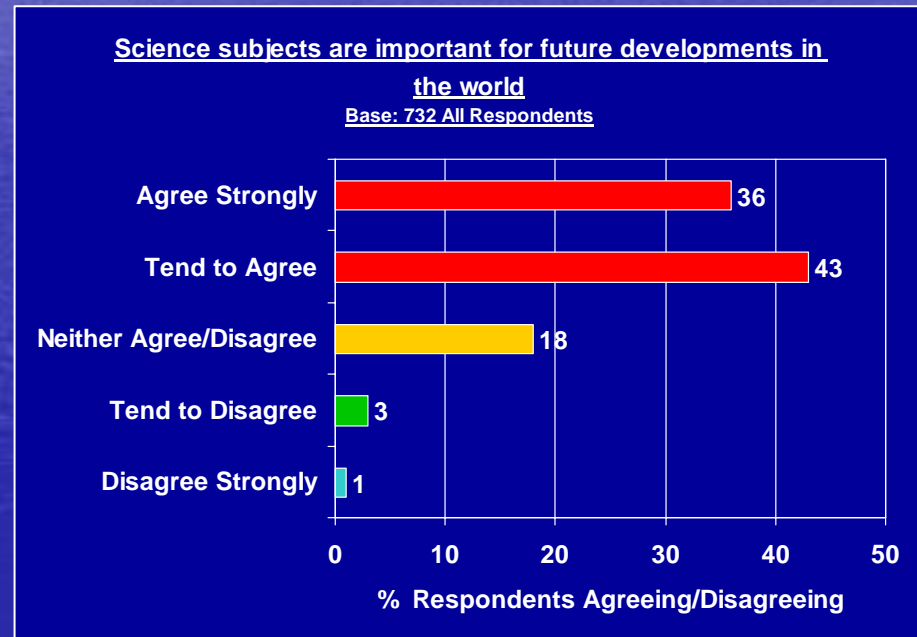
Enjoyment of.....Biology

- Some 52% of pupils claimed to enjoy Biology, with 62% for those pupils taking Triple science.
- Again, higher scores in terms of enjoyment were recorded for selective schools (62%).



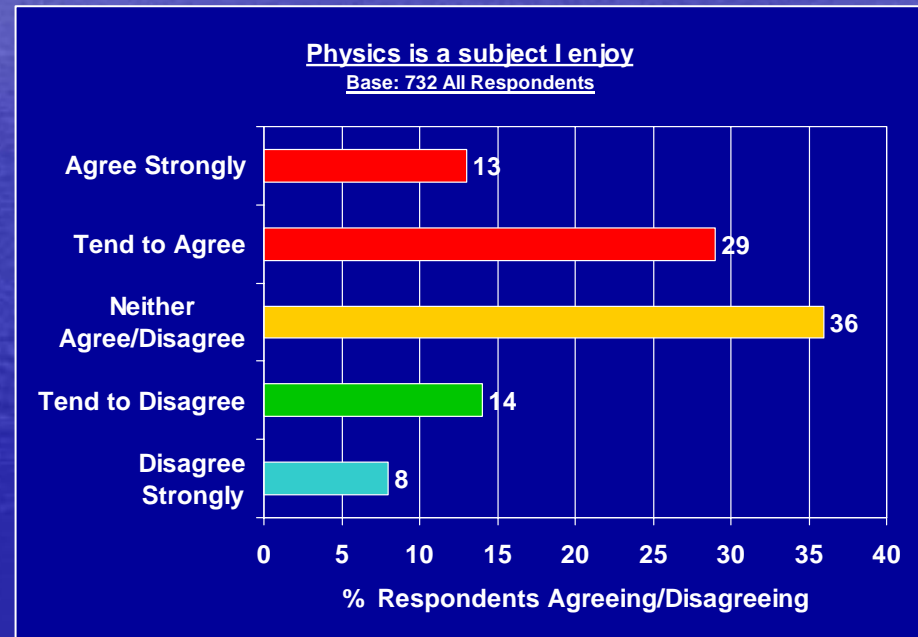
Science subjects are important for future developments in the world.

- There was no doubt as to the importance of science subjects in terms of future world developments, with nearly 80% of pupils agreeing with the statement. There was no real difference of opinion across school types, age or gender on this point.



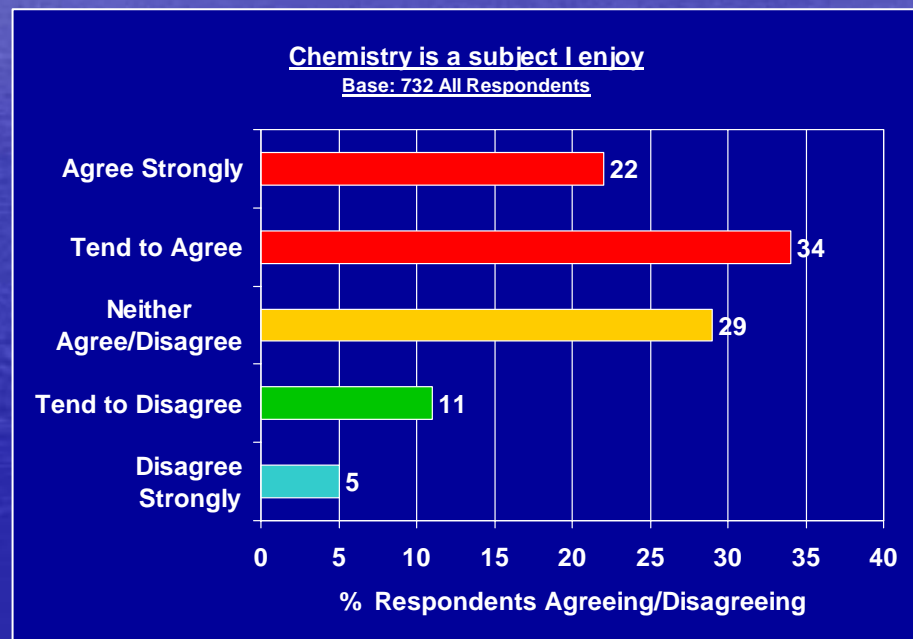
Enjoyment ofPhysics

- Some 42% of pupils claimed to enjoy Physics and this was at a lower level than other science subjects.
- This level slips from 48% enjoyment for year 9 pupils to 37% in year 10.
- Interestingly, some 30% of selective pupils and the same number of Triple science pupils claimed not to enjoy Physics.



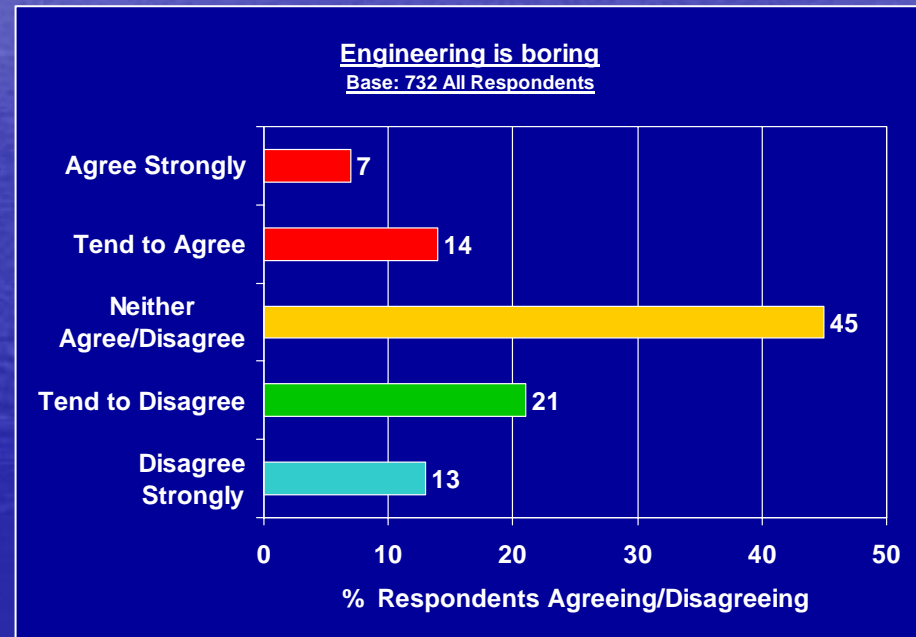
Enjoyment of.....Chemistry

- Chemistry was the most popular of science subjects with 56% claiming to enjoy the subject. This was higher among boys (63%).
- Again, there is a reduction in enjoyment from year 9 (62% agreeing) to year 10 (49%)



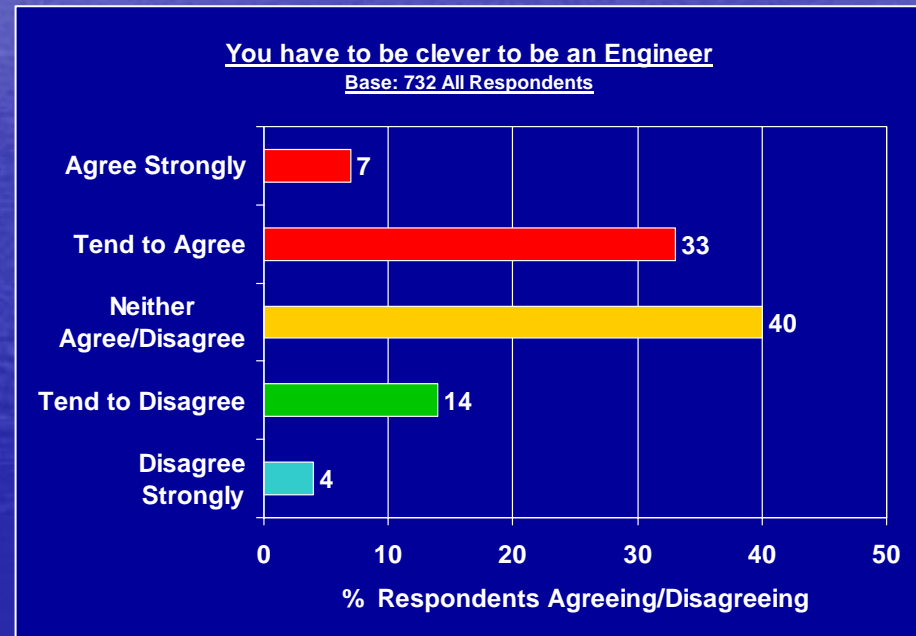
Engineering is Boring....

- Whilst some 21% disagreed that Engineering was boring, getting on towards half of all pupils (45%) did not really have an opinion.
- Girls were less positive and less likely to have an opinion than boys overall.



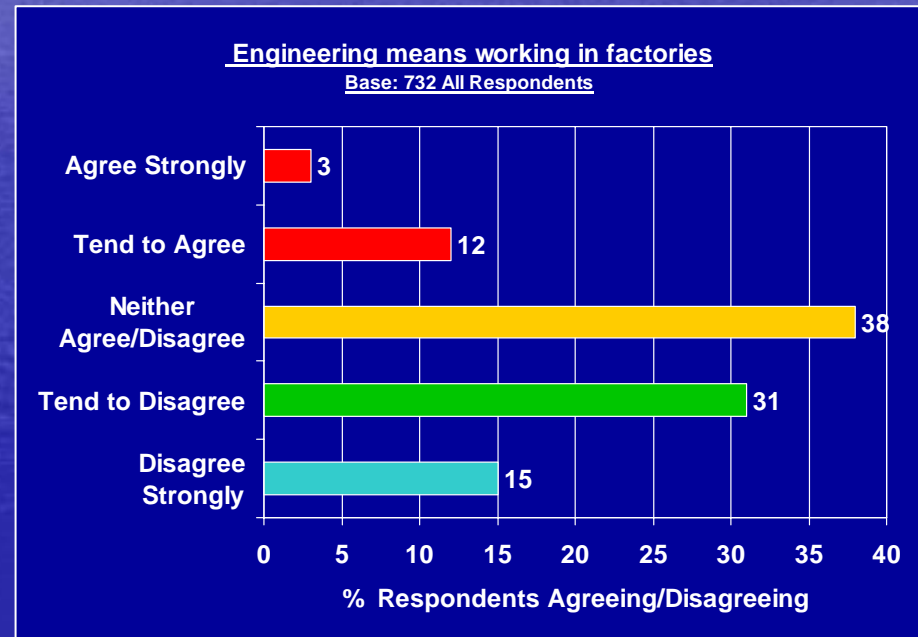
You have to be clever to be an Engineer.

- Again, some 40% did not express an opinion either way, although an equal number, 40% agreed with the statement.
- This was higher for Triple science pupils (52%) and selective pupils (48%).



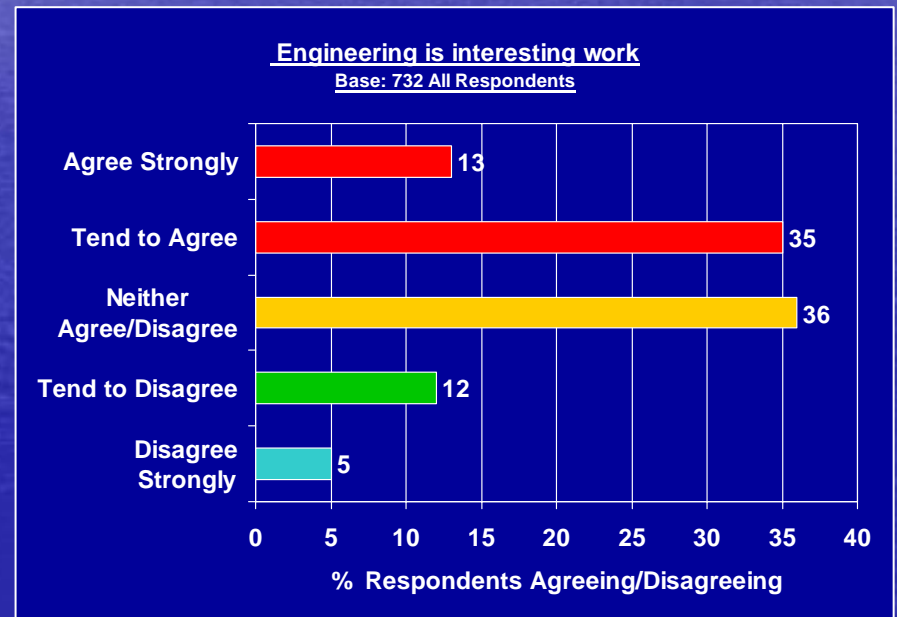
Engineering means working in factories

- Whilst high numbers of pupils (38%) neither agreed or disagreed with the statement, there was a higher level of disagreement overall (46%).



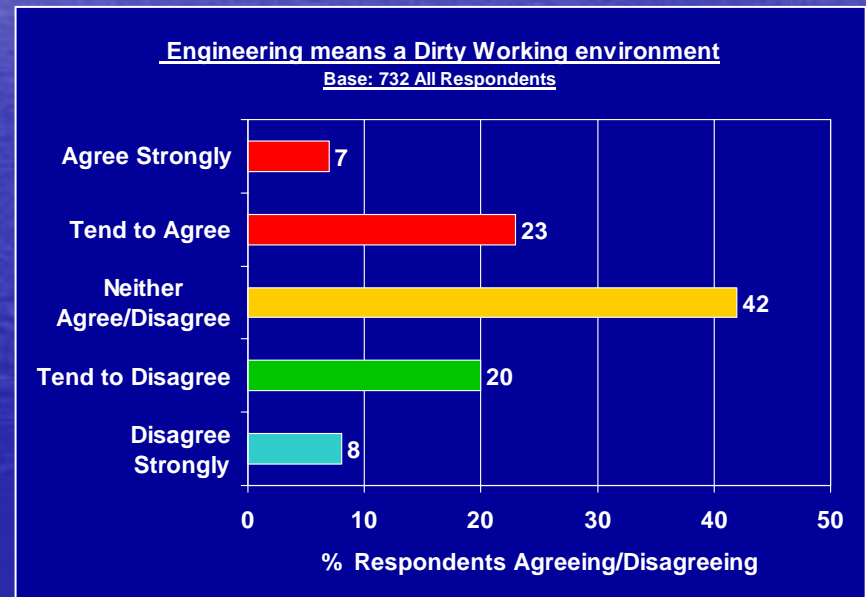
Engineering is interesting work.

- Some 48% of pupils overall felt that Engineering was interesting work, with much higher levels for boys (63%) vs girls (34%).
- Again, a high level overall (36%) showed no knowledge or opinion in relation to Engineering.



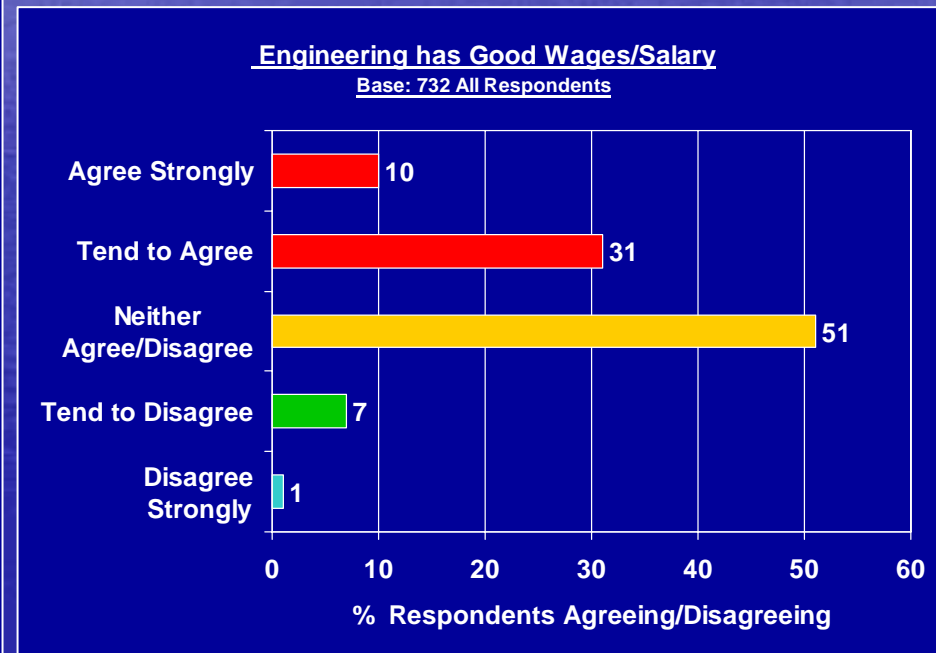
Engineering means a dirty working environment.

- There was a much more polarised response to this statement with roughly equal numbers agreeing and disagreeing, with 42% not expressing an opinion.
- Greater Knowledge of Engineering is important in developing a positive perception because Selective, Triple science pupils, those considering Engineering and those knowing a lot about Engineering all tended to disagree that Engineering means a dirty working environment.



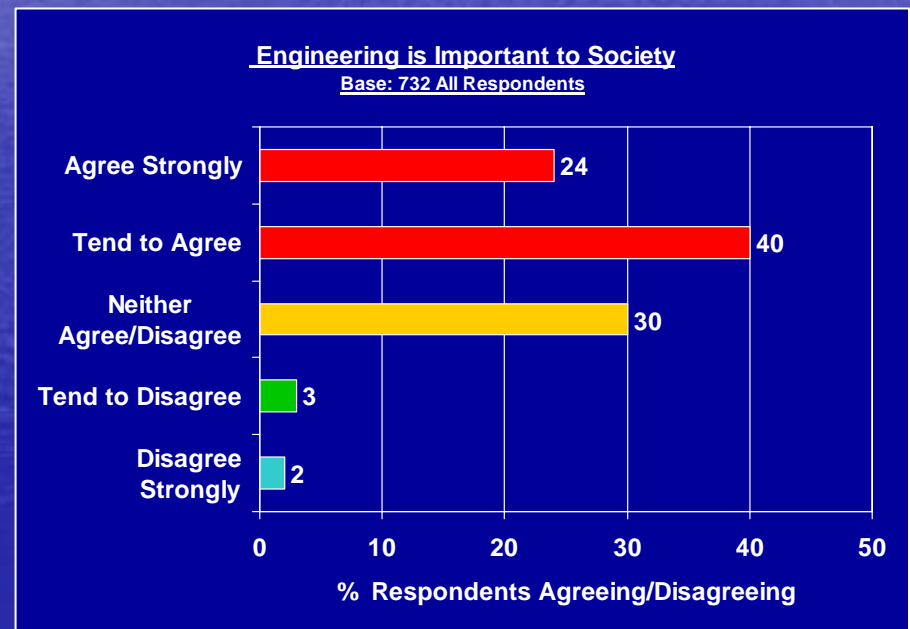
Engineering has good wages/ salary

- Over half the sample did not have an opinion, with boys being most positive overall (51%) vs girls (30%).
- Science/Technical specialist pupils were more likely to have an opinion and were also more positive (47% agreeing).
- Again, those considering Engineering or those who know a lot about Engineering were much more positive about wages/salary.



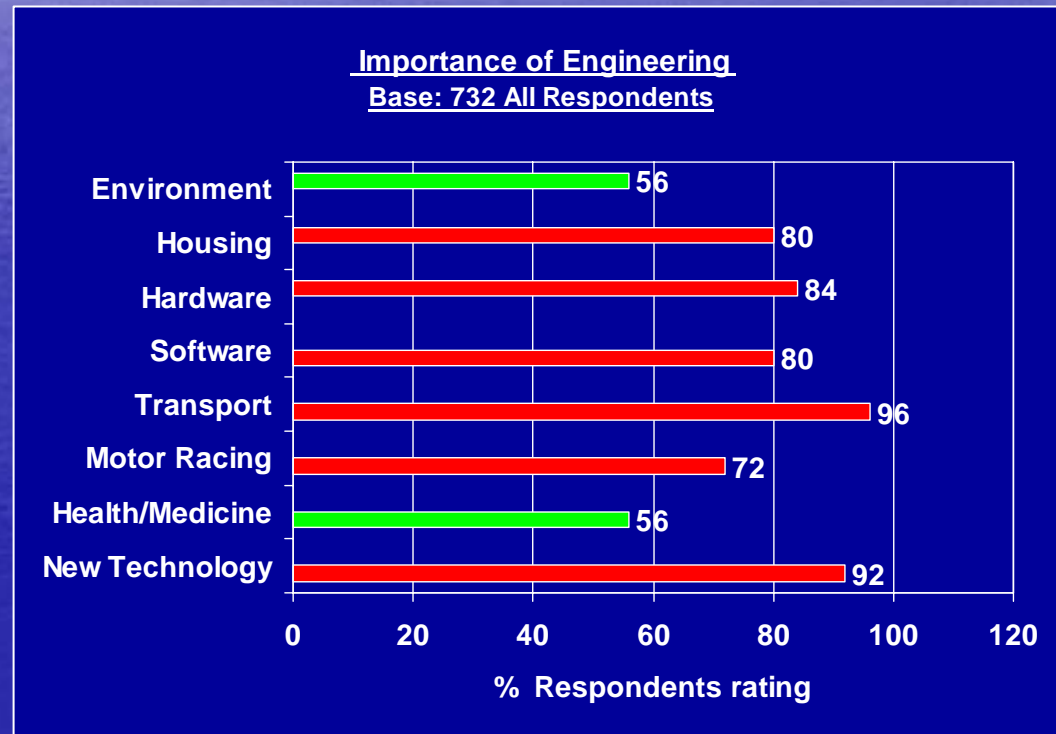
Engineering is important to society.

- Engineering was seen as important to society by most pupils with some 64% agreeing with the statement.



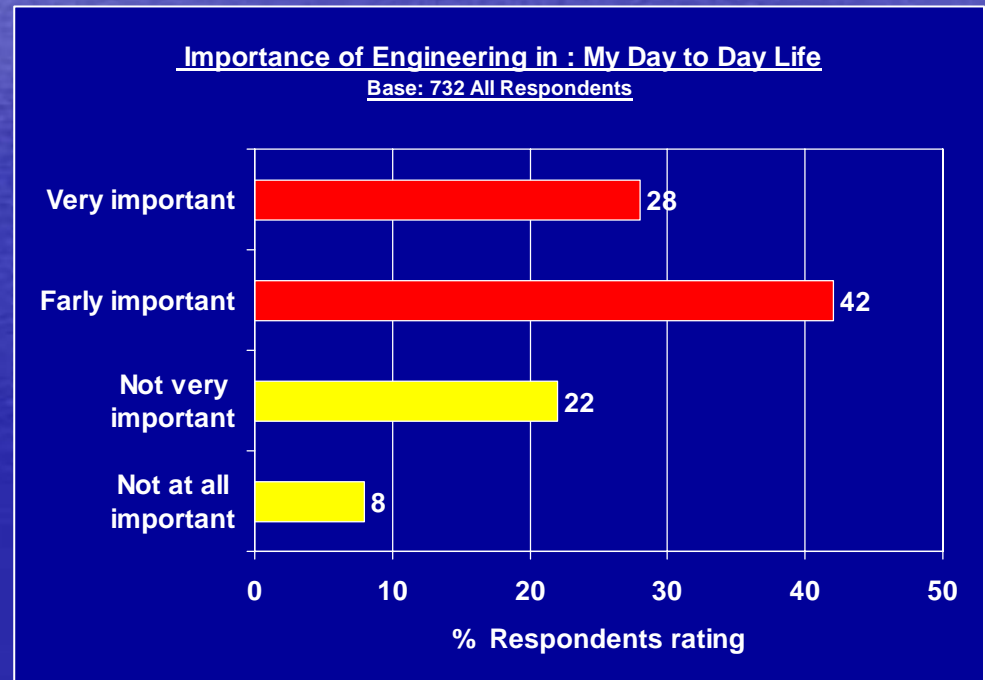
Importance of Engineering

- Whilst Engineering was seen as very important to a lot of activities within the world today, **Looking after the Environment** and **Health and Medicine** were seen by pupils as being much less important with only just over half rating these two activities as ones in which Engineering is seen as being important.



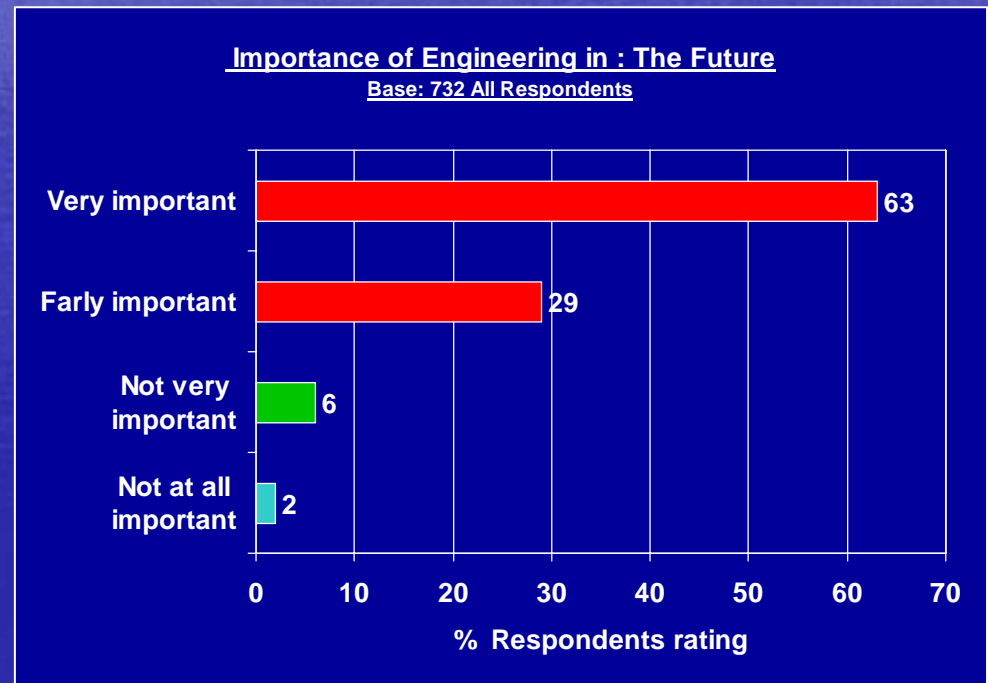
Importance of Engineering in My Day to Day Life

- Some 70% of pupils felt that Engineering was important to their day to day life.
- There were no real differences across ages, gender or school types



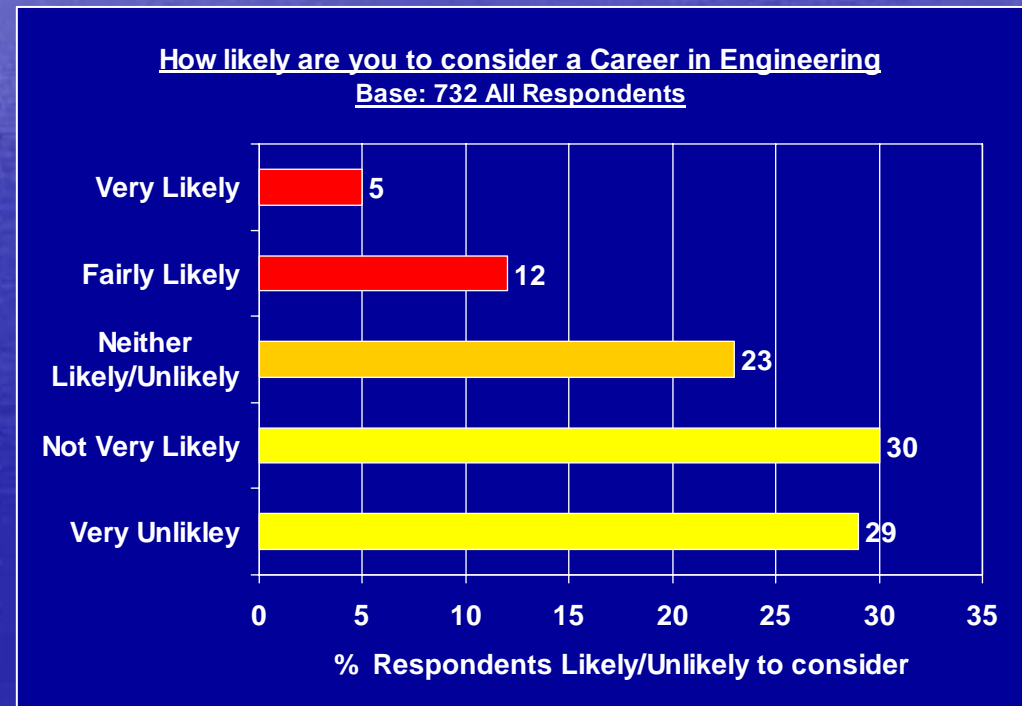
Importance of Engineering in The Future

- Clearly, all pupils felt that Engineering was important for the future (92% rating), with some 63% feeling that it was Very Important.



Likelihood of considering a career in Engineering

- 59% of pupils would not consider a career in Engineering, with only 17% saying they would be Very/Fairly likely.
- There is no real difference across school type.
- Boys are more likely than girls to consider an Engineering career as are year 9 pupils (21% likely vs 14% year 10).
- Greater knowledge about Engineering results in greater career interest, with 66% of those knowing a lot about Engineering considering a career.

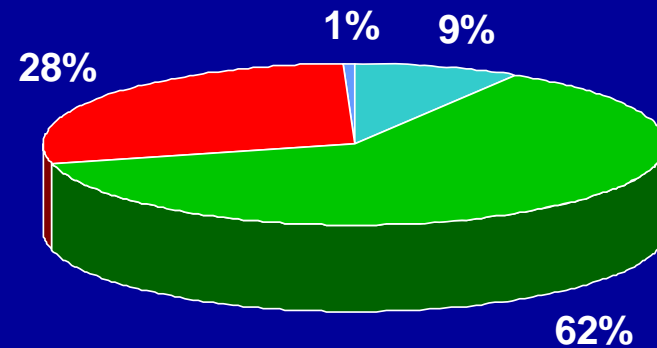


Knowledge of different types of jobs and careers in Engineering.

- Some 90% of pupils claim to know a little or nothing about jobs and careers in Engineering.
- There is no real difference across school type.
- A large number of girls, 39% , claim to Know Nothing about jobs and careers in Engineering (vs 16% boys).

How much do you know about the different types of jobs and careers in Engineering?

Base: 732 All respondents



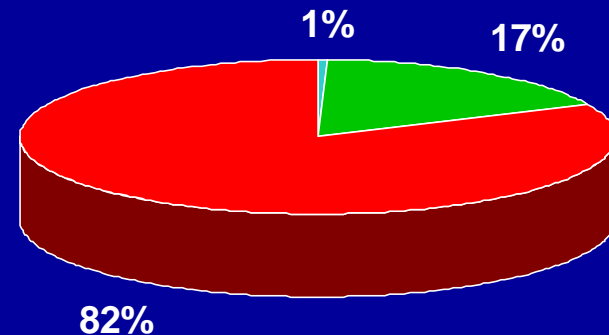
■ Know a lot ■ Know a little ■ Know nothing ■ N/A

Knowledge of the IET

- Only 17% claimed to know a little about the IET, with most, 82%, knowing nothing.
- Those who were considering a career in Engineering (40% Know a little about the IET) or Know a lot about Engineering (59% Know a little about the IET) scored somewhat higher.

How much do you know about the IET?

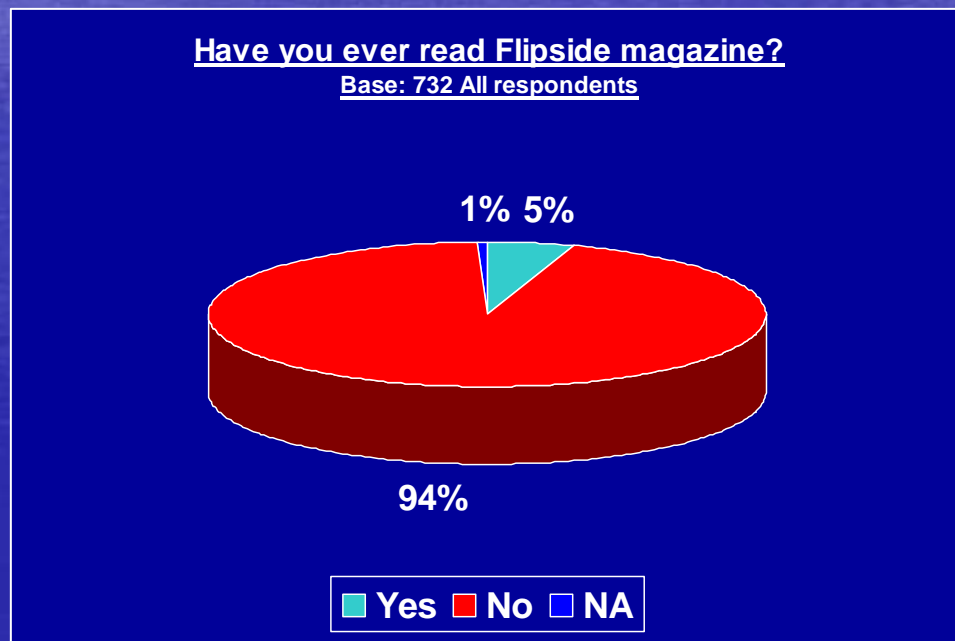
Base: 732 All respondents



■ Know a lot ■ Know a little ■ Know nothing

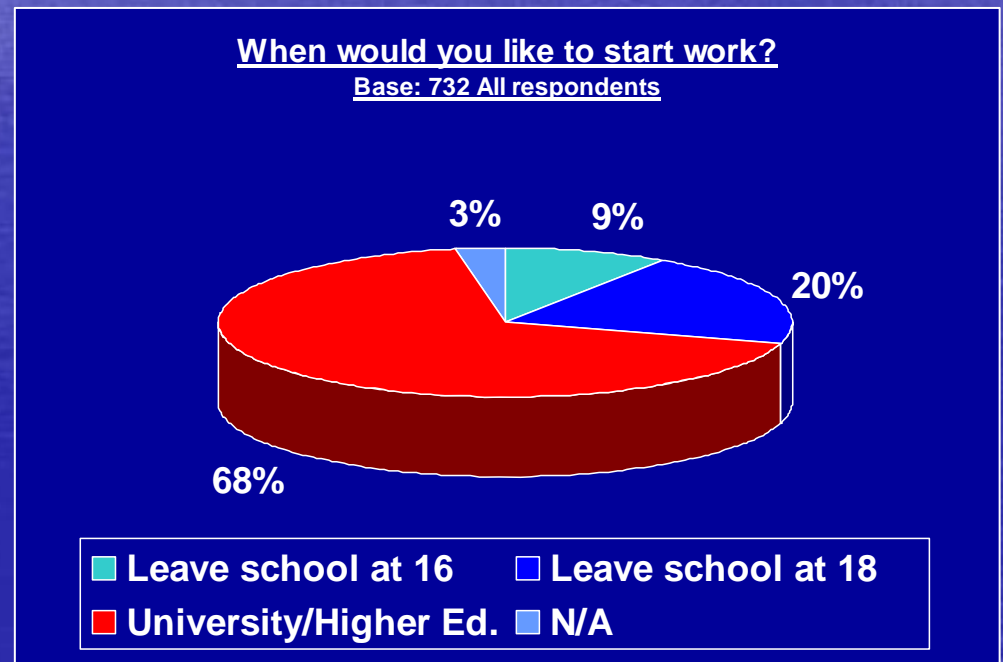
Readership of Flipside Magazine

- Very few pupils had ever read Flipside magazine, with only 5% claiming to have done so.



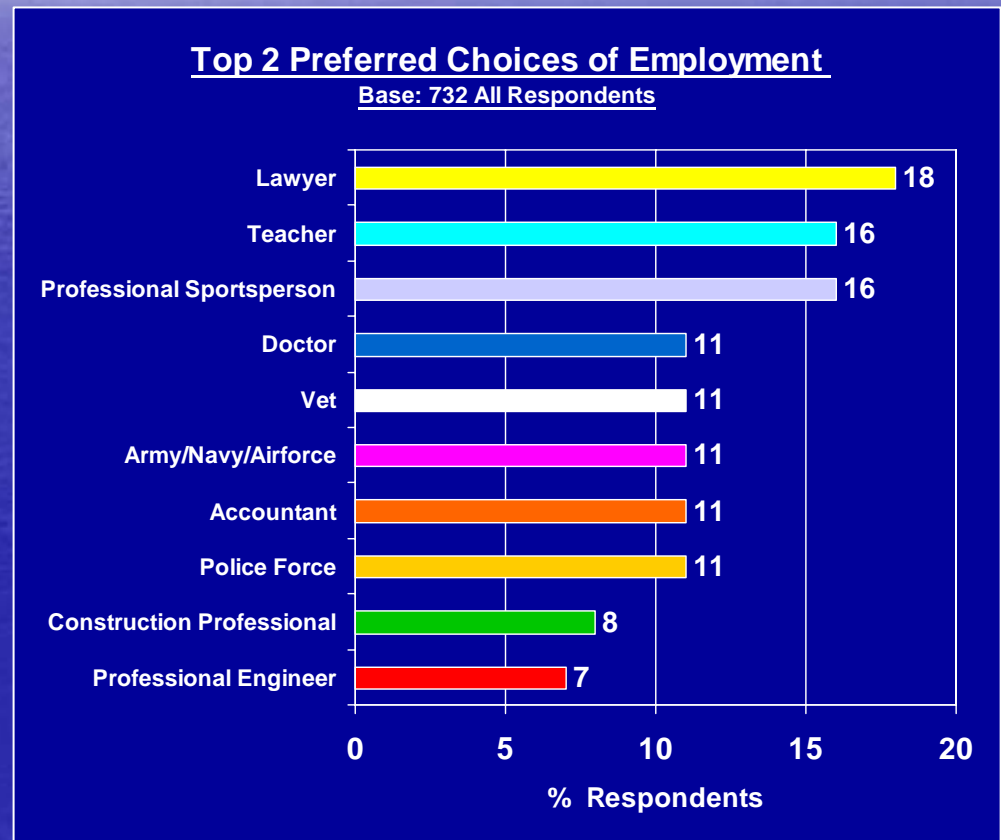
Intention to start work

- Most pupils were planning to go to University/Higher education prior to starting work (68%), with some 20% planning to leave school at 18 and 9% at 16.
- Some 31% of those interested in an Engineering career were planning not to go on to University /Higher education.



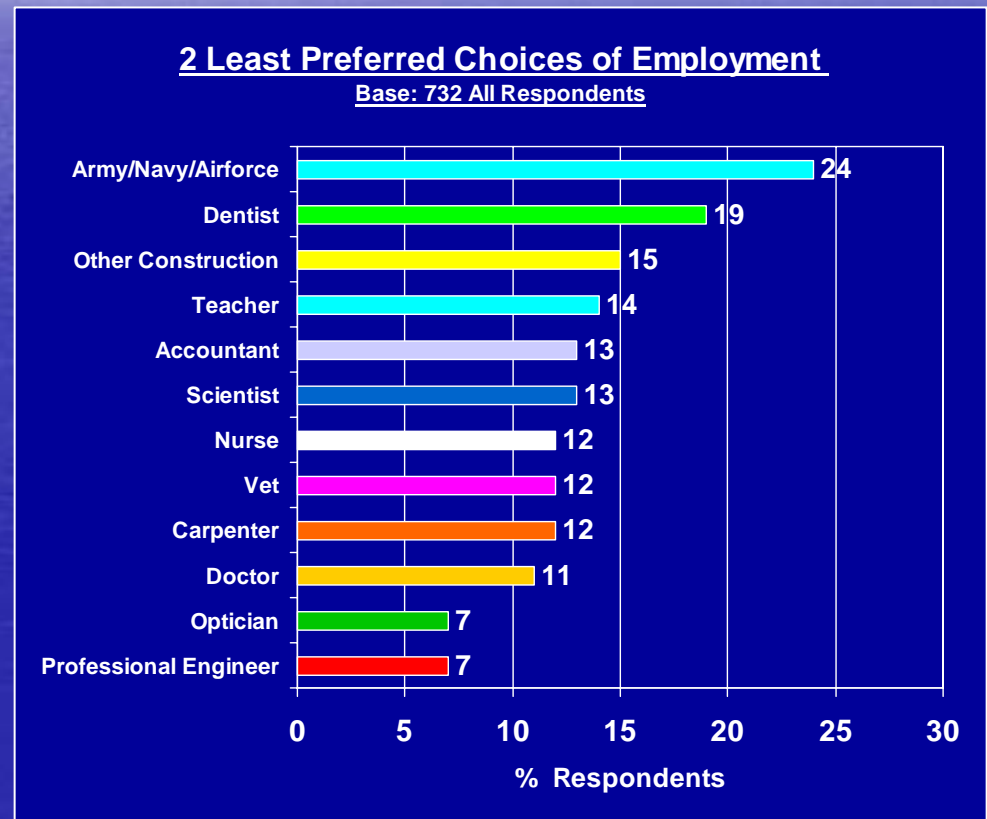
Top 2 Preferred Career choices

- Engineering was rated 11th vs other career choices, with only 7% choosing it.
- Lawyer, Teacher, Professional sportsperson were rated highest.
- No girl chose Engineering as one of her top 2 choices



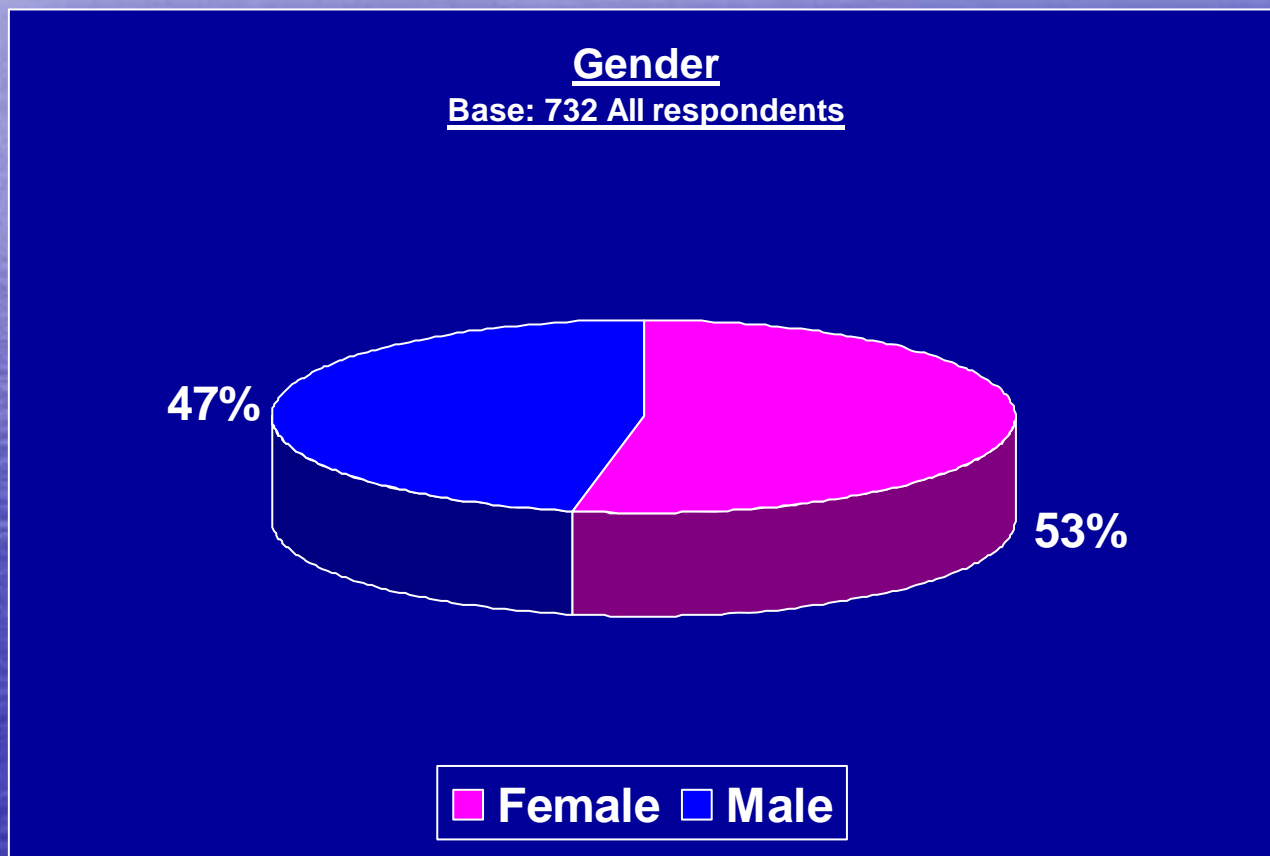
2 Least Preferred choices of employment

- Armed forces were rate as the least preferred choice by all pupils, followed by Dentist and Other Construction worker.

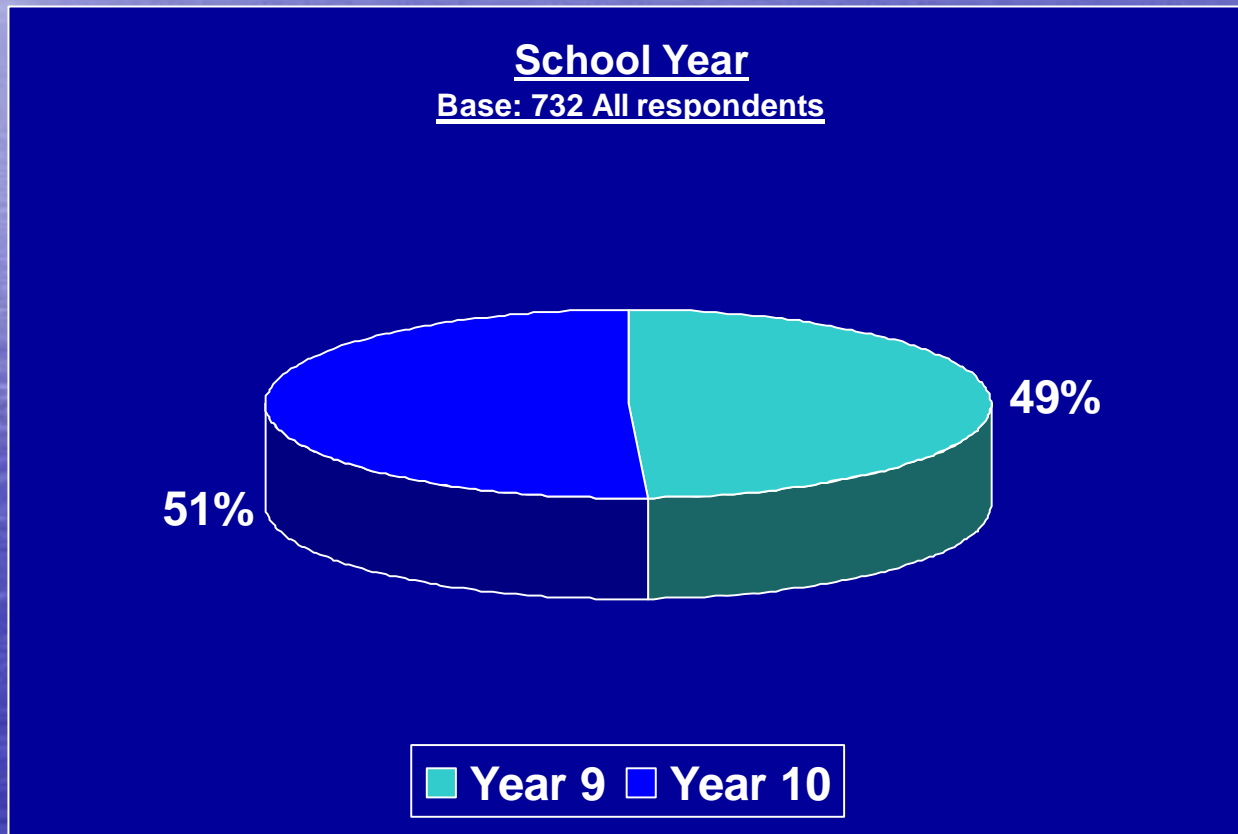


Sample Classification

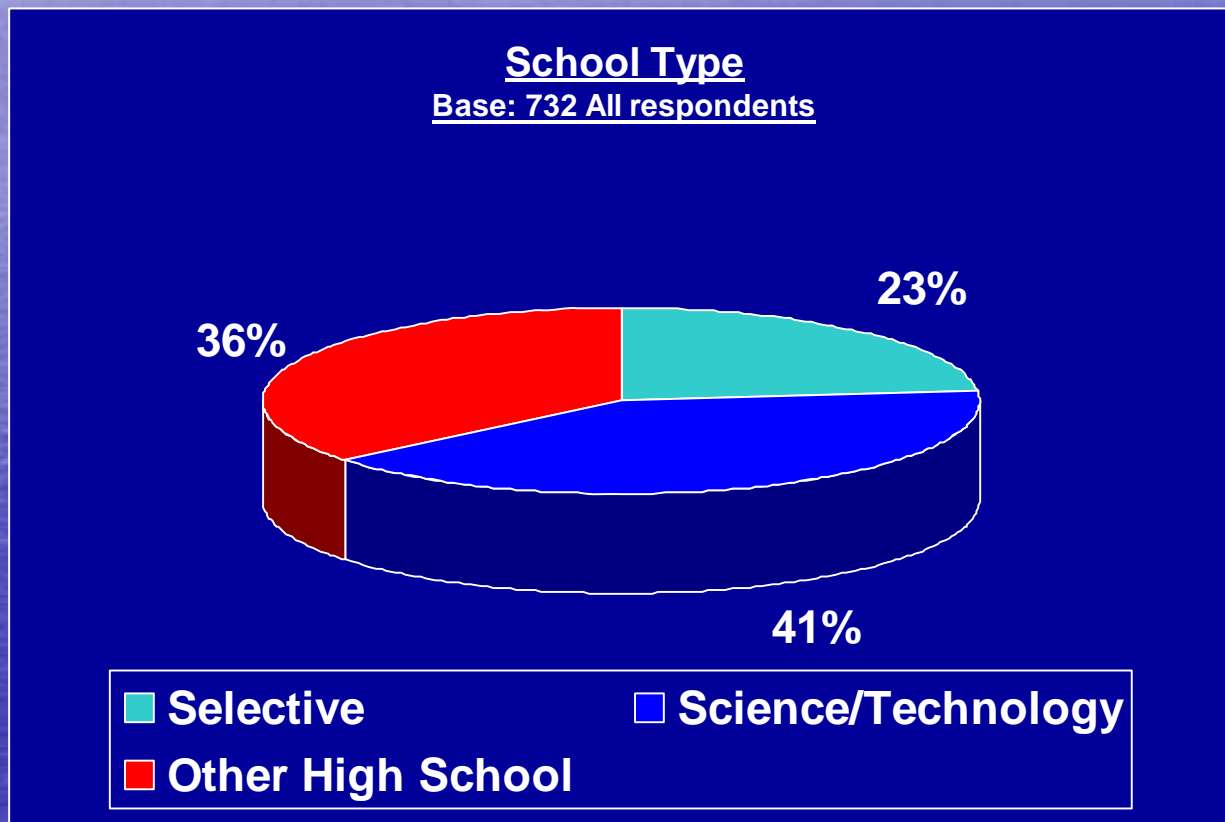
Classification: Gender



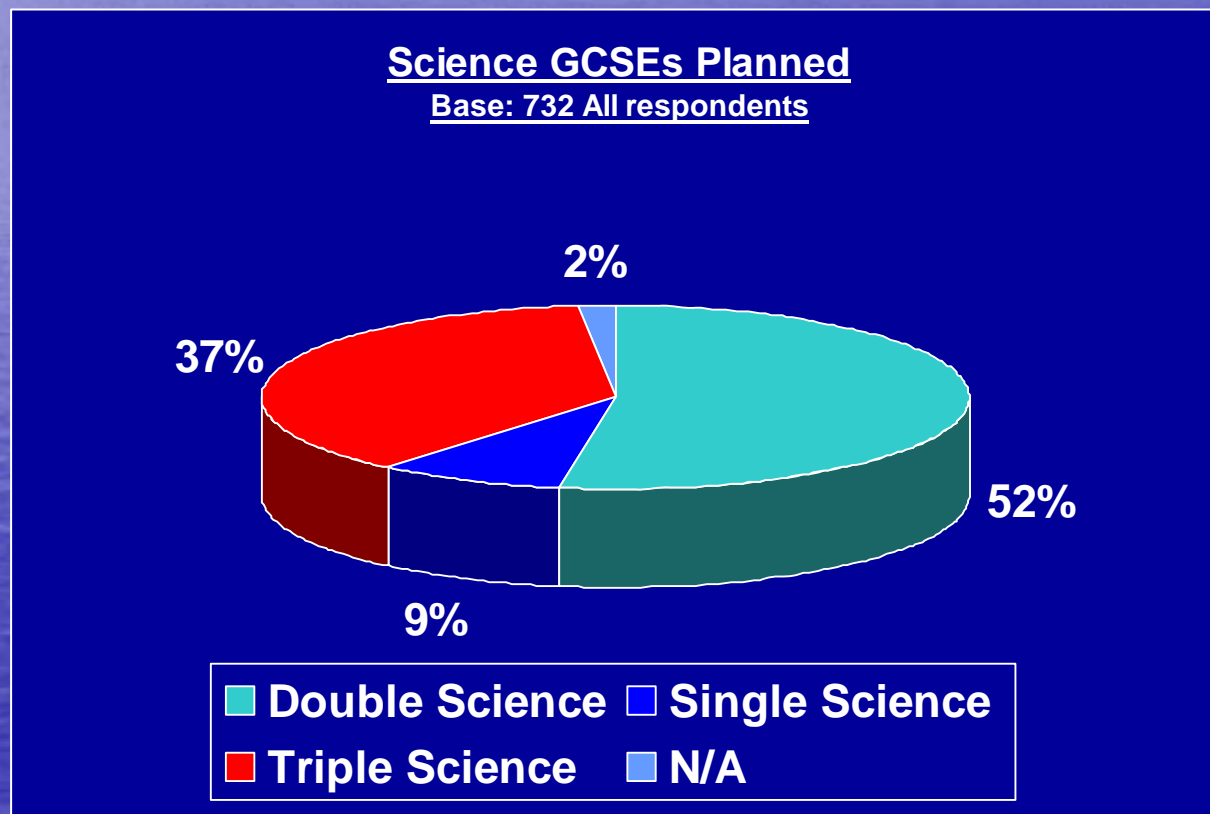
Classification: School Year



Classification: School type



Classification: Science GCSE's



Section : 3

Qualitative Focus Group Study

Key Findings:

Attitude towards lessons in general

- Pupils perceived the two main dynamics in relation to a popular subject or a highly rated lesson were:
 - Good Teacher
 - Large Practical component to the lesson
 - (Or a combination of both)

Attitude towards lessons in general

- Pupils were quick to criticise teachers who they perceived as not preparing adequately for lessons:

' A lazy teacher is one who just gets you to copy out from a book for the whole lesson'

- Subjects that have some relevance to real life were seen by pupils as more appealing:

' School should explain how science is useful to you in your life'

Attitude towards lessons in general

- Quality of teacher was very high on the list of factors influencing subject preference , particularly those teachers that employed more active participation in their lessons.

' It's better when you find out for yourself rather than just copy it from a book'

' It's more engaging when you are not just taking notes'

' Maths is great. She hasn't used the text book once this term. It's all maths games and quizzes and challenges'

Attitude towards Science lessons

- The greater incidence of practicals resulted in some science subjects being more popular than others:

*'We have more experiments in chemistry, it's self discovery'
'I'm looking forward to chemistry, you get a lot of practicals'*

'Not a lot of practicals in physics, lot of calculations, its very theoretical and difficult to do in the classroom'

Attitude towards Science lessons

- Physics was mentioned as the least preferred science subject by many pupils and this was similarly so across girls and boys as well as school type.
- More practical activities in class coupled with more obvious real life relevance helped to push the greater popularity of Chemistry and Biology.

'Anything with a big reaction'

'Good to see the nasty stuff from smoking'

Attitude towards Science lessons

- Outside speakers, fun experiments, educational games were all seen as important components of exciting and engaging science lessons. But it is more than just visual entertainment:

'Physics only becomes interesting when you can ask WHY things work'

'We had an outside company to do science experiments, but they didn't spend enough time explaining WHY things happened'

Attitude towards Science lessons

- A fair number of pupils criticised existing Science Video materials that were being used as educational entertainment or visual learning support on the basis that :
 - the physical presentation was often poor (Black and White, poor quality visuals)
 - Experiments shown seemed old fashioned and lacked relevance to pupils lives today

Some examples of Initiatives that are well received by Pupils

- **Outside Speakers** (eg Rockets, Forensics)
- **External Workshops** (eg Forensics)
- **Practical experiments**
(Blowing Jelly babies up, Dissection, Magnesium burning, Burning food re energy release, DNA out of a Kiwi fruit)
- **Group Experiments or Team challenges**
(Building Rockets- for some schools)

Continued....

Some examples of Initiatives that are well received by Pupils (continued)

- **More modern DVDs**, but with accompanying participation exercises or experiments (eg How volcanoes erupt)
- **Linking what they learn to real life** (eg The Body, Genes /Genetic illnesses, Cooking/Heat Exchange, Forensics, How everyday things work.)
- **Creating Classroom Posters** (Helps learning of key points)

Some examples of Initiatives that are well received by Pupils

- Schools that had provided additional extra curricular opportunities for pupils to engage with sciences to a greater degree were more likely to have more positive attitudes.
- Competitions were seen as fun to partake in but for less keen pupils needed to be part of the ongoing lesson rather than after school activity.
- Team activities vs other schools (County Chemistry Quiz), Engineering clubs (make a plane, transport and egg) tended to be referenced by pupils who were already keen on sciences as initiatives that worked well for them, rather than being attractive to the mass of pupils.

Some examples of Initiatives that are well received by Pupils

- Outside trips (eg Water treatment plants) were always welcomed by pupils, however not all schools were keen to run these activities that often.

As one pupil expressed it:

' When we can't go on an outside trip the school needs to bring the outside trip into the classroom.....'

Some examples of Initiatives that are well received by Pupils

- Outside of the school environment pupils mentioned Science based TV programmes such as CSI and Brainiac, as well as entertaining science publications such as Horrible Science magazine. These were all seen to be a more stimulating way of stimulating interest in the type of science that they saw as relevant and wanted to learn more about.
- Very few mentioned any science websites, although BBC Bitesize was referred to by some pupils as a site that they visited when a test was imminent, and thus they were helped to revise.

Careers Advice

- There is a lack of effective careers information for Engineering. Careers advice was often not dynamic enough in many schools, with pupils feeling that more involvement by subject teachers would be welcomed:

'All there is is a careers library'

'Teachers need to be able to give careers advice- they can see your strengths better than anyone'

Careers Advice

- Some pupils had conducted web based career options exercises via their schools, but often found that jobs and careers that were suggested were at too low a level relative to their own intentions for Higher Education and their ultimate aspirations.

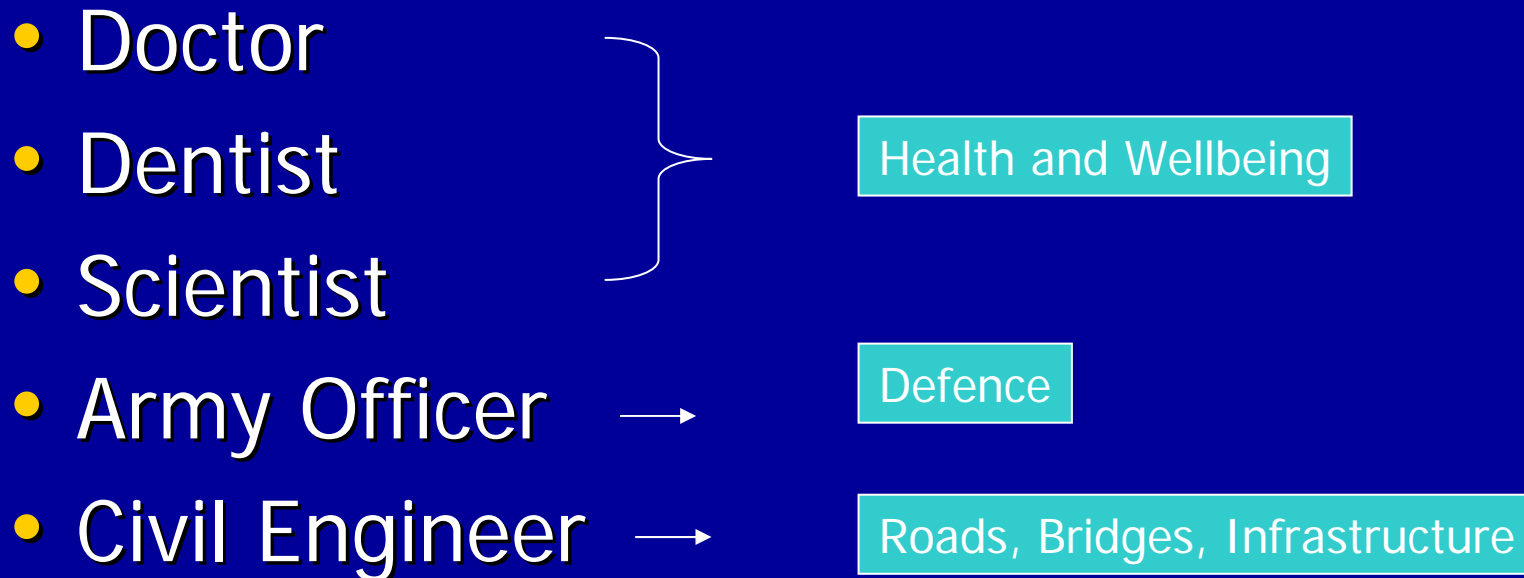
Careers Advice

- There were some pupils who because of their own further education aspirations, felt that specific careers advice was mostly irrelevant prior to the 6Th Form .
- What was needed was a general set of information prior to GCSEs to encourage pupils into sciences, for example, or to become stimulated by particular subjects. More focussed, directed advice and information on specific job roles could be given once A level courses had been undertaken.

Career Mapping

- In terms of value or worth to the community, Civil Engineering was highly rated alongside careers that focussed on Health such as Doctor/Dentist/Scientist and Defence (Army Officer).
- Other career options in Engineering tended to fall in the middle of the pack with some pupils not fully understanding the differences between various Engineering roles and some others associating certain roles with manual oriented work.
- The issue here is one about lack of knowledge about the types of careers available in Engineering.

Career Mapping: Worth to the Community



Highest Ranking Careers in terms of worth to the community

Career Mapping: Worth to the Community

- Journalist
- Designer
- Accountant
- Software Engineer

Lowest Ranking Careers in terms of worth to the community

Career Mapping

- In terms of salary levels Engineering , in all its forms, was generally rated low down relative to other career options .
- Careers in Finance and Health/Medicine were seen to be the highest paid.

Career Mapping

- Again, the issue here for Engineering is one of confusion regarding Creativity/Design vs Implementation with many pupils not recognising the higher status level of a Professional Engineer vs technical roles.
- More information about the types of careers and remuneration levels available in Engineering would be of great help in changing this perception over time.

Career Mapping: Salary Levels

- Scientist
- Doctor
- Solicitor
- Banker

Highest Ranking Careers in terms of Salary Levels

Career Mapping: Salary Levels

- Engineer (incl Chem, Civil, Electrical)
- Technologist
- Designer
- Journalist

Lowest Ranking Careers in terms of Salary Levels

Attitude towards Engineering

- Engineering is seen by pupils as important in the modern world, but pupils exhibited a lack of understanding of different roles and jobs within the profession.

'Tell us what an Engineer does, what kind of career it is'

'It's all about Construction, Building and Maintenance'

'Engineering is to do with tools and fixing things'

Attitude towards Engineering

- This lack of knowledge in what the profession really entails coupled with a perception that sciences are hard subjects and therefore Engineering must be very hard, all lead to a definite lack of confidence and interest in even considering a career for many pupils.
- Those who had relatives already in Engineering were much more expansive and knowledgeable when discussing potential career options and roles. Greater understanding of all aspects of a career in Engineering will lead to more confident career choices.

Attitude towards Engineering

- Girls tend to be less positive and less knowledgeable about engineering overall than boys, and for some, engineering had manual work connotations:

'An Engineer wears overalls, dirty clothes and a hard hat'

- Engineering still appears to be closely associated with Transport and Building, with many pupils finding it difficult to think beyond 'roads and bridges'.

Attitude towards Engineering

- Civil Engineering was perhaps the easiest branch for pupils to understand, with strong references to the infrastructure of the World about them being dependent on Civil Engineering. By comparison, it was difficult for most pupils to perceive Electrical Engineers as being more than Electricians and Software Engineers as being more deeply involved than simply designing Computer Games.
- Chemical Engineers were perceived to be involved in Health (Drug and Medicine development) for some pupils, and Mechanical Engineers were closely associated with Cars and Transport- but generally in the context of fixing rather than design.

Attitude towards Engineering

- When asked to spontaneously offer 3 words associated with Engineering, many pupils again tended to focus more on the implementation rather than the creative, problem solving or design side of a professional engineer's role, for example:
 - *Tools, machines*
 - *Fixing things*
 - *Construction*
 - *Technology*
 - *Building maintenance*
 - *Trains and Engines*

Attitude towards Engineering

- Some pupils who were more aware of Engineering through various science clubs or outside activities had a more positive view of the skill requirements of a professional Engineer. However, it is worth noting that across the sample of pupils in the discussions these types of comments were limited to only a few respondents:
 - *Creating*
 - *Solving Problems*
 - *Adapting*
 - *Finding Opportunities*

Image of a Typical Engineer

- Again, when asked to spontaneously describe a typical Engineer, for the majority of pupils a less than positive image often appeared:
 - Overall, dirty clothes
 - Hard Hat
 - Safety Specs
 - Man or a woman
 - Older
 - Person lying under his car
 - Would never be fashionable

Attitude towards Engineering

- Some of the more positive aspects that pupils would like to see communicated in the context of Engineering were:
 - Your chance to make your mark or leave your legacy on the World through your efforts.
 - Higher Salary levels
 - Importance and worth to the Community
 - Greater communication about the differences between various branches of Engineering
 - A typical Day in the Life of an Engineer
 - Younger, successful role models

Awareness of other Engineering Organisations

- Awareness and experience of other Engineering organisations was limited. Those pupils who had family connections were often more aware, or pupils who were members of Engineering clubs and had participated out of school.
- There was generally very limited awareness of the IET, although at least one school had visited Savoy Place in the last 12 months.

Awareness of other Engineering Organisations

- There was some residual awareness of the RAE and one or two (but no more) references to Smallpeice Trust. These were mostly from pupils who were heavily involved in their own school Engineering club and had competed at various competitive events in the South East and thus had greater knowledge and exposure to outside bodies.

Summary of upgrade areas for Science Lessons



How do Pupils want Sciences to be taught?

Summary of upgrade areas for Science Lessons

Science subject
Content



Real World Relevance



- Relevant to pupils lives
- Careers Info. (Day in Life, Remuneration, Roles and Importance)

What else do Pupils want to be taught?

Summary of upgrade areas for Science Lessons

Look and Feel



Modern and Approachable



- Modern Situations
- Use of outside speakers
- Younger Role Models

How should Science lessons look and feel?