

Student perceptions of the Impact of Science  
and Engineering Ambassadors

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## **ABSTRACT**

The Science and Engineering Ambassadors Programme (SEAs) is the flagship programme of STEMNET (Science, Technology, Engineering and Mathematics Network).

*“The Ambassadors are individuals from a wide variety of STEM (Science, Technology, Engineering and Mathematics) backgrounds. They offer their time and expertise to help schools inspire young people and to act as invaluable role models to students. Increasingly we see evidence that the real-life stories and experiences which Ambassadors share with students is what stimulate interest and generate inquiry amongst their audience” (SETNET Eastern Brochure 2006. P.17)*

My research attempted to find hard evidence to test this claim and, unlike other studies it focused on student perceptions of the programme. The research consisted of a series of case studies involving visits to schools to interview students who had been involved with SEAs directly or indirectly, with some observation. I also interviewed ambassadors, including those involved in student mentoring and relevant school staff. Interviews of county SETPOINT co-ordinators in the eastern region, who had the role of ensuring the programme ran, gave the background to the work being done in schools

I found evidence that ambassadors were having a significant positive effect on student motivation and enthusiasm for STEM subjects and that their presence was enhancing learning. The role of the ambassadors in the learning process varied according to the model of delivery used. I found limited evidence of the scheme having any influence over career or option choices. I found that SETPOINTS acted as initiators and trainers but that schools took the responsibility for day to day organisation and evaluation.

The study identified factors which aided successful SEAs programmes and also those which may have hampered them, and although I restricted my study to one region, there may be elements of transferability in the findings that will be useful to the programme’s national future.

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Candidate's Declaration.

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this, or any other university, for a degree and does not incorporate any material submitted for a degree.

Signed:

(David J Cowley)

Date:

# CHAPTER 1

## Introduction

### The Science and Engineering Ambassadors Programme

The Science and Engineering Ambassadors Programme (SEAs) is the flagship programme of STEMNET (Science, Technology, Engineering and Mathematics Network). STEMNET was previously known as SETNET (Science, Engineering and Technology Network). For further explanation of acronyms see appendix 1, page 182.

STEMNET aims to encourage more young people in the UK to make a choice to enter science, technology, engineering and mathematics (STEM) related careers at all levels, and future generations are properly informed about the science and technology that surrounds them.

With the support of its partners, STEMNET achieves this in two ways:

- Ensuring that all young people, regardless of background, are encouraged to understand the excitement and importance of science, technology, engineering and mathematics in their lives, and the career opportunities to which the STEM subjects can lead;
- Helping all schools and colleges across the UK understand the range of STEM Enhancement & Enrichment opportunities available to them and the benefits these can bring to everyone involved;
- Encouraging business, organisations and individuals wanting to support young people in STEM to target their efforts and resources in a way that will deliver the best results for them and young people.

([www.stemnet.org.uk](http://www.stemnet.org.uk). 2009.)

STEMNET has received funding from the Department of Trade and Industry since 1996 and now continues to enjoy support from the DIUS (Department of Innovation, Universities and Skills) and DCSF (Department of Children, Schools and Families) since then. As a national organisation, it works hard to ensure that no region of the country is disadvantaged, by comparison with any other, with respect to STEM opportunities.

STEMNET's vision, in 2008, was:

*A society, where young people, regardless of background, recognise the contribution of Science, Technology, Engineering and Maths (STEM) to their lives and more are choosing to pursue STEM qualifications and careers. “* ([www.stemnet.org.uk](http://www.stemnet.org.uk) 2008)

#### Who are the ambassadors?

*“The Ambassadors are individuals from a wide variety of STEM (Science, Technology, Engineering and Mathematics) backgrounds. They offer their time and expertise to help schools inspire young people and to act as invaluable role models to students. Increasingly we see evidence that the real-life stories and experiences which Ambassadors share with students is what stimulate interest and generate inquiry amongst their audience”* (SETNET Eastern Brochure 2006. P.17)

#### Personal Background

I had a background in education having taught in secondary schools for over thirty years and spent much of those searching for the answer to the question, ‘what motivates my students’. I had also been involved with education-industry liaison generally and with Education Business Partnerships in particular. Enterprise activities and work experience programmes had been part of my brief for many years and the interaction of a school with the community in which it is situated had been a long term professional interest. As a mathematics teacher I was constantly answering the question, what is the point? The desire to make mathematics either applied or applicable was a recurring theme in my curriculum and lesson design.

In my role as Professional Officer for the Association of Teachers of Mathematics I had been involved in many discussions with engineers and other employers about the perceived lack of quality and, even more crucial, quantity of applied mathematicians available for United Kingdom industry. Was this a perception based on anecdotal evidence or was there a firm foundation for this point of view? This was an important topic as the Science and Engineering Ambassadors' programme's aims, if achieved, would have a positive impact on the motivation of students in the areas of science, technology, engineering and mathematical education as well as, in the longer term, an influence on the skills and motivation of the workforce available to the United Kingdom economy as it faces the challenges of the twenty-first century. An element of my role was to deliver regional road shows for BECTA (The British Educational and Communications Technology Agency) entitled 'Embedding ICT into Mathematics'. A key part of my organisational strategy was to involve SETNET co-ordinators and the regional co-ordinator of the Eastern region was amongst those. She was particularly keen to ensure that the M in STEMNET (Science, Technology, Engineering and Mathematics Network) was given equality with the STE and we shared this aim.

On November 14<sup>th</sup> 2006 I was invited to the Science Learning Centre for the East of England for an event celebrating work done by schools involved with Science and Engineering Ambassadors and read the claim quoted in the opening of this introduction. I discussed this with the Eastern regional co-ordinator for SETNET and a representative from the Department of Trade and Industry (DTI) and they suggested that I considered investigating this claim. Further to my initial discussion with the STEMNET co-ordinator I wanted to search for evidence to test the claims made about its value. What was the justification for this programme? Was it making a difference? Could it be improved? These were key questions that underpinned my research aims.

## The Scope of the study

After a follow up meeting with both the regional co-ordinator and the national programme director for SETNET in April 2007, the purpose of the study was clarified enabling the organisation to benefit from the knowledge I would accrue. I produced both an interim appraisal of findings to date in December 2007 and forwarded key findings and recommendations to them in early 2009.

I had to limit my research geographically as the ambassadors' scheme was national, with over one thousand companies involved. As I had been initially invited to enter into this field of study by the Eastern Regional co-ordinator, I felt that suitably defined the geographical boundaries for my study. I also had to limit my study in age range and decided that my expertise was in secondary and it was those students I would find it most profitable to interview as well as that being where my interest lay. I also felt that it was the key period of student maturation to look at how any career intentions had been influenced. Finally, a study at secondary level could more easily be extrapolated into primary or tertiary sectors if required.

I also realised that I did not have the resources to carry out the type of longitudinal study that would be necessary for me to make any comments about students' achievement or attainment so I was specifically looking at attitudes and perceptions of students.

## Aims and research questions

I set out with the following aims and associated research questions:

1. **To investigate the impact of the ambassadors, both directly and indirectly, on students' perceptions of their learning.** *Is learning enhanced (added value) by the presence of the ambassadors in the classroom/laboratory?*
2. **To critically analyse the roles played by these industrialists in the education of young people.** *What role do industrial visitors play in the learning process? Are they teachers per se?*

3. **To investigate whether the work of the ambassadors was influential in the students' option choices and/or achievement at 14 and post 16.** *Does the work of the ambassadors inspire the young people with whom they work to take the subject(s) to a higher/further level of study?*
4. **To evaluate the role of the brokers, that is the schools and SETNET.** *What is the role of the brokers in assuring quality learning experiences for the students?*

How these aims emerged is detailed in my literature review.

Three sub aims emerged at later stages, through my pilot study and my interviews with county SETPOINT co-ordinators. They were

- To identify factors that contributed to successful ambassador programmes.
- To investigate the variety of models of practice that existed and to make an attempt to analyse their different impacts on students.
- Who and what were ambassadors?

#### Thesis summary and data set.

This thesis is based on research done in 2008 consisting of interviews with students, staff and ambassadors at secondary schools in the eastern region of England. I also interviewed the county SETPOINT co-ordinators or the person responsible for implementing the scheme in the county. On the basis of the data collected during these interviews I was able to interrogate the claim made by STEMNET for the Science and Engineering Ambassadors' scheme and look in broader terms at its impact on student motivation and attitude.

My research took place in five schools in the eastern region, as well as visiting county co-ordinators at their offices and some ambassadors in their place of work. In total I had face to face interviews with 42 students, 5 county SETPOINT co-ordinators, 11 ambassadors and 10 school staff. There was also an e-mail response

from another ambassador making a total of 69 people contributing to my data collection (See page 97 for full breakdown). The fact that the majority were students reflected my emphasis on making students' views the key element in my data collection.

## CHAPTER 2

### Education and Engineering in an Historical and Economic Context

#### The historical development of engineering

In order that the importance of engineering to the development of society is understood, a brief look at its development in the United Kingdom is needed.

*The name “engineer” originated in the eleventh century from the Latin ingeniator, meaning one with ingenium, the ingenious one. The name, used for builders of ingenious fortifications or makers of ingenious devices, was closely related to the notion of ingenuity, which was captured in the old meaning of “engine” until the word was taken over by steam engines and its like. Leonardo da Vinci bore the official title of Ingenere Generale.*

*([www.wikipedia.com](http://www.wikipedia.com) 2008)*

Schama (2002) put engineering into the context of the industrial and economic history of Great Britain. In the first Industrial Revolution from the eighteenth through early nineteenth century, civil and mechanical engineers changed from practical artists to scientific professionals. It is this period that led to Britain’s industrial wealth and dominance. Prince Albert, consort to Queen Victoria, was a passionate supporter of the application of arts and science to the manufacturing industry. The Society of Arts, of which he was President, held annual exhibitions, which, in 1851, developed into the Great Exhibition. His efforts to promote it were key factors in its success. It made a profit of £186,000 and from this sum land was bought in South Kensington on which was built such august institutions as the Victoria and Albert Museum, the Science Museum and Imperial College of Science and Technology. Indeed this area of London is known, by some, as Albertopolis. This was a very positive step forward in enhancing the country’s

training for scientists and engineers and to this day, Imperial College of Science and Technology is renowned for high quality education in these fields.

During the second industrial revolution, acknowledged to be from around 1850 to the start of World War II, chemical, electrical, and other science-based engineering branches developed electricity, telecommunications, cars, airplanes, and mass production. The information revolution of the late twentieth century, continuing to the present day sees the specialist fields of microelectronics, computers and telecommunications jointly extending the boundaries of information technology.

The historical importance of engineers to the economic development of the United Kingdom can be seen in our environment. The great bridges across the Firth of Forth; the Menai Straits; the Severn and the Thames contributed to increased speed of transport for goods and people as did the important tunnels such as that under the Mersey, Thames and, latterly, the Channel. The London Underground system continues to make a major contribution to the economic wealth of the capital.

Nautical engineers enabled Britain to trade efficiently across the world and the development of machines in the textile industries put us at the forefront of the world economy. At home engineers ensured we had readily available power sources and a standard of living that was the envy of the world.

Despite the importance of engineering In 2008 there were serious doubts about the recruitment of future engineers.

*“The engineering sector is facing serious recruitment problems in the UK, with a lack of fresh talent entering the industry. Engineering consultancy, Haden Freeman Ltd (HFL), has recently been forced to look outside of the UK for qualified engineers. Due to the shortfall of engineers in the UK, engineering companies across the nation are faced with a significant problem to find skilled employees. Last year, a survey by the Institution of Engineering and Technology (IET) found that no less than 40 percent of UK companies believed that they were almost certain not to be*

*able to recruit the necessary number of engineers or technicians to meet their needs between now and 2010.”* ([www.engineerlive.com](http://www.engineerlive.com). 2008)

ACE (The Association for Consultancy in Engineering) chief executive Nelson Ogunshakin commented in 2008:

*"Immediate action is needed if we are to solve the engineering skills crisis. Our recent investigation shows that there are today 20,000 unfilled vacancies in the consultancy and engineering sector alone. We will be highlighting this and a range of other issues in our response to the committee's inquiry."*

([www.cellularnews.com](http://www.cellularnews.com). 2008)

and continued,

*"This is fundamentally about education and about the numbers of suitably qualified engineering graduates coming through our universities, of which at present there simply are not enough. As trainee teachers are attracted to study through the waiving of fees, so engineers should be provided with similar incentives. Many of the record numbers of graduates coming out of our universities cannot find work. We must find a way to divert our human resources to where they are most needed,"* (op cit)

In 2008 Sir James Dyson lamented the decline of engineering in our schools and pleads that measures are taken to stop the,

*"...gravitation of young people towards philosophy, sociology and media studies."* (The Times. 21/1/2008. Page 48)

The same article quoted leading industry figures backing Dyson's call. They included Sir John Cridland (Deputy Director of the CBI), Martin Temple (Chairman of the Engineering Employers' Federation), David Delpy (Chief Executive of the Engineering and Physical Sciences Research Council) and Sir Alan Jones (Chairman of SEMTA, the sector skills council for Science, Engineering and Manufacturing Technologies).

So, a nation that became wealthy through engineers and scientists combining with explorers and entrepreneurs to exploit natural resources around the world, was now short of the workforce to compete on level terms with emerging economies such as China and India. The nation that produced Brunel, Stephenson, Watt, Whittle, Dyson and many others whose inventions have changed the world in which we live now looks to many countries with envy at their pool of trained engineers.

But was the shortage of engineers just an historical development in the light of increasing competition, or are there other reasons present in our society today? I hoped to shed some light on the attitude of the present generation of young people to engineering, technology and science.

So how, in just over one hundred years had we gone from a position of dominance, where engineers such as Brunel, Telford and the Stephensons, were seen as national heroes, to a situation where we are short of engineers, who have a much lower social status, and we face increasing global competition in all aspects of manufacturing? I examine some of the possible explanations.

The first explanation for this is placed in historical context by Schama (2002) who hinted that at the beginning of the end of British Industrial dominance and places it at the end of the nineteenth century. The reason for decline was the same one that restricts the economy today, that of overseas competition. By the end of the nineteenth century countries such as the United States and Germany, once massive importers of British goods, were now competitors and, in another pre-echo of twenty first century economic-political activity, they were protecting themselves by their own tariffs. Britain had two options, introduce its own system of tariffs or legislate to protect its own industrialists by reducing the unit cost of their products. The latter, which many industrialists instigated without government intervention, inevitably brought conflict with trade unions. Some of the bitterest labour disputes ever occurred in this period. The seven month lock out of members of the Amalgamated Society of Engineers in 1897 ended in a humiliating return to work on the employers' term and the great London dock strike of 1889 did little to avert

Britain's industrial decline, in the face of concerted overseas competition. (It did, however, lead to the formation of the Labour Party in 1900.) The nineteenth century saw the decline in the status of engineering as a profession as the British manufacturing industry declined in the face of severe competition from other countries.

The two world wars of the twentieth century focused British Industry into a common effort but the post 1945 era saw the country dominate in one area only, as the centre of world finance. (Schama, 2002. P.414) The economic dilemma to keep the country as both a substantial military power and a fully funded welfare state brought conflict between unions and management which was to be a feature of British industry throughout the 1960's and 1970's. This helped to further denigrate the status of engineering and professional status is a key issue in supply for the labour market.

In 1963, Harold Wilson, then leader of Her Majesty's Opposition, committed the Labour Party to the furtherance of science and technology in the pursuit of national economic prosperity. His speech to the Labour Party Conference on 1<sup>st</sup> October that year included the famous, yet often misquoted, phrase,

*"The Britain that is going to be forged in the white heat of this revolution will be no place for restrictive practices or for outdated methods on either side of industry."* (Labour Party Conference, 1963)

He was clearly aware of the issues that the profession faced. Wilson became Prime Minister in 1964 and held that position until 1970 and again from 1974 until 1976 when he was succeeded in both positions by James Callaghan. So a political party established at a time of industrial decline was now committed to the reversal of a perceived continuation of that decline and, more fundamentally to my study, the place of education within it.

## The start of the 'Great Debate'

In many ways the starting point for the most recent vocational education lobby was Prime Minister James Callaghan's speech at Ruskin College on 18<sup>th</sup> October 1976, which started the 'Great Debate' on education. In that speech he connected wealth and industry with high standards of living and the need for good quality education.

This brought a supportive response from industry including this extract from a report called Education and Management from the British Institute of Management in 1979.

*"Everyone – and particularly those actually working in industry and industry related jobs, and those guiding the attitudes of the young people - should understand at least the reasons for the existence of industry and the essential contribution it makes to the national wealth and therefore to the quality of life in our society." (P.2)*

What was the historical context of the Great Debate initiated by Callaghan in 1976? Vocational elements have always been part of formal education, indeed in its primitive state it would have been aimed at securing survival and included hunting, fishing and survival techniques. Philosophical aspects were soon to gain importance and the bipolar nature of education into liberal and vocational was well established even by the time of Aristotle. He noted,

*"...there are opposing views about the practice of education. There is no general agreement about what the young man should learn..."*

(Aristotle. Translated by Sinclair. 1972. P.300)

The values of education in England are derived mainly from Christianity and a vocation originally associated with a way of living or sphere of activity to which one has been called by God. Early education for women also had a specifically vocational purpose as, *"Nuns were recruited from the daughters and widows of noble families and they provided education for girls of this class."* (Lawson and Silver.1978.p.14)

However, formal institutional education was exceptional and restricted to a small minority of the population during medieval times with most education being vocational or 'on the job' training. The Renaissance and Reformation influenced the development of formal education through what we call the Revival of Learning. Although the studies of the classics became an essential foundation for professional training the vocational aspects of education were not lost. The early seventeenth century saw a reaction to the narrow curriculum and Milton, influenced by Hartlib, the focus of the reforming movement, wrote, in 1644,

*"... a complete and generous education is that it fits a man to perform justly, skilfully, and magnanimously all the offices, both private and public, of peace and war"* (p.4).

This is, taken at face value, a true vocational ideal but commentators, including Curtis and Boulwood (1962) suggest his work as a whole does not reflect this principle. Hartlib and Milton's contemporary, William Petty, advocated formal education for all children aged 7 or over including craft instruction in workshops that would be self-supporting from the sale of the products of the students' labours. He too was eloquent about the benefits of such an education,

*"...for hereby it hath come to pass that many are holding the plough which might have been made fit to steer the state."* (Petty quoted in Quick (1929). P. 210)

Dury's Reformed School, founded in 1650, provided education for those between 8 and 20 and contained an increasingly vocational element as students progressed. After the Restoration in 1660 the curriculum drifted towards its classical academic roots despite exhortations from famous scientists such as Sir Isaac Newton and Robert Boyle such that Webster (1971) concluded in his work on education in this era,

*"England advanced towards the technological age with a population ill-equipped to take the fullest advantage of its resources"* (P.34)

Over three centuries after this, contemporary scientists such as Dyson had similar sentiments. The essence is that 300 years of opportunity passed with a combination of initiative and inaction and the result was that the country's leading scientists continued to express similar concerns.

With a few notable exceptions such as the Dissenting Academies, the general pattern of education in the remainder of the seventeenth and the eighteenth centuries remained narrow and restricted. Indeed, as Coffey (1992) points out

*"...it was from the Scottish educational environment, not the English, that two of the most important inventions of the Industrial Revolution emerged." (p.22)*

He was referring to James Watt's work to enable steam engines to be used in factories and John Roebuck's work to mass produce the acid vitriol used in bleach for linen.

It must be remembered that, in this period, a sizeable proportion of children either never attended school, attended very irregularly or left age 10 or 11. Education was not considered as vocationally important for the children of the poorer families and not for girls at all. The picture of English education in the first part of the nineteenth century was one of precarious public schools with narrow curricula, poor academic results, widespread bullying and poor food with the resultant decreasing numbers whilst education for the poor remained patchy.

The Grammar Schools Act of 1840 did little to change the curriculum at the majority of public schools although some of the schools founded at this time including Cheltenham, Marlborough, Wellington, Bradford, Haileybury, Clifton, the City of London School and King's College School were more progressive in their preparation of students for adult working life. There was some debate about the introduction of scientific studies to the curriculum with the likes of Charles Darwin, Thomas Arnold and Herbert Spencer to the fore in encouraging an extension of the teaching of science. Another prominent literary figure of the time was John Ruskin who, although believing in education being an end in itself,

*“...had a practical attitude towards vocational education: he wanted to recapture the pride in manual skills that he regarded as having been lost in the Industrial Revolution.”* (Curtis and Boulwood. Op cit. p. 154)

How appropriate that the college named after Ruskin should see the start of another great educational debate in 1976.

I have already referred to the impact of the Great Exhibition of 1851 and Prince Albert’s leading role. The Paris Exhibition of 1867 further highlighted the deficiencies in the English educational system.

*“...the Industrial Exhibition in Paris in 1867 furnished further evidence of a decline in the superiority of certain branches of English manufacture...this decline was partly due to a want of technical education in England.”*

(Report of the Schools Inquiry Commission. 1868. P.116)

This report and the resulting Select Committee (the first Samuelson Committee) stressed the need for the provision of technical education with an emphasis on science for the lower levels of the labour force and the developing competition from America and Europe would provide the most powerful impetus yet for a reform of the educational system.

What actually happened was far from revolutionary. The City and Guilds of London Institute for the Advancement of Technical Education was formed in 1880 with the task of encouraging the teaching of Applied Science. The second Samuelson Committee published a report in 1884 with a similar position as their first and the Technical Instruction Act of 1889 gave local authorities the power to provide money from a tax on spirits diverted for that purpose.

The Cross Commission (1888) and the Bryce Report (1895) both attempted to give structure to the secondary education system including technical tuition as an integral part.

*“There was a growing consensus that education needed to respond much more explicitly to economic demand.”* (Coffey op.cit. p.60)

The 1902 Education Act introduced the embryo of a co-ordinated education system and did increase opportunity for children from poor families to progress to higher education and included the need for education to respond to economic needs as a theme. However, the classics remained dominant and Robert Morant, of the Department of Education, took most of the blame for his contempt for the abilities of ordinary people.

Academics continued to argue with such as Dewey, Findlay and Adams supporting the expansion of vocational education, but school policies were not in their hands and did not always reflect their views. The fact that it was a continuing debate was illustrated in 1926 by Bertrand Russell.

*“The real issue is: should we, in education, aim at filling the mind with knowledge which has direct practical utility, or should we try to give our pupils mental possessions which are good on their own account?”* (Russell. 1926. P.137)

That the debate had passed into the hands of philosophers proved its longevity and that Newton, Boyle, Darwin et al had had less effect on policy than they would have hoped.

*“A vocational bias in the curriculum and explicit skills training for occupations appeared, however, in less prestigious secondary schools and in particular in institutions of a technical nature.”* (Coffey. Op.cit. p.153)

In summary, vocational and practical subjects had not toppled the ‘academic’ or ‘pure’ subjects from their position at the top of the priority list. The responsibility for this has to be shared between Universities, Head teachers, Government and others in the establishment aiming to protect the status quo for a variety of reasons. Sir Richard Livingstone (1944) was amongst the advocates for the place of vocational elements in education but the Education Act of the same year failed to address the issue.

In 1956 a White Paper entitled *Technical Education* again emphasised the challenge to our system presented by advances in technical education in America, Russia and Western Europe. The response was that the Minister of Education asked

the Central Advisory Council for Education to look at the changing needs of our society with relation to education. The resultant Crowther Report (1959.) merely paraphrased Bertrand Russell's words from 33 years previously.

*"...education could be regarded in two ways - either as a duty that the State owes to its citizens...or as a means of increasing the economic efficiency of the whole community..." (preface. P.xxvii)*

In the next twenty years the debate focused on higher education, with secondary education continuing to reflect traditional priorities. As late as the end of the 1960's the Universities of Oxford and Cambridge were requiring GCE Latin as an entrance requirement and grammar schools had little or no vocational element in their education. My own experience of grammar school education in the late nineteen-sixties gave me an opportunity to study 'woodwork' but at 14 I had to choose between that and Geography.

So a debate had started prior to the fourth century BC and was continuing, yet scientists from Aristotle to Newton and Darwin to Dyson et al continued to express their concerns about the purpose and nature of education. As James Callaghan rose to his feet in Ruskin College in 1976 were things about to change?

#### Liberal education under the microscope

If I was investigating claims of the value of involving industrialists in the educational process then was there a counter argument, similar to Pring's (1995) concerns about the threat to liberal education. Was there an argument for education in isolation from employment? Was the claim of society that education must contribute towards economic prosperity a valid one? Even if it was, how direct should that contribution be?

It is his chapter on educational aims and values that cut to key issues related to my research. The purpose of education was examined and Pring suggested that there were three categories of answer.

1. One might point to the benefits which educational activity can bring. A better job for the individual or a better workforce for society
2. The aim being to learn, to acquire knowledge, skills and understanding.
3. The aim is to learn those things that are valued and which constitute a valued form of life.

His argument then explored liberal education in all its meanings. He cautioned about judging young people as unimportant if they are unable to succeed academically. He did, however, support a vocational theme in education,

*“The main theme of this book, however, in addressing the liberal/vocational divide is that liberal education should enable the young person to see personal significance in that which is so often presented, quite impersonally, as good in itself. In finding personal significance, the learner will quite rightly look for vocational relevance”.* (Pring. 1995. P.156)

Yet again, an apparently logical statement but it prompted me to research if anybody had ever asked young people if they were more inclined to look for vocational relevance if they were aware of the personal significance. Pring welcomed the challenge to education that TVEI and other pre-vocational schemes made suggesting that intrinsic value could be found in the useful and the relevant and that skills could be seen as an ingredient in the development of knowledge and understanding. He challenged the divide between liberal education and vocational preparation,

*“... there is no reason why the liberal should not be conceived as something vocationally useful and why the vocationally useful should not be taught in an educational and liberating way”.* (Pring. Op cit. P.183)

He felt that liberal education was under threat from a variety of angles and that resisting vocational education simply to protect liberalism was false.

Arthur (1993) had explored from a similar viewpoint. He challenged the closeness of the connection between education and economic wealth, or at least

challenged that economic wealth is the most important factor in education. Sacks, in a later work (1999) said,

*“The idea that human happiness can be exhaustively accounted for in terms of things we can buy, exchange and replace, is one of the great corrosive acids which eats away the girders on which societies rest; and by the time we have discovered this, it is already too late.”* (Sacks. 1999. P.24)

He argued that improvement of the quality of human life is as important as the ‘learn more to earn more’ dogma based on the 1988 Education Reform Act which was, in many ways, the culmination of the great debate started by Callaghan at Ruskin College in 1976. He concluded that this

*“...a reductionist view of human nature can have a powerful and essentially negative impact on character formation from an early age”.* (P.111)

and described the task to be

*“...to restore the link between economic markets and civil society so as to create a background against which ethical character can be developed.”* (P.112)

Pring (1995) wrote of closing the gap between liberal education and vocational preparation. He initially identified the perception that the educational system is not succeeding and this helped those who wanted to make change. Employers who said that schools were not teaching the skills and attitudes needed by industry were amongst the most powerful lobbyists for imposed change. This supported my view that Kirby’s following assertion of a well-founded argument was presumptive.

Kirby (1990), writing about Neighbourhood Engineers, made this general point. *“Arguments for encouraging young people understand these things (engineering and technology) in the context of their daily lives are now well founded and for good reason.”* (P.200)

The Dearing Report (1996) supported Pring’s optimism in saying

*“We see the historic boundaries between vocational and academic education breaking down, with increasingly active partnerships between higher education*

*institutions and the worlds of industry, commerce and public service. In such a compact, each party should recognise its obligation to the others.”*(Introduction to Summary report)

As early as 1973, when the School Technology Forum had suggested that the introduction of vocational aspects of education would not threaten the traditionally more academic side. *“In introducing technology into the school curriculum we are thus developing rather than supplanting the traditional aims of liberal education.”*  
(P.4)

Lumby and Foskett (2005) disagreed saying that,

*“...the ritual dance between vocational and academic partners continues to be bashful and tentative,... There remains a lot of progress to be made before they embrace fully and we can approach a position of parity of esteem between vocational and academic pathways.”*  
(P.73)

Pring traced and reviewed the debate chronologically, from Callaghan’s speech in 1976 through to successive white papers and other documents from government or industry-sponsored organisations. His comments on employer involvement focused mainly on the voice of the consumer. He made reference to the increased number of business representatives on governing bodies. Like most researchers and commentators before him he made no specific reference to employers in classrooms, working with the students.

What made Pring so influential for me is that he did not blindly accept the need for education-business links per se, in line with the 1980’s trend, but questioned their value in education as a process. This impacted on my research in reminding me that I was asking questions as well as seeking answers. I was studying the outcome of policy changes on student learning not the intention of the policy makers in their implementation. It would be false to assume they are the same and Pring reminded me of the danger of such assumptions.

Similarly 'does the work of ambassadors inspire the young people with whom they work...?' in relation to my third aim, which was **'To investigate whether the work of the ambassadors was influential in the students' option choices and/or achievement at 14 and post 16.'** This is not the same as 'how do the ambassadors inspire...?'

I identified the 1990's as the era when the pressure for increased education-business links was in grave danger of becoming another 'burden' on teachers. At a time of the National Curriculum, with its associated assessment policies and the 'competitive' element of student recruitment brought in by the 1988 Education Reform Act, such links were going to be difficult to achieve within a school environment without outside help.

The attempts to raise the status of vocational qualifications in the post Ruskin period had included the introduction of NVQs (National Vocational Qualifications) and GNVQs (General National Vocational Qualifications) as well as the opening of Specialist Schools and City Technology Colleges. In practical terms in secondary schools the National Curriculum prescribed and, where there was some leeway, headteachers interpreted. Vocational elements of education were imbedded and my task was to evaluate the effectiveness of one such element and hopefully put it into context for its value, particularly its direct impact on the students.

### Were we really short of engineers?

What was the evidence for a shortage?

Earlier in the chapter I quoted the views of the Association for Consultancy in Engineering and reports on the websites *engineerlive* and *cellularnews*. It should be noted that all these were from within the industry. The Confederation of British Industry concurred.

*“Too many young people are turning their back on science and technology because of faults in the education system,” the CBI (Confederation of British Industry) warned in June 2008. (www.cbi.org.uk. 2008)*

It was argued that thousands of potential scientists are being lost because of a variety of reasons that could include a stripped-down science curriculum, a lack of specialist teachers and uninspiring careers advice. Consequently the UK's world-class science base was being eroded at a time when new international competitors were emerging and traditional rivals were getting stronger, the CBI said.

*“The problems begin in secondary school and reverberate up the education system to such an extent that the number of A level pupils studying physics has fallen 56 per cent in 20 years. Over the same period those studying A level chemistry have dropped 37 per cent. “ (www.cbi.org.uk. 2008)*

Hamilton (2000) put the shortage into context.

*“The engineering profession in the UK is faced with a falling share of the total entry to undergraduate courses. In 1988 the figure was 11%: in 1998 it had fallen to 6%, but over the same period the total number of acceptances of home students entering engineering degree courses increased from 13,641 to 16,298. Within the European Union the UK is second only to Germany in terms of annual intake to engineering undergraduate courses.” (P.49)*

The question “Are we short of Engineers?” has occasionally been addressed by those outside engineering. For example the Finniston Report of 1980 was the Report of the Commission of Enquiry into the Engineering Profession. It proposed the establishment of a statutory Engineering Authority with three new grades of registration based educationally on the master's degree, the bachelor's degree and the Higher National Certificate respectively. Suffice at this stage to say that the Government of the day decided against legislation to create a statutory body. For their part the established professional engineering institutions strongly opposed steps which they saw as threatening their independence and the self-regulation of the profession. The outcome was The Engineering Council, a compromise reasonably acceptable to the Institutions and the Government but opposed by

Finniston. (It was The Engineering Council that asked Hamilton, an engineer, to report in 2000.)

Comparisons with other countries such as those contained in the Hamilton Report, are debatable as an analysis of the varied needs for engineers in economies at different stage of development would be a complex one. The huge range of types of engineering would add to its complexity.

However, for the purposes of my study, I accepted that a shortage of engineers was a reality, or at least a strong enough perception for the programme on which I focused to be set up and running. The question 'is that programme justified and necessary' is not one I intended to explore, although the funders of the programme, the UK government had been convinced of its value, proven by its expansion from 18,000 ambassadors to 27,000 by 2011 announced by Science Minister Ian Pearson in 2008.

(Times Higher Education. May 29<sup>th</sup>. 2008)

### Why were we short of engineers?

The evidence is that the UK had too few engineers, the question is why? The CBI gave an opinion about the drop in numbers taking A level in the physical sciences. Why was that? My fieldwork attempted to get answers to that key question and from those that really matter, the students. It was fundamental to my research as, if it were not true, there would be no Science and Engineering Ambassadors Scheme.

What was the perception of the engineering profession by the students? This was a question I looked to find answers to through my research. However, what was the perception of the profession from the engineers' point of view? I looked at the available written evidence as primary data would be beyond my logistical framework.

Buchanan (1989) identified three factors impacting upon the status of the engineering profession; identity, training and participation. The lack of a single voice for engineering had evolved from the proliferation of engineering institutions in the nineteenth century. He called engineering a “...*profession bound by the historical bonds which it has forged for itself.*” (P.209)

Buchanan dated the decline as post 1850, somewhat ironically as that was the period immediately following the Great Exhibition, part of the purpose of which was to encourage engineering and showcase engineers. He said that

*“There is substantial evidence that the problems of the British Engineering profession at the end of the twentieth century are, in large measure, the result of the shape which the profession assumed during the formative decades of its evolution in the nineteenth century.”* (Op cit. P.211)

In respect of training, practicality had always been more important than theory and academic qualifications. *“A scientist is judged by his publications but an engineer is judged by his large scale achievements”* . (Op. cit P.210)

Social isolation has been a characteristic of the profession. Engineers have avoided political and social activities and that has deprived the profession of spokesmen. In a poorly attended debate on the subject in the House of Commons on a Friday in 1988 virtually all the speakers were impressed by the importance of engineering in the national economy, but they deplored the reluctance of young people to enter the profession. Buchanan noted that amongst elected members of Parliament in that year were 68 barristers, 30 solicitors, 20 accountants, 6 doctors and only 2 engineers. (P.213)

Emerson (1973) reiterates the theme of the proliferation of specialisms in engineering and concludes that,

*“... education must cope with an exponential increase in the population and many engineers will be employed on the clamant and intractable problems of transportation, urban development, pollution control and communal living...engineering education shares the crisis.”* (P. 309)

Thirty-five years on he may well have added global warming and sustainable energy to his list. His point was that engineering was growing new branches quicker than it could train the necessary engineers to develop them, or even to cope with demand.

Norrie could have been writing in 2008 as he wrote in 1956 that

*“A question today is whether the older generation of engineers is guiding technological education with sufficient urge into forms which will best arm future graduates to meet modern requirements.” He added that “...the shortage of graduates has for some time been under review and it is good to note that the government has now recognised the urgency of the problem.” (P. 191)*

The call for urgency had such little effect that the previously reported article in The Times in 2008 Sir James Dyson and others were lamenting the shortage of young engineers.

The number of applicants for engineering courses had remained static at around 24,500 for the past decade, decreasing from 11 percent to just 8 percent of the total number of university entrants. In 2008, the CBI highlighted that this decrease in numbers is partly caused by,

*“...a lack of persuasive careers information encouraging young people to continue studying science at a higher level. As a discipline, engineering simply is not promoted enough to young people choosing their career path. “*

*([www.engineerlive.com](http://www.engineerlive.com). 2008)*

From this conclusion I saw one of my research aims as being to **investigate whether the work of the ambassadors was influential in students' choices at 14 and post 16**. If there was no perceivable impact then the scheme was unlikely to have any impact on the shortage of trained engineers identified in the section above. Impacting on this would be why such subjects as philosophy, sociology and media studies had become so much more popular and the increased choice of subjects available to study at all levels of secondary and tertiary education.

However this would enlarge the study to the massive task of curriculum review and the focus on ambassadors would be absorbed.

What has been done about the shortage of engineers and the falling status of the profession?

The response to the problem can be seen as having three interlinking themes; educational policy, economic pressure, and the perception of the profession by potential recruits.

Legislative efforts to raise the profile of science and engineering in schools

Prime Minister James Callaghan’s speech at Ruskin College connected wealth and industry with high standards of living and the need for good quality education, a key connection to the development of educational debate, and indeed curriculum development, over the thirty two years that have followed.

I have already quoted at least one of the positive responses from industry but what was the government response over the years following Callaghan’s speech? The Government, having initiated the great debate produced a plethora of papers on the subject.

Table 1.

A chronological account of key initiatives post Ruskin

Year	Event
1976	Callaghan’s speech at Ruskin College
1977	Taylor Report
1977	HMI report. Curriculum 11 to 16
1979	Report from British Institute of Management. Education and management.
1979	A Framework for the School Curriculum..DES White Paper
1980	Finniston Report published.
1981	The School Curriculum. DES White Paper
1981	School Curriculum Industry project started

1982	Technical and Vocational Education Initiative launched
1982	Keith Joseph's speech to the Institute of Directors.
1984	Compacts introduced in England
1985	Better Schools. DES White Paper
1985	Curriculum Matters started
1985	Education and Training for Young People. DES White Paper
1986	City Technology College programme launched
1987	Industrial Ambassadors programme launched
1988	Education Reform Act
1988	NVQ's introduced.
1988	Industrialists in Residence trialled in West Midlands
1989	Industrialists in residence introduced in Suffolk
1990	First Education Business Partnerships formed in England
1990	Industrialists in Residence in Essex with Ford.
1990	GNVQ's introduced
1992	Industrialists in Residence Scheme first evaluated
1993	Neighbourhood Engineers evaluated
1994	First Specialist Schools in UK
1995	National Education Business Partnership network formed
1996	Dearing report published
1996	SETNET (Science, Engineering and Technology Network) formed
2002	Launch of Science and Engineering Ambassadors programme.
2003	Passport2success programme launched in Suffolk
2003	DES White Paper. Twenty-first century skills
2004	Tomlinson Report
2005	NFER report for the Engineering and Technology Board
2007	SETNET renamed STEMNET to include Mathematics
2007	Careers from Science. An investigation for the Science Education Forum,
2007	14-19 Education. DES White Paper launched Engineering Diplomas.

I refer below to those not mentioned in my previous chapters, dwelling longest on those with the most impact upon my project.

### Ruskin to SCIP

The Taylor Report (1977) argued that governing bodies should be more representative of the community and that they should exercise more power. In the same year the HMI report on the 11 to 16 curriculum suggested the setting out of national attainment objectives across the curriculum.

*A Framework for the School Curriculum (1979)* and the *School Curriculum (1981)* were responses from the Department of Education and Science (DES) to the problem they had put to Local Education Authorities (LEAs) following Callaghan's speech. It was a conundrum that most LEAs were unable to solve but was a fundamental one. It was 'What should the curriculum look like?'

### Schools Curriculum Industry Project (SCIP)

One of the first educational initiatives to respond to Callaghan's statement was SCIP. The generic aim of this initiative was simply to bring education and industry closer together by opening dialogue and inviting industrialists into schools. Jameson & Lightfoot (1982) were asked by the Schools Council to review SCIP's early workings and reported on some research done in pilot schools in 5 authorities; Cleveland (4 schools), Wandsworth (3), Mid Glamorgan (5), Sandwell (5) and Wiltshire (5).

### Keith Joseph

Keith Joseph became secretary of State for Education in 1981 and stepped into the post Ruskin debate in 1982. In a speech to the Institute of Directors he urged schools to preach the moral virtues of free enterprise and the pursuit of profit. I am sure that the phrase was worded to please the audience but his belief in education serving the needs of a capitalist society was undisguised.

## Technical and Vocational Education Initiative (TVEI) and Compacts

It was from this background, and during Joseph's tenure of office, that two initiatives were launched in 1982. TVEI was first introduced as a pilot scheme in that year and extended in 1988 to all local authority funded schools as a national programme, which ran until 1997. At education authority level the 'projects', as TVEI activities were known, lasted for varying periods within the overall duration of the initiative. TVEI aimed to develop the curriculum as well as support enterprise activities, manage work experience through interaction with the local circumstances.

Compacts were aimed to bring education and Industry closer together. First launched in London in 1984 following a scheme that had operated in Boston, USA, since 1982, they involved the twinning of secondary and tertiary educational establishments with businesses. The East London Compact, the first in the United Kingdom, started with six schools and a Further Education college and, by 1989, had expanded to include ten secondary schools, the FE College and 40 businesses.

### 1985

*Better Schools (1985)* set out the criteria that any agreed curriculum should meet whilst Her Majesty's Inspectorate (HMI) began to set out attainment objectives for a variety of subjects taught between the ages of 5 and 16 in *Curriculum Matters (1985)*. This was one of the results of the HMI report in 1977 on the 11 to 16 curriculum.

An example of the pressure to blur the boundaries between education and training comes in this quote from *Education and Training for Young people (1985)*

*"The results of our lagging so far behind our competitors are serious: British employers have to recruit from a population which at age 18 and over includes a higher proportion of people with no formal qualifications or with very limited occupational or academic attainments; young people in the United Kingdom are not provided with as good a foundation for the continuing education and training in*

*adult life which must be an increasingly important feature of modern economies.”*

(DES 1985)

It is worth noting that Keith Joseph still held the post as Secretary of State in 1985 and this report underlined his philosophy laid down in the previously mentioned speech to the Institute of Directors early in his charge of the department. It set the scene for educational initiatives that followed. Just nine years after Callaghan’s opening salvo the government were putting their name to a report supporting the concept of education for economic wealth.

### City Technology Colleges

The introduction of a pilot of twenty new urban secondary schools was announced by Joseph’s replacement, Kenneth Baker, in 1986. They were to be jointly funded by industry and the DES and would select appropriate children for a highly technological curriculum. Walford and Miller (1991) identified four strands to their ideology:

- a) Improve inner city education*
- b) Better fit pupils to employment through emphasis on technology*
- c) Give choice, diversity and equality of provision*
- d) Be anti public sector and pro private sector*

(Pp. 159 – 160)

### Industrial Ambassadors Programme

The Industrial Ambassadors Programme launched in 1987 resulted from the Technical and Education Initiative (TVEI) programme and, with it, the appointment in the county of a Schools-Industry Liaison Officer (SILO). This was the first such programme in the United Kingdom to use the word Ambassadors and was a fore runner of the programme that I evaluated in this study.

## Education Reform Act

The culmination of government activity in the late 1970's and through the 1980's was the Education Reform Act (1988) which set in statute a National Curriculum and, more controversially, the assessment of it.

*“The implications for secondary education were the strengthening of a traditional, subject-based curriculum at the expense of one more relevant to the economic and personal needs of so many young people and the subjection of schools to ‘market forces’ incompatible with a coherent response to changes.”*

(Pring. 1995. P.31)

## NVQ's and GNVQ's

National Vocational Qualifications (NVQs) and General National Vocational Qualifications were introduced in 1988 and 1990 respectively. This was seen *“as an attempt to raise the profile of vocational awards.”* (Lumby and Foskett, 2005. P.69)

The last year of the eighties saw the early pilot schemes of Industrialists in Residence, including one in Suffolk, the region in which my research was carried out. These were a direct result of the Industrial Ambassadors' programme launched in 1987.

## Specialist schools

The first specialist schools in the UK were opened in 1994. Their main aims were to:

- *Raise standards*
- *Promote diversity*
- *Form partnership with the private sector*

(DES.2001. P.iii)

The last of these aims was mainly concerned with sponsorship. A report in 2001 indicated that such schools were performing *“slightly above the norm”* (Schagen, Davies, Rudd and Schagen. 2001. P.iii)

## Education Business Partnerships

Although Education Business Partnerships (EBPs) were active in some parts of the country nearly twenty years before, the real impetus for the movement came in the early 1990's and by 1995 almost every part of the country had an EBP servicing its local schools, college and business community.

In 1995 a number of EBP managers from across the country met and agreed to establish an organisation that would provide local EBPs with a national voice of their own - an organisation that might provide collective support and leadership and an organisation committed to ensuring education business activity of a high quality nationwide.

In 1996 the National Committee of Inquiry into Higher Education, chaired by Sir Ron Dearing published its findings and predicted a fading of the boundaries between vocational and academic education. This was in the context of its recommendations for changes in 16 to 19 education to further develop standards of living in the country.

*“In higher education, this aspiration (world class learning and research) should be realised through a new compact involving institutions and their staff, students, government, employers and society in general.”* (1996. Introduction to summary report)

Although this report focused on the 16 to 19 age group the ramifications for 11 to 16 year olds were clear, particularly with the changes in the National Curriculum from the 1988 Education Act still being absorbed.

## SETNET

In the same year the Department of Trade and Industry set up SETNET (Science, Engineering and Technology Network) which continued to enjoy support from the DIUS (Department of Innovation, Universities and Skills) and DCSF (Department of Children, Schools and Families) and was, by 2008, known as

STEMNET, including Mathematics in its title. (See appendix 1) STEMNET gave birth to SETPOINTS. SETPOINT contract holders, some of which are Education Business Partnerships, are specially selected organisations skilled in facilitating links between education and the wider STEM community and working with other STEM partners.

#### The SETNET/STEMNET era

In 2002 this organisation launched the Science and Engineering Ambassadors Programme and the subject of my study was born. The diverse natures of SETPOINTS ensured that ambassadors were used differently, even within regions, and in 2003 Suffolk SETPOINT, within Suffolk EBP, launched the Passport2success Programme.

In 2003 a government white paper entitled *Twenty-first Century kills. Realising One's Potential* sought to ensure that work-related learning was available to all 14 – 16 year olds.

In 2004 the Tomlinson report on the 14 – 19 curriculum and qualifications includes a section on 'strengthening the vocational offer' and contributed to the development of diplomas (see below)

In 2005 the National Foundation for Educational Research (NFER) produced a report for the Engineering and Technology Board which was extremely critical of the knowledge that young people have about the nature of engineering and careers within it. Stagg (2007) picked up that theme in his report, produced for the Science Education forum, on Careers in Science.

#### The introduction of diplomas

The latest educational initiative from the government in the period of my study was the introduction of diplomas. The department for Children, Schools and Families responded by pinning their hopes on the new engineering diploma.

*“They are new qualifications for 14-19 year olds that will provide a broad programme of applied and other learning, underpinned by essential skills.”*

Employers wanted young people with good skills, particularly in the basics, and the ability to apply these. They wanted young people who have some experience of work and weare able to make well-informed career choices.

*“Young people who achieve a Diploma will be able to meet these expectations because they will have succeeded across a programme of learning covering English, Maths and ICT, employability skills such as team working and problem solving, and the work skills and knowledge needed to succeed in many industries including engineering.”* ([www.engineeringdiploma.com](http://www.engineeringdiploma.com). 2008)

This has been a brief chronological tour of the developments since Callaghan’s 1976 speech but what have all these initiatives, white papers and acts meant to the student in the classroom? What have been the implications for STEM subjects and their related careers? Why do the CBI and Sir James Dyson echo the concerns of Boyle and Newton, previously mentioned, about the shortage of scientists? Having undertaken a study of the developments I wanted to see what evidence there was of their various impacts on students.

## CHAPTER 3

### A Review of Recent Research

In the next section I looked at relevant literature during the period 1976 to 2008 on the involvement of government, teachers and brokers, meaning STEMNET, SETPOINT or EBPs, in ensuring that students received the appropriate education and support in STEM subjects. I was interested in any research and any commentary related to the impact on students' attitudes and perceptions of the previously discussed initiatives. In line with the aims of my study, I was particularly interested to look for any student input into the evaluation of the various schemes as I felt strongly that only through harvesting students' views, or a longitudinal study of the effects on student achievement, could an effective picture of the impact of policy developments be formed.

#### SCIP and TVEI

Jameson and Lightfoot (1982) reporting on the pilot of SCIP took some note of students' opinions. The students' influences on their attitudes to industry were, in descending order:

1. *Television*
2. *Newspapers*
3. *Family*
4. *School*
5. *Friends*

Three of the many questions were aimed at establishing students' attitudes to industrialists coming into their schools.

1. *Have you had any teaching about Industry at school? Yes: 66.8%. No. 19.1%*
2. *Did you get the chance to meet any people from industry? Yes. 34.2%. No. 32.7%*

3. *What was your response to meeting industrialists?*

<i>Very helpful/interesting</i>	<i>33% (340 respondents)</i>
<i>Helpful/interesting</i>	<i>39.5% (407)</i>
<i>Not helpful/interesting</i>	<i>13.6% (140)</i>
<i>Mixed response</i>	<i>13.9% (143) (Pp.56-58)</i>

This was evidence of students being asked about their attitudes to industrialists coming into schools. However, it was done in questionnaire form, not interview, and the responses were, therefore, predictably general. No follow up to question 1 such as, 'what have you been taught about industry?' or 'how?' had been addressed. Question 2 elicited even less information from the responses with nearly one third of the students asked either not knowing if they had met any industrialists or not responding. The responses to the last question were far from useful and highlighted the problem of asking open questions in a questionnaire. This type of question is far better suited to an interview, where the respondent's body language can prompt a further question to elicit a more precise response.

This research showed the weakness of questionnaire and encouraged me to want to delve further. This is dealt with fully in my methodology section.

Research into the effectiveness of initiatives such as TVEI and compacts is rare and, at a national level, absent but Bell, Howieson, King and Raffe (1988) continued the trend of anecdotal references to student response in their report on TVEI (Technical and Vocational Education Initiative) in Scotland stating that in a mixture of positive and negative reactions to Education-Industry links, positive were dominant. They gave no details of how this opinion had been arrived at. This is the first evidence I found of any valuation of TVEI, compacts or initiatives, other than the fleeting references on SCIP, that included any analysis of their impact on students.

Pring, with hindsight, (1995) saw TVEI, initially, as a "...challenge to liberal education that grew, in the hands of teachers, to be the stage upon which different

traditions competed with each other for the control of the curriculum.” (P.65). He summarised its philosophical impact as “liberalizing the vocational track and by vocationalising the liberal one without betraying the best that is within each” (op cit)

*Education and Training for Young People (1985)* hit back at employers who were clamouring for government initiatives to increase the skill of the workforce. It reported that the majority of sixteen year olds sought to enter the labour market directly from school whilst in Japan 95% stayed in fulltime education until nineteen years old and in Germany 60% of school leavers entered an apprenticeship. The sting came in the statement that employers in major competitor countries were making a larger contribution to vocational education than in the United Kingdom.

#### The momentum for vocational education

Gorman (1989) discussed the governmental view of school industry links and referred initially to the 1980 report from the DES, in which the need for pupils to acquire an understanding of the economic basis of society and how wealth is created. He went on to suggest that the previously quoted 1985 DES report, *Education and Training for Young People*, was even more direct in its connection the role of schools in producing the labour force for economic success, stating that

*“It is vital that schools should always remember that preparation for working life is one of their principal functions.”* (Gorman. 1989. P.12)

Gorman reported that many industrialists welcomed the statement. Typical of this support was that of the Confederation of British Industry (CBI) whose chairman in 1988, Sir Adrian Cadbury, encouraged members to make links with secondary schools. Industrialists were by now eager to grasp the opportunity to influence government policy on curriculum development. Here again, we had the interlinking of economic pressure with educational policy.

Gorman did make some reference to benefits for pupils and stated,

*“Well-planned industrial links can help to stimulate pupil interest in a subject – the mere fact of getting out of school or having somebody new in the classroom can be motivating in itself.”* (op cit. P.12)

However, there was no justification of this statement and the book contained no reference to any evaluation, involving the students, of any work done. In many respects this sentence was similar to the section in the SETNET brochure that initiated my research. If I could find evidence to support their claim then I may find evidence to support Gorman’s assertion. He did not support his assertion with any evidence. This served to emphasise the student perception element of my study as a previously overlooked issue.

Gorman reported the results of CBI questionnaires to both business and schools from a 1988 survey, lack of time being the largest barrier in the perceptions of both groups, but with no reference to pupils being asked. Yet again, a questionnaire had not given any meaningful responses to help me with my work. He went on to refer to the importance of planning in his chapter on bringing people in to school but this section was full of examples with no reference to any evaluations of any form of their effectiveness in increasing learning and motivation.

#### Lack of evaluation and justification

Miller (1989) produced one of the most ironic pieces of work on Education-Industry links. He wrote the concluding chapter in the book on education Industry Links edited by Warwick. The whole book was noted for its absence of any evaluation of any of the schemes detailed, yet has a concluding chapter dealing with that very topic. Interestingly his tabular comparison of formative and summative evaluations includes teachers, LEAs, industrial sponsors, external evaluators, insiders, other schools, parents but not pupils. This is in the section on the approach taken by the School Curriculum Industry Project (SCIP). I had already found, through Jameson and Lightfoot (1982), that student opinions do not form a significant part of SCIP evaluation. Miller took the same philosophical position.

The TVEI approaches seemed more teacher focused. This brought me back to the question 'who is evaluating the impact on learning?' and the answer, in most cases seemed to be that it was left to the teacher. That in itself was an acceptable strategy but as such evidence, if it exists, was unpublished. Surely external evaluations should make some reference to this?

Miller's view of evaluation is one of evaluating the process, and does at least, or should I say, at most, refer to a performance indicator involving the word 'pupils'. In his four categories of indicator, Inputs, process, outputs and outcomes, he defines outputs as

*"...measurable results of the initiative, for example the number of pupils staying on, or those gaining certain qualifications"*

(P.264)

Any such data could only be obtained by a longitudinal study. In such a study as mine, it is impossible to reach any conclusions about student attainment related to the impact of industrialists in the classroom. This statement is further explored in my section on the limitations of the study in the conclusion.

Another unsubstantiated claim in Warwick's (1989) book was.

*"Visitors to the classroom such as those referred to above also have a very real part to play in the wider aspects of socialisation."*

(P.95)

It is not that I disagree with such statements; it is that I seek the justification for making them, that the authors did not. Warwick too looked, perhaps more critically, at the motivation of the visitor who could, at worst, be accused of self-interest. He cited three case studies relating to a local supermarket, a travel agents and disabled access to the school. All were clearly well planned and my personal experience suggested that they would have motivated many pupils. What a shame there was no report of any evaluation of that assumption.

By the end of the 1980's the challenge laid down by Callaghan had been picked up by many including, crucially, the Department of Education and Science

significantly led by Keith Joseph from September 1981 to May 1986. I have already referred to Kirby (1990) and this generalisation.

*“Arguments for encouraging young people to understand these things (engineering and technology) in the context of their daily lives are now well founded and for good reason.” (P.200)*

The bases of the arguments may have been well founded but if they had been accepted as valid it was only by repetition or momentum, not by any valid research.

Kirby, on the same theme, asserted the need to bring young people closer to an understanding of engineering and technology. He stressed the difference between the factory floor machinist or the odd job plumber and the professional person who achieves recognition as a Chartered Engineer (CEng) or Engineering Technician (Eng Tech.). This could be interpreted as a justification for including such an understanding in the curriculum.

It is amazing that, in this myriad of educational initiative and attendant research that the views of students, or even the perceived impact on students, had not been sought.

As Ruddick and Flutter (2004) pointed out, *“Pupils...capacity to reflect analytically and constructively – when given space and encouragement- on aspects of learning that are important to them.” (P.28)*

My research concentrated on students, the consumers, and another of my research aims was derived from this conclusion. It was to **investigate the impact of the ambassadors, both directly and indirectly, on students’ perceptions of their learning.** The most important aspect of this are the words ‘students’ perceptions’ as that is what was missing from the research I have reviewed.

## Teachers lead the way

The introduction of the National Curriculum, following the Education Reform Act of 1988 was a major piece of legislation that had numerous implications for schools. In one of its more notable sections it laid the foundations for assessment at regular intervals from age 7 onwards, which continued to be the subject of debate, and potential industrial action by head teachers, in 2009. It is often forgotten that it prescribed that all students in Key Stage 4 (15 – 16 year olds) should receive an element of work-related learning. What this appeared to achieve was placing the onus for Business-Education links firmly on the teacher.

Price (1992) gave an account of the development of the Industrial Ambassadors Programme, which had the following aims:

- *“As a means of changing the attitudes of young people towards those who create wealth through industry.”*
- *To promote knowledge and understanding of industry among teachers, careers officers, parents and students.”*
- *Thirdly “to establish a new, catalytic force for liaison and effective communication between industry and education in a way which stimulates young people.”*
- *Fourthly “the programme is seen as an effective means of encouraging industrial concerns to form links with their local schools and colleges.”*
- *Finally it “provides a real opportunity to develop the management potential of individual industrial ambassadors.” (Pp.30-31)*

I noted that there was no direct reference to student learning and little to attitude, except for the taking of a more positive view of industrialists. The training of the ambassadors formed a large part of the article and the outcomes were anecdotal and dominated by ambassador feedback. It was clear that marketing the initiative to industry was considered the greatest obstacle to the whole package.

The outcome section featured only one piece of student feedback from a nine-year-old girl, who was reported as saying,

*“ Most of what we do in school goes in one ear and out of the other, but when you work with the industrial ambassador, what you learn stays in your head because you know you’ll have to use it.”* (op cit, P.38)

This was a very interesting comment and reference was made to further evidence of such an attitude in my fieldwork findings. There was evidence that marketing the programme to students, and possibly parents, was also a priority. It would be fascinating to know what educational and career paths this young girl took.

Gifford and Howden (1992) put forward a rationale for Business and Industry Links in the educational field of Design and Technology and, again, no student perceptions are recorded. However, in a typically teacher knows best manner, 13 benefits for students, are identified and I deal with them in detail in chapter 5.

The teachers’ perception of the potential benefits for students was ambitious but the article comments on the key role of the teacher, a post National Curriculum trend.

*“...careful planning is required to ensure that contacts are used to enhance educational practice and that links are not contrived.”* (P.9)

Smith (1992) wrote of the Industrialists in Residence scheme and it was yet another article that focused clearly on the industrialist with detail of the appropriate training needed and the resulting attitude of the individual in going into the schools. The topic of what the company as an institution expected was also addressed. There was no evaluation of the impact on either the learning or motivation of the student but a point was brought to the fore that clearly had to be a fundamental part of my inquiry. That was the role of the school, and in particular the teacher.

*“For the school, an ‘in residence’ scheme’ considerably extends its range of expertise and also the contexts from which learning can be derived”*

(Smith 1992. P.51)

The key phrase was ‘can be derived’, which was indicative of the key role of the teacher in identifying how best to use the increased opportunities. This implied careful planning and this issue arises again in my findings section. Indeed Smith made direct reference to this.

*“It was, in every case, planning between someone on the school’s management structure and the industrialist which helped the latter to understand the culture and climate of the school, perceive the role which would be expected of them by the school and contribute fully to the schemes and projects.”* (op cit. P.50)

In the article the only reference to any planning between industrial ambassador and school was a lunch meeting during the ambassador training when teachers

*“...set the scene, describing their school, the group of students concerned, the curriculum context and the kind of learning outcomes and student activities it might be appropriate to address in the time available.”* (op cit. P.36)

The implication, in both cases, was that the teachers planned the activities and invited industrialist participation. So, if the 1980’s was a decade of a growing momentum to encourage education-business links, then the 1990’s was becoming a decade where the responsibility for that was with schools.

Bridges (1993) was part of a team of researchers from the University of East Anglia that evaluated the Neighbourhood Engineers Scheme in the early 1990’s. The evaluation was carried out through 10 case studies. Neighbourhood Engineers was, in some ways, a forerunner of the Science and Engineering Ambassadors Scheme but with a focus on engineering.

The researchers *“...found only very limited and fragmentary evidence of its direct impact on children.”* (Bridges. 1993.P.26)

The reasons for this lack of evidence can be précised as follows:

- 1/4 to 1/3 of engineers related to teachers but not to the children
- in many cases action had only recently started and many students had had no direct involvement with engineers
- most contact was a 'one-off' experience
- many of the children who were interacting with neighbourhood engineers did not realise they were engineers

The following four styles of working with students were identified:

- talks, lectures, formal presentations
- project based work
- industrial visits
- work experience

Bridges found that teachers responded positively because the initiative did not impose a curriculum change agenda but was supportive of their existing practice. Engineers' initial motivation tended to be at the professional interest end of the spectrum but they developed other motivations as they worked with students.

Bridges' conclusions on the scheme were that it was:

- good value for money
- a flexible model
- a model for other professions
- teachers developed a positive perspective on engineers
- engineers found satisfaction in partnership and increased awareness of schools of their profession.

It was clear that none of his conclusions referred to students. In five years a comparative plethora of writing in education-industry links with very little consideration of student views, or indeed the impact on students' attitudes. I became even keener to fill this gap in research.

However this section of my literature review had identified another major research aim for me as Bridges did not fully investigate the role of the industrialist in the classroom, or school. He outlined models of education-industry partnership but I wanted to go one step further and **critically analyse the roles played by the industrialists in the education of young people.**

#### Teachers get support for developing education-industry links.

Education Business partnerships were, and still are, different in nature across the country. Their key support agencies and host organisations differed (some LEA based, some in Careers Services, some independent) and their core activities varied to reflect local needs and circumstances - but they did share a number of common goals.

Put very simply these included,

- preparing young people for the world of work in particular and adult life in general
- raising teacher awareness of the world of work and the work-related curriculum
- to contribute to the raising of standard achievement via work-related contents
- to support the business community in its need to create a world class competitive workforce for the future
- to promote the benefit of lifelong learning

Osborne and Collins (2000) involved students in their research on science teaching concluding,

*“ Pupils found too much of the later years of science education to be an experience that was rushed; dominated by content; repeated too much of material they had previously encountered; required too much ‘copying’; lacked opportunities for discussion; and was fragmented leaving them without any overview of the subject.”*  
(2000. P. 5)

Their study involved 144 pupils aged 16, 117 parents and 26 teachers in 45 focus groups held in different parts of England. It was encouraging to find some research at last that involved canvassing student views and in interview situations, not just questionnaires.

Interrogating further research I found Hillage, Barry and Pike (2002) who published an evaluation of Education Business Link Clusters. The following are extracts from their comments on business involvement with schools.

*“Most pilots reported that the number of employers involved with schools in the cluster (on non-work experience-related activities) had increased significantly. ... Brokers also helped ensure that activities with employers were better planned, by working with the schools and employers and/or facilitating meetings between them and/or producing relevant background materials.”* (Pp.15-16)

They also looked at the factors effecting success and identified the following school based constraints:

- Initiative fatigue
- Special measures
- Competition between schools limiting co-operation
- Teacher familiarity with EBL (Education-Business links) activities
- Teacher supply constraints

As for employer based constraints they identified only the dependency of the links on a few individuals within the companies involved. Among their conclusions was that:

- Brokers help improve education business link activity
- Brokering is more important than clustering
- Clustering can work but only in the right circumstances
- EBL is generally viewed as a marginal activity
- Winning schools to the relevance of EBL takes sustained input and evidence.
- EBL activity requires funding
- EBL activity can bring results
- Effective brokering requires a range of skills and approaches
- Brokers provide the time and expertise lacking in schools
- Customised support is often better than pre-conceived activities

Some of the above could impact directly on the work of ambassadors and I was interested to find out whether my research could identify any of the above factors as constraints. This leads to a subsidiary aim which would **identify factors inherent in successful practice and, by implication, absent from unsuccessful practice**. Some of the constraints above could be factors acting against successful practice.

The methodology for Hillage, Barry and Pike's evaluation is based on the following paragraph extract.

*"Each of the pilots was visited on a number of occasions (generally four or five times over the two years) by members of the national evaluation team. In each of the areas, the evaluation team attended cluster meetings. Schools and EBP personnel, and others, were interviewed and data collected on the indicators set out in the evaluation framework."* (2002. P.4)

Unless students came under the collective of 'others' there was no evidence of any student input into the evaluation yet, later in the document, appeared this,

*"There were a number of benefits reported accruing to students, schools and employers as a result of the achievements in the pilots outlined above. Brokers and teachers reported that EBL activities were well received by young people." (P.17)*

Despite many initiatives traditional problems were still evident. In 1997 the Southern Science and Technology Forum listed a series of concerns including grave concern about mathematics, especially in contextualising it in science and technology. It also identified a continuing gender imbalance with girls grossly under-represented. Some research done in all girls schools showed how they were, or were not, attempting to address this imbalance. The gender issue is a large one with a great many variables. My study did look at this, though it was not the prime focus.

In 2002 SETNET launched the Science and Engineering Ambassadors Programme and the subject of my study was born. The diverse natures of SETPOINTS ensured that ambassadors were used differently, even within regions, and in 2003 Suffolk SETPOINT, within Suffolk EBP, launched the Passport2success programme. This diversity ensured a variety of models of Ambassador work and it became a sub aim of my project to look at the effectiveness of different models.

#### The ROSE project and its offshoots

2003 was an important year for the background to my study as The ROSE project (2003) led by Sjoberg and Schreiner, opened the door for reporting of student views in research into Science and Technology education. It covered thirty five countries and aimed to shed light on students' attitudes to science and technology teaching. The questionnaire given to students covered such areas as what did students want to learn about; what they thought about their science lessons; environmental challenges and possible career options. There were 255 statements that needed tick box responses and the results showed a generally positive view about the potential contribution of science and technology to the world in the future but students were sceptical about trusting scientists, with girls

more sceptical than boys. The results showed that students were concerned about the environment and felt that science and technology could solve some of the world's problems, but they were less convinced about its likelihood of doing so. Again girls were more doubting than boys and the Japanese were the most sceptical nation. In developed countries, including England, students did not think that science had opened their eyes to exciting jobs and girls disliked science generally. This was, incidentally, in marked contrast to developing countries where science was held in much higher regard and students expressed far more confidence in it and enjoyment of it. In all countries boys were less concerned about doing something meaningful and helping other people but more enthusiastic about working with machines than girls.

One of the final statements for students to rate on a four point scale was 'I would like to become a scientist'. English boys gave this 1.9 whilst English girls gave it 1.5. This compared with figures of over 3.5 for both genders in Uganda and over 2.5 in most developing countries. Only Japanese, Danish and Norwegian girls expressed less desire to become a scientist than English girls. The responses to the statement 'I want to get a job in Technology' showed similar results, although the gender gap in developed countries was much higher than the responses to the science statement with English girls giving 1.7 and English boys 2.5.

In 2006 Jenkins, who had been a participant in the ROSE project, and Pell and later Jenkins alone published papers on the implications of the ROSE report in relation to English students. Jenkins briefly discussed the Science and Technology boundaries and summarised,

*"In the case of both science and technology, students' perceptions are also likely to be strongly coloured by their experience of the school versions of these enterprises and those experiences are themselves likely to differ to varying degrees. Such perceptions may also be gender-related. "*

(P.66)

Jenkins and Pell's study, based mainly on questionnaires given to whole classes gave them 1277 usable questionnaires from 34 schools. A total of 1277

usable questionnaires (617 boys and 660 girls) were eventually received from 34 schools (a 60% return). 1180 were 14 or 15 years old and about 7% of them came from fee-paying schools, a proportion that accords surprisingly well with the wider national picture. The findings were generally in agreement with those from the ROSE project.

Jenkins pointed out that much more needed to be known about why, despite young people thinking science and technology important, they failed to respond to the subjects in terms of enthusiasm, further study and career aspirations. I shared his view of the importance of this and some of the questions that he posed were relevant to my work.

*“To what extent, if at all, can the difference be attributed to school-based factors, such as the content of the science curriculum, the way science is taught and/or assessed and the alleged difficulty of the physical sciences as subjects of study?”* (P.66.op cit)

Whether Science and Engineering Ambassadors have any impact on these would be part of my study.

*“How important are other factors such as the influence exerted by parents, students’ peer groups within and outside school, or careers’ advisers, and what is the nature and extent of their interaction?”* (Jenkins & Pell. 2006. P.50)

Although not one of my research aims, it was likely that student interviews would touch on these points at some stage.

*“ How and why do students’ attitudes towards, and interest in, science and technology change as they progress through compulsory schooling and how are any changes related to success in these subjects at school and to the factors that influence that success?”* (op cit P.50)

This would be more difficult to analyse in a series of case studies and responding to this lends itself to a more longitudinal study. However some changes in student attitude related to working with ambassadors may come to light.

In 2007 Bishop and Denley published a book aimed at early career science teachers in which a whole chapter was devoted to the student voice. They followed up the ROSE project with some student interviews of their own about attitudes to Science. The results showed that students appreciated teachers who 'made the effort', who cared about science and were passionate about it. It was no surprise to the researchers that students liked teachers who explained well. The answer to what engages students was more elusive but phrases such as 'fun', 'enjoyment' and 'involvement' were commonly included in responses as was the relevance of the science teaching to everyday life.

One student response quoted was, *"In school it prepares you for what there is in the real world because if you wanted to go into a job to do with science you'd have to have a basic knowledge that would help you and you would have to know what jobs were out there and what to expect."* (2007. P.179)

There was, however, no discussion on how adults other than teachers, such as Science and Engineering Ambassadors, had or might have had on the students' attitudes to the subject. Also the study was restricted to Science and did not look at other technology lessons, only technology within science. However it was interesting to see some documentation of students' views being included in educational research on the quality of teaching and learning.

#### The first research directly related to the ambassador scheme

This accumulation of reported benefits to students with, until Osborne and Collins in 2000 followed by the ROSE project in 2003, a notable absence of any real evidence, leads me to one of two possible conclusions. It is possible that the students had not been asked for their opinions at all. However, my experience in schools suggests that the students had been asked to do some sort of evaluation, most likely by questionnaire, and the summaries for that had been produced by teachers for the evaluations involved. There were inherent weaknesses in this model. I have seen some evaluation forms in my career and in my research, and

most tend to the trivial with student comment about the sandwiches and the length of breaks dominating. It is extremely difficult to write a questionnaire that combines the simplicity needed to enable students to complete it with the sophistication necessary to obtain useful criticism. As I have indicated my methodology chapter will deal with my rejection of questionnaire in more detail.

The previously mentioned works by Osborne and Collins, Sjoberg ,Jenkins and Pell and Bishop and Denley, had involved students but had not mentioned adults other than teachers in the classroom. This was the focus for my project so my work would complement previous work although the above had certainly identified questions that I hoped to illuminate through my research.

The Tomlinson Report (2004) attempted to raise the profile of courses with a vocational content, including changing the certification of them and suggested the unification of assessment to give vocational qualifications equal weight with the traditional academic ones.

### Science and careers

Stagg (2007), responding to the Science Education Forum's concern about provision of careers information, advice and guidance in relation to science, looked at external support, including SETPOINTS and Science and Engineering Ambassadors' Scheme specifically. This was the first reference in any research that I found to their possible impact. He noted that,

*"...there has been no detailed research into their impact on progression in science and STEM education and careers."* (P.5)

So another researcher in 2007 reached the same conclusions as me about the lack of research in this field. Indeed his recommendations were summarised thus:

- ✓ *Carry out more extensive research into where science teachers get their careers information.*

- ✓ *Carry out research into the role and activity of external partners (e.g. Science and Engineering Ambassadors), focusing on the nature of the training they receive, the extent to which they provide careers 'messages' in their work, and the extent of untapped potential in this area;*
- ✓ *Carry out research into techniques and strategies for incorporating science careers 'messages' into teaching and learning in a wider range of GCSE and GCE A level courses;*
- ✓ *Carry out research into strategies for developing professional development programmes for science teachers that would incorporate science careers, whilst addressing other high priority issues for the teachers.*
- ✓ *Consider setting up regionally-based Science Careers Ambassadors to support teachers and careers professionals. (P.6)*

I certainly hoped to shed some light on the second of these recommendations in my research. It was possible that some hints as to the question posed in Stagg's first recommendation may also come to light.

In Stagg's section on career choices at year 9 he quoted a relevant paragraph from a document produced by NFER for the Engineering and Technology Board (2005)

*"Students generally appeared to lack knowledge about the variety and range of SET careers, and understanding about what they might involve. (They did not realise that engineering, for example, involves skills and knowledge that they already had or would like to acquire, and that its study can lead to an interesting and fulfilling career. This also applies to career opportunities for scientists and technologists". (p32).*

This lack of awareness of the exact nature of engineering is something I wanted to explore in my student interviews. He also found little evidence of SEAs work. It also aligns closely with my third aim that is to consider the ambassador's work in relation to the encouragement of further study and possible career choice. I

wanted to also investigate whether the ambassadors themselves see promoting engineering as part of their role. This directly relates to the aim formulated earlier in this chapter.

*“Experience of Science and Education Ambassadors was very limited amongst the schools surveyed. The schools surveyed do not seem to have been able to use SEAs effectively. Five of the six schools had no contact. One Head of Science said: “I had contact with one...but (this) ran out of steam. I was wondering what was the best way to use him, and I did not have time to plan it.” (P.14)*

I certainly hoped to supplement Stagg’s research in this respect. Indeed I felt that I was plugging a large gap in all the research in that hard evidence of student perceptions of the impact of Education-Industry links in general, industrialists in the classroom to be more specific and SEAs to be very specific was missing from the research found.

#### My aims emerged from my literature review

Thirty-two years after Callaghan started the great debate, it continued. The overwhelming omission from the debate was factual data about the impact on students of any of the myriad of initiatives that have been introduced. It led me to believe that my research, which focused on precisely that, would make a hitherto unmade contribution to the debate.

My review of the literature had shown me that there had been very little analysis of, or indeed attention to, student perceptions in any research that had taken place. Economic pressures and educational initiatives had combined, or competed, to influence practice. There had been no previous investigation of the impact of ambassadors on students’ perceptions of their learning. Indeed there had been little on their learning at all. No longitudinal study had been attempted in any area of business involvement in education. Such a study would have given an insight into the impact of industrialists in terms of achievement and attainment as well as the attitude and motivation that a study such as mine could hope to achieve.

My analysis of the roles that they play in the education of the students would be from research, and not from theory, or expectation, such as Gifford and Howden. That too many young people were turning their back on science and technology because of faults in the education system was the CBI's concern in 2008. My third aim, looking at the possible role of ambassadors in inspiring students to take the subjects further would, I hope, begin to identify the real reasons for this perceived failure.

Finally the role of the brokers, Schools, STEMNET, through SETPOINTS, and Education Business Partnerships will be uniquely studied. Have these bodies achieved what they set out, when formed in the mid-nineties?

I was led to four firm research aims with related key research questions with each. They were as follows:

**To investigate the impact of the ambassadors, both directly and indirectly, on students' perceptions of their learning.** *Is learning enhanced (added value) by the presence of the ambassadors in the classroom/laboratory?* Included in this aim is to investigate the hypothesis that everybody is a teacher. The process is discussed in section 4.5.

**To critically analyse the roles played by these industrialists in the education of young people.** *What role do industrial visitors play in the learning process? Are they teachers per se?*

**To investigate whether the work of the ambassadors was influential in the students' option choices and/or achievement at 14 and post 16.** *Does the work of the ambassadors inspire the young people with whom they work to take the subject(s) to a higher/further level of study?*

**To evaluate the role of the brokers, that is the schools and SETNET.** *What is the role of the brokers in assuring quality learning experiences for the students?*

A subsidiary research aim, which impacts on much of the above will be: **To identify factors inherent in successful practice and, by implication, absent from unsuccessful practice.**

Two other sub aims were to emerge during my interviews with SETNET county co-ordinators.

The first was **to investigate the variety of models of practice that existed and to make an attempt to analyse their different impacts on students**, as in my first aim.

Finally the question **arose, who and what are ambassadors?** This is looked at in more depth than the cursory definition from STEMNET literature that I quoted in my introduction.

I had four main aims and three sub aims and embarked on my research confident that I was cutting a new path and that my findings would shed new light, from a different focus, on issues that have been discussed since the nineteenth century and in real focus since Callaghan opened the Great Debate in 1976.

## CHAPTER 4

### Methodology

#### Developing a methodology.

##### Problem statement

It was important for me at this stage to identify what I could achieve through this study and what I could not. I was confident that I could research attitude, motivation and perception from students. I was also equally sure that I could not evaluate in any detail the effect of the ambassadors on attainment or achievement. The number of variables in assessing student achievement was so large that isolating the influence of ambassadors would be a difficult task and would need, in my opinion, a long term study of groups of students who had both been and not been involved with the ambassador programme. To do this would require a longitudinal study following a group of students through from, at latest, year 9 to year 12. Any such data could only be obtained by a longitudinal study. In such a study as mine, it is impossible to reach any conclusions about student attainment related to the impact of industrialists in the classroom. This statement is further explored in my section on the limitations of the study in the conclusion.

Similarly, I rejected the concept of any quantitative analysis of SATs or GCSE results as the huge number of factors involved in that would make it impossible to isolate the influence of any ambassador input.

By speaking to some year 12 students I obtained an idea of the influences that the ambassador programme had upon their achievement, but more likely their attitudes towards the subject. I set out on what was, essentially, a series of brief case studies. I had, therefore, all the advantages of case study, described by Nisbet and Watts (1984).

- 1. The results would be easily understood by a wide audience as I could describe them in non academic language.*
- 2. They would speak for themselves.*

3. *They would catch unique features that may be otherwise lost in a large scale data survey.*
4. *They would be strong in reality.*
5. *They would provide insight into similar situations.*
6. *I could undertake them myself and did not need a team of researchers.*
7. *They could include unexpected results. (P.21)*

The collection of qualitative data about student perception of the ambassadors was the key element in my fieldwork to address my first aim. Aim 2 could also be addressed by student response as well as data collected by talking to ambassadors, teachers and brokers. Aim 3 was about student perception again and would be best addressed by direct contact with them as well as with their teachers. The final aim was related to the role of the brokers (STEMNET and SETPOINT) and would be best addressed by looking at the process that they go through to ensure quality. It was clear from this that direct contact with those involved was key to my research, so arranging that was fundamental.

I wanted to interview a range of students, both male and female, at schools using ambassadors in different ways. This was key and would further my knowledge in all aims. I also wanted to interview some ambassadors to get their views on their roles and their input. Also some staff, both teaching and support, to determine their perspective of the importance of the scheme to the learning and to ascertain why the model of delivery chosen in their specific school had been selected. I also wanted to interview the county SETPOINT co-ordinators in order to get some background on the ambassador training and the amount of flexibility in the scheme. This latter set of interviews would also help me to select a suitable sample. This issue is discussed in more detail after the report on my pilot study.

### What type of approach?

I embarked on my research journey with Bassey's words of advice appealing to my mathematical mind. He defined research as "*systematic, critical and self-critical enquiry, which aims to contribute to the advancement of knowledge*". (1999. P.2)

Systematic it must be or it could develop into a ramble through experience and literature with no aim or purpose. It is my personal opinion that being self-critical is fundamental to avoiding arrogance. People who do not examine their beliefs and their actions can often appear to have blind faith in themselves, which is not always shared by others. So if research must be systematic, critical and self-critical it should also be a balance of experience, reasoning and research.

I approached my research intending to be both scientific, in the systematic sense as put forward by Bassey, and also to develop my interpretive skills. I also heeded the advice given by Murray and Lawrence for the practitioner based enquiry.

*"The challenge for those involved in practitioner research is not to seek the superiority of one method over another, but to understand intellectual lineage of methods selected and/or their relevance to applied problems."* (2000. P.9)

The challenge of successful research, I felt, was to avoid categorisation and to keep all options open. What of interpretive and positive approaches? Was I to follow one route and associate myself with one of these paradigms or could I, once again, combine both?

*"For interpretive social science, the only aim is enlightenment and through enlightenment, rationality in a critical, moral and reflective sense"*, (Carr and Kemmis.1986. p.94), whereas the positivist approach is more scientific and looks for solutions to problems.

*“The most important implication is the recognition that there are objective solutions to educational problems, and that these can be established by using the methods of science.”*  
(op cit. p.69).

I could associate with both these seemingly opposite standpoints. Critical and reflective enlightenment were certainly sought but there also emerged educational problems, which may or may not have solutions. What about the qualitative – quantitative standpoint? I wanted to avoid seeing opposites in research methods such as quantitative and qualitative; interpretive and positivist. Hammersley challenged the qualitative-quantitative divide, suggesting that

*“The distinction is still misleading in my view because it obscures the breath of issues and arguments involved in the methodology of social research.”*  
(Hammersley. 1992, P.159).

The two views did not strike me as mutually exclusive. If one is looking for solutions to problems then surely a deep understanding of the system in which those problems exist, and in which they may have been created, will lead to a rational examination of them and therefore a more likely environment in which to find solutions. This apparent blurring of the boundaries fitted with my personal approach as I felt that I was, indeed am, by nature a positivist, which almost certainly developed from my mathematical background. However I was, without doubt, following a more interpretive approach to this research. Although I felt that there was a problem to be solved, that of a shortage of engineers and a lack of real impetus in schools to lay the foundations for a solution, I was also not setting out with the aim of finding solutions. If I could seek enlightenment and rationality, as an interpretist would seek, then the solutions, if they existed, would be there for others.

### My ontology developed.

So, I was convinced of the necessity of research, and therefore needed to look for a theoretical framework for my study.

Stephens (2007) asserted that Bourdieu's point that knowledge is accorded social status was borne out, in my opinion, when that knowledge serves a valuable purpose in society. In many ways Bourdieu reflected the motivation of many early 'explorers' by suggesting that social activity and its products have value that can buy other products and therefore generate capital.

My background in teaching enabled me to have much empathy with constructionists who view social phenomena as being accomplished by social actors, according to Bryman (1993). Teachers are, in my opinion, the ultimate social actors and students do not lack much in comparison. The interaction between individuals that produces social outcomes was a key factor in my research, and an ontological position as a constructionist was the most logical position for me to take.

Simplistically the argument from premise to conclusion is deduction whilst the reverse argument from conclusion to premise is induction. Induction is arguing from fact to uncertainty whilst deduction is argument from uncertainty to fact.

Deductive reasoning dominated science until the 1600s. Deductive logic such as;

*"All planets orbit the sun, the earth is a planet therefore the earth must orbit the sun"*  
(Cohen, Mannion and Morrison. 2000. P.4)

Mouly (1978) gave a good explanation of inductive reasoning

*..if one collected enough data without any preconceived notion about their significance and orientation – inherent relationships pertaining to the general case would emerge.."*

(Mouly 1978. Quoted in Cohen, Mannion and Morrison. .2000. P.5)

Bryman pointed to the analytical induction model of research. This term was coined by Znaniecki in 1934 and later often analysed, notably by Robinson (1951). He highlighted the tension between sensitivity to theory and the unadulterated exploration of participant views. He also critically examined the connection between epistemology and data collection. He went on to support my view that quantitative and qualitative methods may be perceived as different ways of approaching the same problem, thus providing the potential for triangulation. The notion that quantitative research tests theories, whilst qualitative research generates theories, Bryman dismissed as an outdated convention.

Bryman (1988) put forward an argument for not holding too fast to a theory early in research.

*“The prior specification of a theory tends to be disfavoured because of the possibility of introducing a premature closure on the issues to be investigated, as well as the possibility of the theoretical constructs departing excessively from the views of the participants in a social setting.” (P.81).*

Popper (1963) argued that theories are interesting only if they have high degree of probability or corroboration. Against analytic induction, in which a hypothetical explanation is an early part of the process, closely following a definition of the phenomenon (Denzin. 1970), he argued that,

*“...many apparent cases of induction turn out to, if analysed more carefully, to be cases of the method of trial and error.” (Popper. 1963. P.64)*

I accepted that but would argue that research in which pre-conceived hypotheses are not built of stone is, to some extent, trial and error. In my interviews I trialled some hunches built on experience and the claims of STEMNET , as opposed to concrete hypotheses, and analysed those results. Working from conclusion to premise involved some trial and I was aware that my sample gave the chance that I arrived at STEMNET’s premise a higher probability. They, however had deduced that conclusion in a very anecdotal and un-scientific way and I used sounder research techniques to approach the problems.

However if analytical induction suggests itself to address one sub aim, that is ‘who is a teacher?’ dealt with later in this chapter, then I maintain that my other aims are to be addressed by grounded theory. As Strauss and Corbin (1988) say in their definitive work on the subject.

“...theory that was derived from data systematically gathered and analysed through the research process. In this method data collection, analysis and eventual theory stand in close relationship to one another.”

(P.12)

This work followed Strauss’s co-operation with Glaser (1967) on the formation of grounded theory.

Table 2.

A tabular summary of the key stages in grounded theory.

Process	Activity	Comments
1	Collect data	Semi-structured interviews and observation are most common
2	Transcribe Data	Full transcriptions
3	Develop categories	Using open coding
4	Saturate categories	Keep going until no new examples of a particular category emerge
5	Abstract Definitions	Of each category
6.	Theoretical sampling`	Guides next data collection
7	Axial coding	Making connections between categories
8	Theoretical Integration	The formulation of a theory
9	Grounding the theory	Applying theory to all the data and validating it.
10.	Filling the gaps	Further collection of relevant data

Data is collected. In my research this was mainly from interviews. The data is then transcribed and categorised. An important step is the saturation of each category. This means the interrogation of all the data until no new examples of data category can emerge. From this theory can emerge and further data collection informed by such theory. This too is inductive and a clear example of arguing from fact to uncertainty or induction.

Seale (1995) suggested that grounded theory in data is an important element in supporting claims with credible evidence.

*“The grounding of theoretical statements creates clear links between concepts and their indicators, and between claims and the evidence for them.”*  
(p.115)

Seale argued that theoretical statements have more credence and what Popper would see as higher probability if they are formed from data that indicates them. In my research if I interviewed 20 students all of whom said that working with the ambassadors had changed their career path from media studies to engineering I would argue that the degree of that as a theory was of high probability. The same statement from another 50 students would increase its validity, although it could not be discounted that the next 100 students I spoke to said that the scheme had no impact on them at all. Popper (1963) discussed ‘reasonableness’ as inherent in inductive theory. It is a matter of judgement, dependent on the nature of the research and the arguments for generalisation in the study that makes possibility into probability. I would argue that the more evidence supporting the formulation of a theory, then the sounder the argument. However the expectation of counter examples existing remains real and only a census, as opposed to a sample, would eliminate that completely. My comments later on the ability to generalise from my findings deal with this.

Usefully, as I found him on many occasions, Bryman (2004) pointed out the weaknesses in grounded theory.

- *Can researchers suspend their awareness of relevant theories or concepts until a quite late stage in analysis?*
- *Can be unable to spell out possible implications*
- *Transcription is very time consuming*
- *It can be doubted that grounded theory always results in theory*
- *It can be vague. What is the distinction between concepts and categories?*
- *It can lead to loss of context and narrative flow*
- *The presence of competing accounts of the ingredients does not make it easy to characterize it or to establish how to use it.*

(p.407)

So did my theories precede my research or succeed it? The only theory or hypothesis I have put forward is that ambassadors may be teachers and this follows my readings of the work of the Shulmans (2004) on communities of learners together with my brief exploration of teaching and learning. I purported no hypotheses for any of my four main aims or for my two sub aims relating to models of delivery or factors evident in successful practice.

In any case I have been inductive in my research, as my report on the analysis of data will demonstrate. Whether through some sort of analytic induction or of a method based on 'grounding' theory in evidential data I argued from facts to theory.

## Epistemology

I turned, as I often did, to Bryman (2004) for his thoughts on theory. He succinctly dealt with many models, including Phenomenology, Symbolic Interactionism, Versteh, Naturalism and Ethogenics, and suggested that,

*“...these are now intellectual undercurrents which tend to be viewed as providing qualitative research with its distinct epistemology.”* (1993. P.50)

I felt, before my research, that I associated most with Realism and Constructionism but later in the chapter I review how the process of the research amended my views on this. Realism is

*“...the belief that entities exist independently of being perceived (common sense realism) or independently of our theories about them, which may or may not be accompanied by the belief that knowledge of these entities is possible.”* (Swann and Pratt 2003. P. 213)

Empirical realism asserts that reality can be understood and I believe that my research set out to do just that. My background in Mathematics is probably responsible for this empathy with that viewpoint which has much in common with positivism. As my research continued my view of myself as a realist strengthened. Glassner and Loughlin's (1987) opinion that the character of what the interviewee is saying could also be treated, through a realist approach, as a factual statement and validated by observation clearly identifies with my combination of mainly interviews with students but also some limited observation of their work. I had also gained some valuable triangulation by my interviews with the ambassadors.

In summary I had a version of grounded theory to explore my main aims but am quite comfortable to adapt and amend the basic strategy. I could identify elements of analytical induction in my analysis of the roles played by the SEAs in the education of young people.

When reviewing the theories that I had explored, especially grounded theory and analytical induction, I came up with a methodology that fitted both my outlook, as a realist, and my research problems.

1. Rough definition of the problem. The problem is the impact of adults other than teachers, specifically Science and Engineering Ambassadors, on student learning and motivation.
2. Hypothetical explanation. That all people, including ambassadors, are teachers. This hypothesis comes from my interpretation of the Shulmans' work on communities of learners and from many definitions of teaching and learning.
3. Examination of cases to determine fit with hypothesis. This will come through my interviews.
4. If lack of fit then a change of hypothesis will be needed, or the hypothesis is proved incorrect. If it is felt that the hypothesis is being confirmed then explanations of any exceptions to the case, if they exist, will have to be examined and the reasons for their exception investigated.

However, the method associated with grounded theory of developing and saturating categories was still an important element in my data analysis. The only theory that I had developed prior to data collection was the one that ambassadors are teachers and my exploration of the definitions of teaching and learning informed this. Much of my research was not hypothesis based, however, and clearly lent itself more to the traditional model of grounded theory. This is further discussed in my concluding chapter where the combination of grounded theory and analytical induction that I am describing will be explored as part of my contribution to theory.

What I found more difficult to assess in myself was on which side of the emotionalist constructionist argument I stood. Silverman (2005) gives this quick comparison of the two standpoints and suggests *that "...emotionalism reflects, in the researcher, a strong tradition in qualitative research which prioritises the study of perceptions, meanings and emotions."* (P.10)

Table 3.  
A comparison of key elements of emotionalism and constructionism.

	Emotionalism	Constructionism
Focus	Meaning and emotion	Behaviour
Aim	Authentic insights	Studying how phenomena are constructed
Preferred data	Open-ended interviews	Observation, texts, tapes.

(op cit. P.11)

I had been attracted by Bryman’s (2004) definition of constructionism and its belief in social actors. However I clearly was aiming for the authentic insights into student perceptions of the impact of the ambassadors on their learning although I could argue that I was also interested in how the relationships were constructed enabling that impact to be realised. However I would suggest that the latter was a secondary aim to the former, much as I could argue that my focus was more about meaning and emotion, in terms of my desire to gauge student perception, rather than measure achievement or attainment.

I was intent on obtaining my data mainly by semi-structured interviews with observation playing a minor part but giving my data some triangulation. I was also concentrating on perceptions and meanings in my data collection so giving my work strong elements of emotionalism. This must be tempered with my thoughts about “*students as social actors*” (Bryman 2004. Pp.192-193).

Teaching and learning.

Many of the ambassadors in my study worked directly with young people, either in a classroom situation or individually, one to one. A core philosophy of the scheme is that the learning process will be enhanced so my second aim and associated research questions focused on these relationships.

**To critically analyse the roles played by these industrialists in the education of young people.** *What role do industrial visitors play in the learning process? Are they teachers per se?*

It is this last phrase that merited examination. If I was to answer it I needed to explore the act of teaching, inevitably leading to some exploration of the act of learning. I concluded that a brief look into these two huge topics would be essential for me to answer the question I had posed, are ambassadors teachers per se? So what are teachers or what is teaching?

Hirst gave his thoughts on the latter question.

*“...teaching is what is technically known as a polymorphous activity. It quite literally takes different forms.”* (Hirst 1973. P.165)

This was hardly definitive but he maintained that teaching is characterised by its point or purpose. Teaching is intentional but learning can be unintentional, although schools, he felt, are only concerned with intentional learning. Learning, he suggested, is also polymorphous but defined by an intention or some specific achievement. As a side note it is somewhat unfortunate if schools do tend to ignore unintentional learning as many of the learning experiences in vocational education are of that nature. A student on work experience will receive many such learning experiences but, as that is less likely in a classroom situation, even with an outsider being involved with the learning.

*“A teaching activity is the activity of a person whose intention is to bring about learning by another person, whose intention is to achieve some end state.”*  
(op cit. p.171)

In the same book Hamlyn (1973) shed more light on the learning process.

*“...there are a number of differing kinds of learning process which are more or less fitted to the differing kinds of knowledge, competence, skill or what have you, that may be required of human beings.”*

(op cit. P.193)

Slavin (1991) took this further and expanded Bloom's spectrum of intellectual endeavour (Bloom et al, 1956) which ranged from simple and factual to complex and conceptual. He started with knowledge and ascended through comprehension, application, analysis and synthesis to evaluation. Slavin identified the needs inherent in the learning process.

McGuinn (2002) looked at learning through extracts from a book called '*A Bone from a Dry Sea*' by Dickinson (1992). Part of the story is set in Africa four million years ago and concerns a young hominid called Li. McGuinn analyses his learning in terms of both need and response and used Slavin to contextualise the learning that was taking place.

Gregory's response to McGuinn's comments summarises learning as "*...in short, an essentially social enterprise.*"

*(Davies, Gregory & McGuinn. 2002. P.145).*

He did, however, hint at an economic purpose in education elsewhere in the book.

*"Education (and schooling) have as their ambition the introduction of the next generation to the accomplishments and achievements of human beings in a given society at a given time."* (op cit. P.50)

This opened up a definition of learning that applied to Li, in four million B.C. and equally to the next generation of scientists and engineers for the twenty first century.

The Shulmans' work (2004) on communities of learners was the stimulus for me to develop my ontology in this research process. Their six facets for teacher development, namely Vision, Motivation, Understanding, Practice, Reflection and Community set parameters that included more than just qualified, or trained, teachers. Indeed if the basic concept of learning is that we all learn throughout our life and we consider what stimuli cause that learning it is not difficult to come to the conclusion that teaching is not restricted to those with a qualification to do so.

Their paper went into detail on the definitions of the six facets and the authors identified five clusters of attributes around which accomplished teaching develops.

The attributes identified by the Shulmans were:

- *A cognitive cluster that includes discerning, understanding and analysing*
- *A dispositional cluster that includes envisioning, believing and respecting*
- *A motivational cluster that includes willing, changing and persisting*
- *A performance cluster that includes enacting, co-ordinating, articulating and initiating*
- *A reflective cluster that includes evaluating, reviewing, self-criticising and learning from experience.* (Pp.264-265)

One could deduce, from this argument, that these are basic human qualities and not restricted to teachers. Or the argument from the other direction is that all human beings have teacher characteristics in them. If these can be identified when one is put in a position where teaching is expected from you, or learning is expected as a result of your input, then the definition of teacher is partly, or wholly, satisfied.

Teachers involved with the scheme assumed that the ambassador had sound knowledge base of the subject and it is the interaction of that knowledge base with the vision or ideology within the community of practice that is the key to learning. The Shulmans argued that the other element is shared commitment, support and incentives. I have met many people from whom I have learnt and could, indeed, suggest that I meet them everyday.

Hirst (1993) made a useful observation in reviewing Oakeshott's theory (1962) that there are two kinds of knowledge. There is technical knowledge, which can be learned, remembered and put into practice and there is theoretical knowledge, which exists only in use and is not reflective (knowledge for

knowledge's sake). These are distinguishable, but inseparable, both being involved in every concrete activity.

*"The logic of educational theory I therefore now see as demanding the justification of what is done in any particular case by reference to knowledge, understanding and practical principles, which principles have been subject to the test of practical experience"* (Hirst. 1993 P.157)

It was tempting to presume that the SEAs would show more technical knowledge, whilst the teachers would demonstrate more theoretical knowledge. I deliberately used the words show and demonstrate rather than possess.

Sikes, Measor and Woods (1995) looked at the stages of development of a teacher and stated.

*"There are 'proper' and 'improper' approaches to teaching"* (P.113).

They defined teacher propriety as described in their sample. Characteristics fall into four main areas: appearance; attitude to pupils; relationships with colleagues and teaching.

This was actually a prelude to an exploration of different teaching styles and, at one stage in a transcript of an interview with a teacher deemed to have a 'proper' approach the teacher rejects the *"child centred stuff."* (op cit. P.115).

This was completely at odds with the thinking of such radicals as Gattegno who was quoted in Brown, Hewitt and Tahta (1989) as saying,

*"There's a Copernican revolution to be made. Let us begin with the learner, not with the teacher and the teachers' courses, or the regulations or the curriculum. Let's begin with the learners"*. (Brown, Hewitt & Tahta. 1989. P.14 )

This exploration of teaching and, to a lesser extent, learning enabled me to look in a more focused way at what the ambassadors were achieving in the school situation. Are ambassadors teaching? Did any of them fit Hirst's (1973) definition of

teaching? In other words did they have a pre-conceived intention to bring about learning?

If not teaching were they involved in learning? Did they fit Gregory's role as introducing achievements of human beings to the next generation? In the different models that I looked at the answer will be slightly different and I shall revisit this topic after I detail my findings. In short, it was a question of how they worked with students. For this reason it impacts upon another of my sub-aims, that of exploring the different models of practice that exist within the scheme.

### What method?

In thinking about method I reminded myself of the PRICE acronym from Swann and Pratt (2003) an invaluable yardstick in terms of principles for good research practice.

*P - Purpose. Be clear in what you are trying to do and what methods you use.*

*R - Rigour. Be prepared to subject ideas to scrutiny. Eliminate error.*

*I - Imagination. Be aware that research is creative.*

*C - Care for others. Exercise a moral duty.*

*E - Economy of effort, time and resources. (P.178)*

How would I gather the data required to address my aims?

Data collection can be done in a variety of ways. My review of literature had shown me the weaknesses of using questionnaires. Jameson & Lightfoot (1982) are examples of this. In my role as a teacher I had seen many student questionnaires purporting to evaluate a programme or event, but which focused on the trivial.

Gillham (2000) advised against the use of questionnaires in case studies as they are at the most structured end of the continuum of data collection methods.

*"Questionnaires are of little use if meaning and understanding are primary concerns."* (Pp.78-79)

Questionnaires are often poorly completed and this reduces data quality and completeness. Questionnaires are also inflexible. I, with the aid of Drever (1995) identified some specific weaknesses.

Firstly you only get a proportion back. In schools this can be a large proportion if the students are given the questionnaires to complete in a supervised situation. However that controlled environment will not ensure that the answers are complete. Indeed it is likely that many students will look for as brief an answer as possible.

Another problem is that questions have to be carefully constructed and, even then, may be misunderstood. There is always the possibility of questionnaires being treated frivolously. The most important reason, for me, in not using questionnaires was that in analysing responses you never get answers to questions that you don't ask. It was vital that I had the option to probe responses further, to tease out explanations for brief answers and to ask sub-questions.

In all, I concluded that questionnaires were unsuitable for assessing the kinds of perceptions I was interested in. They were more suited to the collection of quantitative data than qualitative. The alternative, interviewing, gives high quality data. You can usually be sure that respondents will treat it seriously because you are there to set the tone. You have the ability to explain any ambiguities and correct any misunderstanding of your questions. This is particularly important when obtaining data from young people, as not only may they not understand the question they may not listen to it intently. Finally, and vitally, you are able to probe for clarification.

Drever (1995) pointed out two further advantages that could be gained by interviewing people in their school or workplace. Firstly you can gain an impression of their working environment and, second, you are aware of their manner and their body language. This goes back to the issue of social acting, the element of constructionism that I find difficult to reject from my theoretical standpoint.

The fact that Jenkins and Pell (2002) used questionnaires fitted well with its purpose as a UK follow up to the international ROSE project but their method of data collection had some limitations, as discussed in my methodology chapter, and my student interviews would build on their overall findings in a deeper and more focused manner, admittedly with a lot less students. To that extent my study would complement theirs.

What type of interviewing best suited my aims? I had no doubt that semi-structured interviews were the answer.

*“Semi-structured interviews begin with a pre-determined set of questions, but allow some latitude in the breadth of relevance.”* (Freebody. 2003. P. 133)

I rejected structured interviewing as I did not want an inferred set of answers. I wanted my respondents to go off the point briefly but I did not want to go to completely open-ended interviews as I had a core of issues to address. So I had decided on my interview method but what about the technique and the factors influencing my interviews?

### Question selection

I had four distinct groups of interviewees and required appropriate sets of initial questions.

I dealt with my key interviews first, those with the students. I was dealing with children as young as 13, and across the ability range, therefore I wanted to make my initial questions simple. This would enable the students to speak and me to listen. I was always aware of my need to prompt or probe.

From experience I was aware of the need to put students at their ease. I suspected that they would be naturally guarded. There would be an assumption that I was questioning their role in the programme and, by implication, their progress. I also assumed that they would associate me with authority, i.e the school or the local authority, as I was introduced as being from the University of Brighton.

My preamble, my first question, and my last were the only ones I planned in detail are set out in the interview schedules (appendix 6, page 189).

### Interviewing adults

I used more structured interviewing techniques with teachers and ambassadors. I wanted to concentrate on possible advantages to the students, perceived by the adults, some of which I have gathered from my reading. If there were any disadvantages then I wanted those to come out in the interviews also.

Bridges (1993) commented that the motivation of the ambassadors had to be explored also as their attitude could, indeed almost certainly would, influence students if only as a role model as adults other than teachers. My interviews with ambassadors gave me some very clear indications of their attitudes in approaching their work with students.

Finally my interviewing of SETPOINT co-ordinators had a different purpose and acted as a background to my research and not an integral part of it. I therefore selected the following questions as a menu for those interviews. It did, however, pose a real danger of my seeming to be judgemental, as they knew that their line manager had given me permission to speak to them. It was important that the questions were phrased to be information gathering in nature and not judgemental. The limitation that I had to accept from this was that the co-ordinators were going to point me at successful practice, or at least what they perceived as successful practice. This did not particularly work against me for two main reasons. Firstly, the identification of factors encouraging successful practice would inevitably hint at their absence in poor practice. What emerged as more likely than poor practice was non-practice, and the barriers to participation are dealt with in my findings.

The questions I used for the SETPOINT co-ordinators were as follows, with the option for follow up questions as is the practice in semi-structured interviews.

- What is your role in the programme?

- What is the definition of an ambassador?
- How do they differ from other industrialists working in schools?
- Are you aware of different models of ambassador work?
- What is your perception of the impact of the ambassadors' work?

### Recording the data

In general I used a digital voice recorder but for all but one of the county coordinators made notes only after my first recorded interview. This goes back to the point I made about the role of their line manager and I felt, in arranging the interview, that they may assume that she would be able to access the recordings. I decided, therefore, that note taking was the better way forward, especially as this set of interviews was for contextual purposes and for the sample selection, not for the data that would play the major part in addressing my aims.

At first I was not sure of whether I needed to get full transcripts of every interview or just keep the interview and analyse it directly from the tape. I decided to test this by keeping full transcripts of my pilot study (see appendix 7, page 191) and reviewing the need for this after my analysis of that part of the study. I decided to keep digital recordings that I could repeatedly listen to. This, in my opinion, was as useful to my data analysis as having transcripts. It had the advantage of reminding me of the context of the interviews.

### Groups or individuals?

The advantage of group interviewing is that it enables students to challenge each other and feed off each other in a way that may not be possible in a one-to-one. As Kvale (1996) stated,

*“The interaction among the interview subjects often leads to spontaneous and emotional statements about the topic being discussed” (P.101)*

Eder and Finnerson (2003) *“advocate using group interviews with children as these capture group interactive processes.”(P.43)*

Also, as Drever (1995) points out,

*“...children may be less inhibited if they meet an adult as a group.” (P.16)*

The language that young people use amongst themselves may help understanding. I was, however, very keen that no individual student should be allowed to hide. It was likely that the student who was least enthusiastic about the scheme would have some valuable things to say about it and I was determined not to miss such data. I used my experience as a teacher to avoid any individual deliberately taking a low profile, indeed I intended to react to any attempt to do so by positive individual questioning.

*“Interviewing will provide their analyses of what they hear in their talk and will proceed to answer in terms they deem, at the moment, to be relevant to the specific questions...”* (Freebody, 2003. P.134)

In many respects I was in the hands of the host schools and also limited by time. Group interviews would be the most time-effective for both schools and myself. They would also avoid some of the ethical issues that would have to be overcome with one-to-one interviews. In my pilot study I tried both and evaluated my results. I deduced that the group interviews I conducted in my pilot gave me more information, more quickly. Individual interviews were often very slow as the interviewee was nervous. This nervousness was less conspicuous in group interviews where more confidence was displayed by all involved.

### My role as an interviewer

I was aware that my position as an outsider, but with a background in education, might affect the response of the students. They may have seen me as wanting to get support for the scheme, giving me the answers that they perceive I

was looking for. A response to this may have been to shorten the interview, a situation which, in my experience was not one with which most young people are comfortable, especially with someone they do not know.

*“The interview is not a simple tool with which to mine information...it is as much about seeing a world; mine, yours, ours theirs as about hearing accounts. Opinions, argument, reason, declarations: words with views into different worlds.”*

*(Schostak. 2006. P.1.)*

If this proved to be the case in my pilot study then I may have had to look at the use of focus groups, which might give me more open responses. However I did intend to have a combination of individual and group interviews in my pilot study to see which got the better response.

My background as a teacher and researcher had given me familiarity with role of insider researcher, but now I was to act as an outsider researcher. Was I, in Kvale’s (1996) definitions a miner or a traveller? I felt I was a traveller who, *“wanders with the local inhabitants, asks questions that lead subjects to tell their own stories of their lived world.” (P.4),*

How would I be perceived by the school staff, by the ambassadors and, most importantly, by the students?

I felt that my background as a teacher, then working in schools as a subject specific supporter and now as a researcher would be well accepted with all adults working in schools. I clearly would be seen by SETPOINT co-ordinators as sent by their manager and needed to be aware of that in my interviewing. I was dealing with a scheme that was centrally considered to be a key part of the organisation’s programme and instrumental to their funding bids to government. However, I expected them to be supportive of the scheme as part of their job was to be so. If they privately were not then I doubted that it would be demonstrated to me.

How would the students view me? I introduced myself as being a postgraduate student from the University of Brighton and carrying out research into the Science and Engineering Ambassadors’ Programme. I hoped that this would give

me some separation from other parties involved. I did not want to align myself with ambassadors, teachers, support staff or SETPOINT, although I felt that this last possibility was the most likely in the students' perceptions. However I was not convinced from my own experience in schools that students would be aware of the purpose of such outside bodies and would perceive the programme to be school led.

I was aware of the power imbalance of the interview as a process and the exaggeration of that with children. As Eder and Finnerson (2003) said, *The respondents are vulnerable because they have no control over the production or distribution of the research* " (P.49) or as Kvale (1996) put it, *"In professional interviews there is an asymmetry of power. The professional is in charge of the questioning of a more or less voluntary and naïve subject."* (P.20)

### Observation

There was, in my research, some observation as Eder and Finnerson (2003) stated, *"Observation can help the researcher to assess some of the basic communication norms and patterns.* (P.40)

There was a limit to the amount of observation that could be done as much of the work was done in one-to-one situations where my presence would have upset the relationship between ambassador and student. Attendance at day events would have been possible but did not fit the time scale. I had, during my school career, attended many such days and was well aware of their format.

### Ethical issues

At all times during my work I adhered to the Revised Ethical Guidelines published in 2004 by BERA (British Education Research Association)

I addressed the ethical issues relating to STEMNET's involvement as they had agreed to pay my expenses for fieldwork, though no payment for work done. I arranged a meeting as mentioned in my personal context section, with the eastern Area Regional Co-ordinator and the National Programme Director. In that meeting with them I established that my research would be independent although the data would be available for them to use.

The study would be limited in its generalisability and would not be intended to be judgemental on SETPOINTS per se. This was key to getting honest answers from the county co-ordinators. STEMNET had my permission to use the findings as they wish, subject to my permission to edit them. In basic terms STEMNET can use the data but could not 'use' the researcher.

Kvale (1996) identified three ethical aspects of the researcher's role which he calls "*scientific responsibility, relation to the subject and researcher independence.*" (P.118) The scientific responsibility is to use correct methodology and report findings accurately and honestly.

### Informed consent

Approaches to schools were my first key ethical hurdle. My school for the pilot study was selected by the Eastern Regional co-ordinator through the county SETPOINT co-ordinator. Through this I was given the name of a contact (a member of the teaching staff) at the school and sent her all the necessary consent letters for students. (See appendices 3 and 5, pages 186 and 188)

The information contained in the letter that schools gave out is contained as item 1 in appendix 2, page 184.

Letters were also sent to schools for adult participants (appendix 4, page 187), although I only insisted on consent letters being given to me prior to interview by minors. All adults had had to have received the letter, or they would not have

been talking to me, and therefore consent was by presence, in the knowledge that they were aware of the purpose of my research.

At the start of the interviews students were reminded of what I promised in my letter, that they did not have to answer any questions if they did not want to and that if they wished to stop the interview they could do so at any time. They were also asked if they had any objections to the interview being recorded, knowing that anonymity was assured. I told them I wanted to ensure they were there because they were happy to be and that no compulsion to be there had been implied.

Adults were also reminded that the interview was voluntary and that they had the right to not answer a question if they so wished.

#### Confidentiality and anonymity.

Students were promised confidentiality and anonymity by me before the start of each interview. I did tell them that feedback and, therefore, possibly some comments would be passed back to staff but that no comment would be attributed to any individual. Indeed, no names would be mentioned to staff at all.

School staff and ambassadors were given the undertaking that the findings related to their particular schools and companies would be sent to them before any names were published. In the end I decided that all schools, ambassadors and companies taking part would be anonymous. This was because I was concerned that if some agreed to their names being used and some didn't the research would look un-coordinated.

However all schools and companies were sent a copy of the fieldwork extract referring to their input and asked to check the factual content. Any responses were acted upon. This letter also leads to the third of ethical issues.

### The consequences of the interview

*“By interviewing, the importance of the researcher as a person is magnified because the interviewer him, or her, self is the main instrument for obtaining knowledge. (Kvale. 1996. P.117)*

All participants were told of what would happen with the data collected. I made it clear that it had two purposes, to inform a report for the scheme’s organisers, STEMNET, and to form a large part of the data for my thesis (appendices 4 and 5).

Many of the issues discussed in this chapter would be tested by my pilot study. Actually carrying out interviews and collecting data to be analysed would either confirm or force me to amend my proposed methodology.

## CHAPTER 5

### The Pilot Study and Choosing the Sample

I begin this chapter with a report on my pilot study, which took place in School P. This was an all girls comprehensive school with a higher than average ability intake. This constituted a pilot study and involved interviews with two staff, and students arranged so: a group interview of six girls and three individual interviews of girls. I also contacted the SEA who chaired the school liaison group by e-mail.

School P was an 11-18 Voluntary Aided Comprehensive Catholic Girls' school located in a small city. The school achieved Specialist Status in the Humanities in 2005. This school was suggested to me as a suitable starting point by the regional STEMNET co-ordinator but the fact that it was an all girls' school gave me some issues to ponder. I had to be aware that the attitudes to engineering may include gender issues and would look for that in my research. This brought gender issues to the research as I was aware that the attitude of girls to engineering, in particular, may be different to boys. Some of the response I received highlighted this issue. For instance one student said of the Industry Day,

*“When we did the constructing, because we were girls it was quite a nice thing to be introduced to that. It was quite interesting to see the sort of careers that are out there...It was nice to see girls being treated the same as boys”* In general, however, gender was not an issue with the students. Whether or no it was with parents was a question I did not have the opportunity to investigate.

The school had around 800 pupils on roll, including 190 in the sixth form, and was heavily oversubscribed, with many pupils coming from a wide geographical area. It had, at the time of my visit in June 2007, 4 forms of entry and would be expanding to 5 forms of entry from September 2007. In 2006 the College was rated 'Outstanding' by OFSTED, achieving grade one in all categories.

The school's prospectus linked Science and Mathematics in its description of curriculum enrichment activity.

*“The Science Department supports the teaching of this varied subject by ....”*

It then listed a variety of activities across the year groups from years 7 to 12. Key companies were mentioned by name and many of the activities were organised in conjunction with the Mathematics Department.

### Interviews

Year nine students were the focus for the interviews with the group interview involving six girls. There were three individual interviews with year 9 girls. I had asked for a member of staff from SETNET to be with me for ethical reasons but this wasn't possible so, with the co-operation of the librarian, these interviews were carried out in a corner of the library.

**Key pre-interview issues** established with informal discussion with staff:

- The only work done by year 9 with the SEAs was the Insight into Industry day, which therefore, formed a focus for the interviews.
- Options were not an issue as Double entry Science was compulsory for all year 10 students.
- The ambassador was only a figurehead for work in the school and was not known by students.

**I interviewed two staff**, both key staff in the Insight into Industry day. One of them was from the Science Department and the other was the Head of Mathematics. The transcribed interview started with the Science teacher and the Mathematics teacher joined us during the interview. These key points emerged from that interview.

The support of parents was very important. At open evenings parents were encouraged to join the team responsible for organising industry liaison. There were clearly different levels of 'ambassadors'. The designated ambassador chaired the planning team and involved others from his company and other businesses in the

area. I did not know how many of these are designated SEAs. There were also interested parents who had been invited to bring their expertise to the group.

The group planned to initiate an activity to all year groups from year 9 upwards. For instance, year 12 were given a 'management day' and year 10 had done a 'twenty questions'. There were also informal meetings after school for year 10 girls who had expressed an interest in an engineering career.

I was unable to meet the **Ambassador** but did ask him some questions by e-mail, to which he responded quickly (see appendix 8). In future sets of interviews I intended to meet ambassadors face to face, and also any non-ambassador business people working with students. This definition of an ambassador and the importance of the title is something I pursued with STEMNET and SETPOINT co-ordinators.

Ambassador comments included the following points:

- Industrialists bring 'up to date' information to the classroom. New technologies and new innovations that neither staff nor students may be aware of.
- Feel that the need to apply learning to real life situations is an important part of the education
- Developing awareness of the professions. Also the need to smooth the transition from full time education to profession is often a difficult one, even for graduates and such programmes as these can help.
- See industrialists as enthusiastic about work. Also the skill of presenting is a good one for young engineers' personal development.

I was also shown a selection of **student feedback forms** from the Insight into Industry day. These did little to inform the planning process and the most common comments were related to refreshments provided during the day.

The aims of the 'Insight into Industry day' were

- To provide a greater awareness among the students of the importance of business and industry in our society
- To give students the experience of some of the skills that may be required at work
- To further the knowledge base from which students make their own career choices.

I felt that it clearly succeeded in the first and the last of the aims. The middle aim would have needed more detailed questioning about the individual workshops to establish whether it succeeded.

#### Comparison of findings to literature review

Following my pilot study I reviewed my literature review. I had reasons for doing this. My pilot was crucial in guiding the direction of my fieldwork and a complete recap of the rationale behind my work I felt useful. How much had my first experience of fieldwork reflected or contradicted the opinions that I had formed after my reading? One of the main reasons for carrying out a pilot was to test that the methodology used is fit for task and to conclude some implications for research that my pilot had identified in my mind. The need to contextualise this in my aim of approaching this analysis from a different view point was to the fore of my reflective thinking at that stage. If I was to contribute something unique to knowledge then I had to ensure that this was an integral part of my rationale in approaching my fieldwork.

Bridges (1993) concluded that *“the researchers ...found only very limited and fragmentary evidence of its direct impact on children.”* (P.26) In his research on the Neighbourhood Engineers Scheme. This pilot study suggested that both direct and indirect impact.

Gifford and Howden (1992) put forward a rationale for Business and Industry Links and the 13 benefits for students, identified by teachers are listed such:

1. *the experience of a different kind of learning*
2. *a sense of involvement in the 'real' world outside school*
3. *first hand experience of the kind of world their parents might be involved in*
4. *a chance to meet 'experts'*
5. *a chance to meet someone else in the role of teacher*
6. *improved social skills through interacting with other adults*
7. *potential to develop a useful range of new experiences*
8. *chance to gain an insight into industry*
9. *opportunity to gain access to a greater variety of materials and techniques*
10. *opportunity to appreciate some key economic issues*
11. *validation of work that might seem isolated if solely classroom based*
12. *a strengthening of the school's position in the community*
13. *increased enjoyment, motivation and enthusiasm.*

(P.3)

This pilot study had given some evidence of 1, 2, 3, 4, 5, 8, and 13 at least giving evidential support to their theory.

Gorman (1989) was also supported by my findings.

*"Well-planned industrial links can help to stimulate pupil interest in a subject – the mere fact of getting out of school or having somebody new in the classroom can be motivating in itself."*

(P.12)

Price (1992) looked specifically at the Industrial Ambassadors Programme, launched in Staffordshire, as a pilot, in March 1987 and summarised its aims, which I refer to in more detail in my conclusions chapter. Price's work (1992) had no

effect on my questioning as I was testing the aims laid out by STEMNET for the main scheme whereas Price looked at the aims of the pilot scheme.

### Implications for my research

1. I needed to address the importance of being accompanied for individual interviews, although the corner of the library did provide a good quality recording, without disrupting the library's function unduly. My response to this was to pursue mainly group interviews, as I felt that there was a more vibrant atmosphere in that situation.
2. I needed to look at the theory relating to interaction between interviewer and interviewee. This particularly in relation to the difference between individual and group interviews. Were there aspects of interviewees saying what they wanted me to hear? If so, was that related to their perception of my purpose? If so, should I look at how I introduce my self and my purpose?
3. I clearly needed to concentrate on greater depth and less breadth. Identifying factors, which contribute to successful practice and/or hinder such was more likely to be the most generalisable findings that I could hope to obtain.
4. I needed to look for different models. In this case a once a year session gave the students no personal relationship with the ambassadors or others from business.
5. I needed to include a co-educational school in my sample.
6. I needed to explore the definition of an ambassador and how that role differed, if it did, from other business people working in schools.

I did not feel that the use of full transcripts was justified and decided to use digital recordings of all interviews in my research. This would enable me to extract the data needed and code it accordingly.

### Sample selection

Following my pilot study I searched for different models of ambassadors working with students. In the pilot a once a year session gave the students no personal relationship with the ambassadors or others from business. Models of ambassadors working in the classroom, mentoring or guiding individuals in a subject specific or other way as well as ambassadors being directly involved with teaching staff in planning and delivering activities were being sought. I decided that talking to the brokers, the SETPOINT county co-ordinators would be the most efficient way of obtaining this information.

I needed to include at least one co-educational school in my sample and ensure that my sample was as balanced as possible. I was also aware that my fieldwork would be in schools where good practice was, at least in some part, evident. It was unlikely that I would be invited, let alone welcomed, into a school where the ambassador scheme was not operating, or operating poorly. I wanted to identify factors which worked against the effective operation of the scheme and these could only, therefore, be obtained from the co-ordinators.

Chronologically this fitted well, as my fieldwork was to start in September, enabling me to use August to visit county co-ordinators and evaluate the information gained from them to formulate my final sample.

### Implications for my methodology of interviews with county co-ordinators

The most important information that I gained in this series of interviews was in relation to the profiles of the registered SEAs and also, perhaps more importantly the models of activity that they were involved in. All these would impact on my work in schools and enable me to focus my questioning in relation to the model of delivery used.

I was also keen to involve both genders in my research as my pilot study had been in an all girls school, with identified issues related to the perception of

engineering as a subject and career from the students, parents and school. I did not want gender issues to be a major part of my research although I was aware of some of the implications.

My final sample, compiled with the help of county co-ordinators and with the criteria from my pilot study, foremost, consisted of:

An all girls selective school (School A) in Essex, where I would look at the model of an ambassador working with a small group of students on a very regular basis and in a strictly curriculum focused way. This school also had taken a stance of positive discrimination in favour of having engineering in the curriculum designed for the most able 20% of the population.

A mixed comprehensive school (School B) in Cambridgeshire, designated a specialist Technology and Mathematics and Science where both sexes were involved in variety of education industry initiatives. The school was very committed to such links.

Two mixed comprehensive schools (C and D) in Suffolk using the Passport2success programme as a focus for SEA work. One of the schools was using it in a curriculum based way, involving Engineering students whilst the other was putting mentorship first in a non curriculum based way. The scheme involves using ambassadors on a one-to-one mentoring basis and a fuller explanation of the scheme appears in the section on interviews with county SETPOINT co-ordinators.

## **A Summary of Fieldwork**

### What Fieldwork do I do?

I met with the SETPOINT co-ordinators for Hertfordshire, Cambridgeshire, Essex, Suffolk and Norfolk.

### School A context

(School A) All girls selective school. The school had made a considered decision to discriminate in favour of engineering as a subject by offering 'AS' Engineering to year 10. I spoke to the Deputy Head responsible for this initiative. I was keen to know how it had been 'sold' to parents as my pilot study had indicated that they were the group most likely to be difficult to persuade. A school governor, both an engineer and female, spoke to the students in year 9 before they chose their options. The option was made available to a group of the most able students and 13 had opted in favour. The subject was made available to all students in year 10 and 15 took the subject of AS level Engineering.

I visited a lesson and observed much of it. During the lesson I focused on the group of 4 girls who were working with the ambassador, who worked for Network Rail. I was able to speak to the class teacher, who was also Head of Department, before the lesson and the Ambassador. During the lesson I spoke to three of the four girls in an area off the main workshop and was able to record their responses to my questions.

The ambassador had set a challenge, after discussion with the class teacher, suitable for Unit 3 of the AS level Engineering course. It was 'to develop a means of detecting the presence of a train as it enters a section of railway track and register when it leaves.' The students then interpreted that challenge in individual ways and used the ambassador as a project adviser. He attended lessons at least once a fortnight and had made his e-mail address available to the students for any questions in between.

### School B context

School B was a mixed 11-19 comprehensive school of around 1750 students. 300 of those are in post 16 studies. It served a small town together with a host of surrounding villages and rural settlements. It was a specialist technology

college with Science and Mathematics also specialisms, as well as IT from a community aspect.

I interviewed a mixed group of 4 girls and 4 boys from years 9 and 10 who talked to me about their 'Robot day'. My second interview was with the subject leader for Technology. My third interview of the day was with a year 12,, who had been influenced by work done in his own years 10 and 11 but had also acted as an assistant ambassador on an activity day. I followed this with two further interviews with groups of three. They were all male and were both years 10 and 11. A similar aged group, but all female, followed after lunch and my day concluded with an interview with the assistant headteacher whom I had met at the start of the day.

#### School C context

(School C) A mixed comprehensive. I interviewed students and mentors involved in the Passport2success scheme instigated by the county's SETPOINT through the EBP. Strictly this scheme did not limit itself to SEAs but mentors, who had similar but slightly less training are involved as well as fully trained SEAs. These mentors, in this case from British Energy and based at the nearby power station, worked with an individual student for a period of 12 weeks. There were currently 13 year 10 students on the scheme. The mentors were offering subject specific support to the engineering course but widened their input into careers and 'employability' issues.

I met first with the teacher in charge of the Engineering course that used the mentors as an integral element and the member of the support staff who had direct contact with the ambassadors and organised the liaison. During the day I met three groups of students, totalling 10 in all. Of these nine were male and one female and all were year ten. I also met two of the mentors from British Energy.

#### School D context

(School D) A mixed comprehensive. I initially met with the Deputy Headteacher in charge of the curriculum and the member of support staff responsible for liaison with the mentors and the member of the support staff who

had direct contact with both mentors and mentees and ensured the smooth running of the interaction.

Business mentoring had begun at the school in the academic year 2006 – 2007 and targeted a small group of students who were underachieving academically and presenting some behavioural problems. The school concluded, after a year of the programme that the scheme should continue as it played a part in raising the self-esteem of some of the students and contributed to the increased self-confidence needed to become more engaged and successful learners.

I met with two groups of year 11 and a mixed year 11 and year 12 group. The total number of students seen was 7. (One year 12 boy and 3 girls and 3 boys from year 11.) I then spoke with another mentor and also with the mentoring Manager of the county SETPOINT/EBP responsible for the Passport2success scheme. My day finished with feedback to the two school staff.

Table 4

Tabular summary of interviews

School	Staff	Ambassadors	Male students	Female Students	Total students
P	2	1(by e-mail)	0	9	9
A	2	1	0	3	3
B	2	1	9	4	13
C	2	2	9	1	10
D	2	7	4	3	7
TOTALS	10	11 + 1	22	20	42

I also interviewed 5 county-SETPOINT co-ordinators giving a total of 26 (+1) adults and 42 students

Analysing the data

Following my pilot study I had transcripts of all interviews produced professionally (see appendix 7). I decided that full transcripts gave me no more than a careful interpretation of the recorded interviews. I was, after all, able to listen to these interviews as often as I wanted allowing me to pick out key comments well after the interviews had taken place. It was crucial, however, that these notes were made as soon after the interviews as possible. To this end I listened to each digital recording of an interview as soon as possible after it had taken place and made detailed field notes, including some key quotes.

I then did an initial coding of my notes, according to their relevance to my aims, or to any sub-aims that were to develop. This was done electronically, by colour. For instance all sections of text in my field notes relating to my aim about career pathways were coloured green. This enabled me to cut and paste to produce sub sections related to each aim and sub aim. (Obviously some text appeared in more than one section).

This made saturation easier as any text that was not coloured posed the question, what is it there for? Or what is it telling me?

This method fitted with my combination of grounded theory and analytic induction summarised earlier. My sole hypothesis, that all ambassadors were in fact teachers was being interrogated, and the more open evaluation of the effectiveness of their work was also developing. As my data analysis continued I saw no need to change either my hypothesis or my aims but three sub aims were emerging. The first was an analysis of the different models of practice in the way ambassadors were used in schools.

A further issue to arise was the identification of factors inherent in successful practice and, by implication, absent from unsuccessful practice and a third was 'Who and what are ambassadors?'

## CHAPTER 6

### Findings from Fieldwork

**Aim 1. To investigate the impact of the ambassadors, both directly and indirectly, on students' perceptions of their learning. *Is learning enhanced (added value) by the presence of the ambassadors in the classroom/laboratory?***

*“SETNET’s function is to ensure that young people have a positive attitude to STEM so that they are more likely to choose STEM careers, at all levels, or recognise the value of STEM in the modern world. IT achieves this in two ways. One is by bringing science, technology, engineering and mathematics activities, experiences and excitement into classrooms throughout the UK, enhancing and enriching the national STEM curriculum. “*

*(SETNET Aims and Objectives. [www.setnet.org.uk](http://www.setnet.org.uk) 2007)*

The first of these aims focused on student learning and specifically on students' perceptions of their learning. Clearly the comments from students during my fieldwork are crucial to this theme of my work. The quotes from students are intended to be illustrative of opinions and generally representative of their views. Where comments are individual or not representative that is stated.

**There is no doubt in my mind that the ambassadors (mentors) were having a significant positive impact on the students' learning and attitudes.**

The key question, however, was what impact? Learning was clearly enhanced when ambassadors were involved in classroom, or classroom related activities.

In my pilot study the responses I got strongly suggested that students enjoyed interaction with adults other than teachers. I received a generally positive view of the 'Insight into Industry day'.

*“Yes, it was alright, it was fun”*

*“It was really good, we saw so many different aspects of work...you realise how different everybody’s jobs are, how important they are.”*

This was a day when a variety of professionals working in the STEM subject areas (Science, Technology, Engineering and Mathematics) came into the school and put on workshops for year 9 students. The workshop on banking was the least popular and this seemed to be because of the less ‘hands-on’ approach taken during it by the students.

*“It was quite fun but the banking was boring.”*

*“I liked most of it but I didn’t really like the banking, it was a bit boring.”*

*“The banking wasn’t reality, it wasn’t happening there and then.”*

My interviews with the staff responsible supported the students’ views. They felt that working with industrialists helped the students and so motivated them directly. There was, however, a very clear staff view on what the ambassadors were bringing to the classroom. There was no intention for the business people to be involved in learning in a curriculum sense. *“I wouldn’t see their (ambassadors’) role as bringing anything to the learning. I see it more as bringing an awareness of careers,”* was a quote from one of the organising staff showing an honestly limited expectation of the purpose of the day.

The Ambassador who co-ordinated the day felt that he, and his colleagues, were aware of the need to apply student learning to real life situations. In an e-mailed response to my questions he wrote, *“there is a need for pupils to be able to apply their learning to real life situations.”* It is probably that the definition of learning is different in the minds of teachers and non-teachers. The teachers think of learning as one of meeting and understanding new concepts, of acquiring knowledge in a curriculum coverage sense whilst the ambassadors see learning as applying knowledge.

This fitted well with Gifford and Howden’s (1992) take on Education Industry Links where they identified the experience of a different kind of learning as one of

their fourteen benefits for students in pursuing such liaison. I looked for further evidence of this in my research.

The ambassador in school A, working with a small group on a specific engineering problem was giving practical advice and support on a project that formed part of the students' assessment for examination. In school A I was only able to speak to three students and their individual feedback was similar to each other. They found it very useful to have the ambassador with them in class and the e-mail contact in between visits was excellent. It was unanimously felt that the reality of the problem was a motivating factor.

*"yes, he's given me ideas about...that I've never heard before."*

*"He's helped me with the development of the idea".*

This ambassador was clearly having a positive impact on the group of students with which he was working as the comments above, from two of the three students showed. His specific knowledge of the problem was a great benefit to all the students. He was enhancing learning both in and out of the classroom by his availability, through his regular presence in lessons working with the small group and by his willingness to answer questions by e-mail.

School B, with a wider model of industry educational links was exerting a more subtle influence on the students. The impact was indirect but identifiable in the school's ethos, which clearly involved putting learning into context. In my interviews with students in school B I found the effect on student attitudes to STEM subjects was also limited with only one boy admitting that his educational priorities had now changed. Others suggested no change. They did identify quality of teaching as the major factor in enjoyment of science.

*"One of my teachers isn't as good as the other one, she doesn't explain things in enough details"* was how one student put it but three or four others made similar comments.

The number of different teachers and resulting gap between lessons can be a problem.

*“We have a lot of teachers and one we have once a fortnight so we forget things...so we have to spend fifteen minutes going over what we were doing.”*

The students also identified some attempts in Mathematics to make it relevant to the world of work.

The ambassadors in school B were having a far greater indirect impact than a direct one. The school’s commitment to putting STEM subjects into context was demonstrated by the allocation of a senior member of staff and resources to this initiative. This involved many industrialists in a variety of roles, both in their own workplaces and in school. This commitment had clearly transmitted to the students who appreciated the school’s efforts in involving local companies in their learning.

*“She tries to help us and where we might need it.”*

*“In graphics we design things that companies actually would use...”*

The role of the predominantly school led initiatives was to contextualise learning. Application of STEM subjects enhanced the learning process and visiting scientists and engineers gave a variety of input greatly valued by the students. This reflected my findings in the pilot study in terms of the type of learning that took place. I found that the work of the ambassadors was contextualising learning by encouraging students to apply previously attained knowledge to practical situations rather than accumulate new knowledge.

The mentors attached to engineering students in school C were making a difference to the students’ attitudes to school in general as eight of the ten students interviewed gave a clear indication of that in their responses. . However it was in school C that evidence emerged that the ambassadors were having a greater influence on confidence and communication skills than on curriculum issues. Students at school C all felt very positive about their mentors and grateful for their input, although one student did state a preference to be doing ordinary lessons.

This was the exception and reflected some reluctance on the part of the individual student to participate in the mentoring scheme. The majority used the words confidence and self-confidence regularly. More than one of the students identified the specific support with presentation skills and in producing quality projects on time as of particular benefit.

*"...because they've done it, they've done things before that you've got to do."*

*"They explain it better and help you to understand it."*

*"My mentor helped with my presentation"*

were typical quotes and the students felt that their presentation skills had permanently improved because of their mentors.

There was a positive feeling about school generally as the scheme helped the students to focus on their academic needs, although one expressed concern about missing an engineering lesson.

*"It's like anything in life, if you really want to do it, nothing stops you."*

*"It helps me a lot..."*

*"It helped me in other ways as well..."*

This was the effect that one student reported about his attitude to engineering now. He was determined to do it and he knew what grades he needed.

*"I'm like, more head down in maths now, but I really don't like maths."*

More than one student identified the role of the mentor in identifying what grades were needed to follow the appropriate further education pathway to the chosen career. Focus and confidence are emerging as key concepts.

Thus, my interviews in school C indicated that the mentors were having a direct impact on the students' progress through their engineering course. All but one made comments to this effect. The impact was generally outside the curriculum

confines and impacting on wider skills such as communication and presentation skills. The influence on confidence was a major finding.

*"They tell you what you can achieve in life, it's made me more confident."*

*"I'm not so stressed any more."*

Whether this continued after the mentoring programme was completed could not be definitively established but my research suggested that, in most cases, some long-term boost in self-confidence would result.

In school D the overwhelming impact of the ambassadors was on behavioural and attitudinal facets of the students' education. In the school, which operated a similar model of contact between student and ambassador to school C, with a difference in the selection of students chosen to receive input, the following student perceptions about learning emerged.

Increased confidence and self-confidence was demonstrated in various ways. In one student it was through the confidence to obtain and then keep a part-time job. Confidence was a consistent theme in assessing the Passport2success programme. The students showed a positive and focused attitude towards their studies generally as the sessions with their mentors had put their personal aspirations and goals into the context of what the curriculum was attempting to deliver for them.

*"She's changed my attitude to school because I know there are things I haven't got an option in."*

*"It made me become more organised in my work, in my planning and my revision."*

Help with coursework and projects were reported as a positive factor.

*"He looks through my work and helps me with it."*

It also helped them with target setting and goals.

*"She (my mentor) sets me targets."*

In summary my interviews with students in school C gave me the feeling that they felt that their mentors had helped them with deadline meeting and organisational skills in general. It helped them put school into perspective as a key and present part of their life, but not their whole life. They tended to become more forward-looking and not just pre-occupied with the present.

These findings enabled me to develop the earlier generalisations about learning types. The apparently clear divide between applying knowledge, which appeared to be something the ambassadors were consistently doing, and accumulating knowledge, which had seemed to lie in the teachers' domain was somewhat muddled. The advancement of curriculum knowledge still appeared to be out of the realm of the ambassadors, except where specific engineering projects were concerned, but there was clear evidence that non-subject specific skills, such as communication and presentation were being taught through the work of the ambassadors, yet it only manifested itself in a situation where one-to-one contact between student and ambassador was the core of the model. It could be argued that these were not new skills but that the mentors had increased the confidence levels of the students to such an extent that they had empowered them to use skills that they had previously lacked the confidence to use.

**Aim 2. To critically analyse the roles played by these industrialists in the education of young people. *What role do industrial visitors play in the learning process? Are they teachers per se?***

*“Teaching is what is technically known as a polymorphous activity. It quite literally takes different forms”* (Peters, R. 1973. P.165)

The second of my aims focused on the role of the ambassador within the learning situation. Indeed it led the subsidiary question, are the ambassadors teaching?

Teaching is characterised by having a point or purpose. Teaching as an activity is intentional whereas learning can be unintentional. Peters (op cit. P.166-167) argues that schools are only concerned with intentional learning and, in the modern day assessment-led curriculum it could be argued that this is because intentional learning can be measured against aims. However learning, though sometimes unintentional, is also a polymorphous activity and can be defined by intention or some specific achievement.

**In all the schools, with their variety of delivery models, the student-ambassador relationship certainly had flourished, bringing a variety of benefits to the young people involved as well as satisfaction, and a degree of personal development, to the ambassadors.**

The roles of the ambassadors varied. This was by design (see methodology) and I attempted to reflect the variety of delivery models in practice. In school A he was acting as a curriculum adviser whereas in schools C and D, through mentoring roles, they were being critical friends, supporting student development in a much wider sense. School B's model gave the ambassadors the role of subject expert, bringing specialist and up to date knowledge to help the students contextualise their academic learning. This also had an added positive effect by bringing contemporary experience of the engineering and science world to teachers.

Were the ambassadors teaching?

*"A teaching activity is the activity of a person whose intention is to bring about learning by another person, whose intention is to achieve some end state."*  
(Hirst, 1973. P.171)

Here the definition of teaching is tied to the definition of learning. Taking Bloom's (1956) categories of learning which starts with knowledge and ascends through comprehension, application, analysis, synthesis to evaluation, I have identified ambassadors in a variety of situations involved in comprehension, application and some degree of analysis. In school A the ambassador was encouraging all three in his students by asking practical questions and giving

problem specific probes. In schools P and B the model of delivery was designed to enable students to apply knowledge previously gained. The basic form of intellectual endeavour, knowledge, seemed to lie almost completely with the teachers as do synthesis and evaluation. The noted exception to this is the ambassador in school A, who was working with a small group on a specific project. It should be remembered, however, that these were very able students who would be working at the higher ends of this spectrum for a greater proportion of their time and the work was in the classroom, under the overall guidance of a teacher. The needs of the student, or group of students, involved cannot be ignored in assessing the role of the ambassador in the learning process. Slavin's (1991) analysis of the needs of the learner names motivational needs; physiological needs; safety needs; belongingness and love needs; esteem needs; need to know and understand; aesthetic needs and self-actualization needs and the different models addressed different needs for students.

In all cases the ambassadors acted as role models, either consciously or not. They received unanimous respect from the students, even in the case of the student who had not engaged with his mentor or the scheme. In a world where young people are often accused of lacking respect the reasons why this occurs is fascinating. The comment from the student in school B about visitors getting immediate respect from students was important. There could be a number of reasons for this. It could be that all adults get a 'honeymoon period' in which they are listened to and not challenged as is often the effect of a new teacher with a new class. Is this a period of testing the relationship, with students wary of the adult response to challenge or is it that respect is there to be lost, at odds with the expression respect must be earned?

Another explanation is that anything that 'disrupts' the pattern of schooling was perceived as positive by the students. Their responses indicated that an element of this was prevalent. A third possibility is the nature of the relationship between ambassador and student and its inherent differences from the student's relationship with parents and teachers. This was particularly obvious in the student mentor model in schools C and D. The relationship between student and

ambassador is non-confrontational, often with mutually agreed rules. Many students, especially those who underachieve, feel they are constantly in conflict with their environment, namely home and school.

So I suggest that a combination of change of routine from the normal school structure together with the short term nature of the relationship and the fact that it was built on lack of confrontation enabled the student-ambassador link to flourish.

*“Better conversations...”*

*“It’s not like you and the other kids, it’s just you and your mentor so you get individual attention”* were two typical comments from pupils in school C. An ambassador working in the same school said,

*“In the first meeting you try and define the relationship, the boundaries.”*

In all the circumstances I had investigated it certainly had flourished, bringing a variety of benefits to the young people involved as well as satisfaction, and a degree of personal development, to the ambassadors.

In my pilot study I got the feeling that the school had made science more ‘applicable and relevant’ in year 9.

One student said, *“Well I didn’t always like science but I kind of think I’ve had a kind of more broader aspect of it this year because of the industry day and just the teachers. They just kind of made me realise that science isn’t just a subject in school and like there’s a lot more you can do with it once you leave school.”*

It appeared that the students in school P perceived that the industrialists had an effect on the attitude of the teachers in making science more relevant but I suggest that this was due to the nature of the curriculum in year nine as compared with year 8.

Industrialists involved in the ‘Insight into Industry’ day were seen as positive role models. They were seen as successful in their chosen career. They were also

seen as enjoying their jobs, a factor that was seen as important. They were also seen as distinct from teachers.

*“... they weren't really strict. They were ...letting us have our opinions and say what we thought as well”.*

The fact that the ambassadors had given up the time to come into school was appreciated.

The lead ambassador in school P suggested some intent in his work. In his opinion Industrialists brought 'up to date' information to the classroom, new technologies and new innovations that neither staff nor students may be aware of. He also identified learning benefits for the ambassadors, giving as an example that learning to present to an audience was good development for a young engineer.

In school A the students, who were working with the ambassador on a specific project that he had helped them to design, were very appreciative of the direct role he was playing in their assignment. This assignment was a key element of their GCSE Engineering course.

*“He gives us the ideas...and he has helped me when I want something checked. I'm not familiar with this area of work”* was the comment of one student but typical of all three.

It was the specific link to Network Rail and the specialist nature of the problem that made him so valuable to the students. This was almost inevitable, given the way he was asked to set the task, but extremely useful and relevant to the course being followed. The ambassador acted as an adviser rather than a teacher. The teacher had taught the skills, the ambassador was helping the students to apply them correctly, and to question their practicality in presenting solutions. He definitely brought an attitude of economic realism to the academic solutions that the students were offering from their more academic experience.

In school B, the students were positive in their views of the ambassadors involved, with only one exception.

*“...very helpful and knowledgeable”,*

*“...plenty of ideas to help us improve our work”,*

*“...enthusiastic”*

were three typical comments from students who had taken part in events involving ambassadors.

In comparing the employers with teachers, they were again very positive about the ambassadors and others from the business world. Cynically it could be seen as being negative about teachers. Examples of comments about the adults from the business world were,

*“...more specialised”,*

*“...more up-to-date knowledge”,*

and *“teacher’s experience is longer ago”,*

suggesting that they perceived teachers to be, quite logically, less up to date with specific business practice and less specialised in their knowledge. There was also the same perception that the ambassadors came with a very pragmatic approach to problem solving, that there had been in school A.

*“...business people were always talking about the costings of our work.”*

Interesting comments were made about the respect given to the ambassadors who were considered,

*“...kind and helpful.”*

One student commented that if an employer came into school students would listen initially. This comment was quite philosophical on further enquiry as the student’s perception was that they would listen to anybody initially, teacher or other, and that many teachers were not listened to because of familiarity. Was this a case of familiarity breeding contempt? This opened the possibility of a whole new study on the relationship between teachers and students that was beyond my

remit. It did, however, give further justification for using adults other than teachers in the education process.

In school C, which was using the ambassadors as mentors for a group of students studying engineering and where students met ambassadors on a one-to-one basis the comments reflected this methodology.

*“You can say how you feel and if you don’t get it, whereas if you’re in class the whole class will take the mickey.”*

was a comment from one student showing an appreciation of the confidential nature of the dialogue. It may also reflect that this student was lacking in self confidence and was aware of his fellow students’ perceptions of him in a negative sense, which reflected his lack of confidence.

The mentors were respectful of the students’ feelings and advised well on what can be achieved in life and how. Also the one-to-one aspect was appreciated in terms of the individual attention received. A student summed this generally held opinion up well,

*“It’s not like you and the other kids and the teacher. It’s just you and your mentor so you get undivided attention throughout the lesson.”*

Both these comments are indicative of a need for individual attention and the students selected for this programme were ones that underachieved in a large class situation.

School C had attempted to enable e-communication between students and mentors with varied success. Three students had used the E-mentoring that had been set up by the school, where messages were routed via the school to ensure security, but meetings were weekly and most did not use the electronic system. Only one student felt that it was very useful and a “great” idea. The mentors in the school were fulfilling a teaching role in terms of the application of knowledge based on a sound academic grounding. However the nature of the students involved ensured that a life skills curriculum was being pursued through the mentoring.

These were under-achieving students with low self esteem and low self confidence and had been selected for participation in the scheme because of that. Also the structure that the Passport2success programme gave the mentors encouraged them to discuss life skills in the context of the individual student's own experiences. This was a strength of the scheme. Indeed the programme almost prescribed a life skills curriculum enabling the mentors to naturally impart skills gained from experience of life as well as experience of engineering per se. The role of the brokers (SETPOINT through the Education Business Partnership) was key in providing the structure that was making mentoring so effective as they were responsible for structuring the scheme and training the ambassadors.

School D, which was also using ambassadors on a mentoring basis but not subject specific produced similar comments from students. They liked and respected their mentors, both as people and as professionals. The fact that mentoring was one-to-one made the sessions successful as any peer group pressures were removed and comments could be made without worry. They all perceived their mentors as 'friends' with a representative comment being

*"...more of a helpful friend"*

This resulted in an ability, on the students' behalf, to be open and honest.

They liked the agreement of ground rules and the lack of confrontation.

*"In the first session we put down what you can do and what you can't.... we sat down and we both signed it."*

#### The Ambassadors' views of their roles

The ambassadors also commented freely on their perceptions of their roles. The ambassador seen working in school A, liked to see motivated youngsters bringing a project to completion. He was more than happy to write project brief as it ensured that the students were working on an area in which he had expertise. He also expressed his gratitude for the support of his company in allowing him to have a regular input.

In school C the one-to-one meetings were positive. The ambassadors were pleased to be able to help with communication skills, which were obviously an issue with this particular group of students, who were, on average, in the lower half of the ability range. One had started helping students with a project that involved a presentation and saw how much difference successfully completing this task meant to the individual students. This made him volunteer for the passport2success programme when the chance arose.

The ambassadors saw themselves as neither teacher nor parent.

*"I'm not going to tell you what to do, I'll coach you, I'll advise you, I'll ask you what you think but at the end of the day you've got to work it out for yourself, it's your decision"* was a typical comment. In response to my question, *"why do you do it?"* to ambassadors in school D these were two responses from two staff with one particular employer.

*"I'm passionate about school liaison. Before this scheme I was involved in work experience, mock interviews, and skills days."*

*"Passport2success is a brilliant scheme."*

They cited examples of individual students being 'turned around' by mentoring, particularly in terms of attitude. They were sure there was mutual benefit and felt the scheme could involve more junior members of staff. It definitely *"helps you to develop your own inter-personal skills."*

When asked what they felt they brought to the development of the young people that teachers couldn't, the ambassadors used words such as *"an outsider's point of view."*

*"The development of an individual in relation to jobs and careers."* said an ambassador in school about his role. *"I'm helping him to deal with different situations."* said another.

They did feel that they re-enforced what the teachers were saying most of the time. They felt there was an attitude from the students of 'you're only a

teacher, what do you know?’ The ambassadors felt that they had the credibility of having ‘been there and done it’ in employment terms. Students did listen even to little things like *“tuck your shirt in”* and when the students took advice and saw that it worked the mentor’s credibility rose. They brought an independence from school and home to the meetings.

A mentor working in school D commented thus: *“The students see you as someone who is not part of the school...There’s not an us and them syndrome. I think you’re viewed as an independent person and you can have discussions that would be more difficult with a member of staff.”*

The mentors saw themselves neither as parents nor teachers, but brought an independence from the attitudes that students may have had towards either group.

*“I volunteered my time. We try to build a bond...I’m not as judgemental as a teacher. I’m not going to mark them down.”*

*“It’s more of an adult –adult relationship.”* were two independent comments from ambassadors in school C. They realised that the line between education and welfare issues was often crossed and that the training had prepared them well for this. This line was crossed more often and more comfortably as the relationship developed. They were often giving reassurance and that was something the students did not always receive from parents. They felt that they brought an outside and up to date view of the world of employment.

*“I am able to bring a degree of impartiality and non-judgemental approach to it.”* Rules are negotiated not dictated and this gave them a non-confrontational standpoint.

*“We don’t see the child in trouble, like teachers do.”*

The mentoring took place in an unstressed environment. One suggested that an initial lack of familiarity was an advantage.

*“I’m not your teacher, I’m not your parent. I’m an adult with experience. I’m not going to tell you what to do. I can coach you and I can advise you...at the end of the day it is your decision.”* Was another’s attitude towards his mentee.

The ambassadors all got personal satisfaction from their role as mentors and felt that the students valued what they were doing. Feedback from both students and schools had been positive. On the subject of boundaries ambassadors were happy with their freedom.

*“They don’t easily disclose personal things, but it’s up to them to lead.”*

There was an opinion put forward that the success of the scheme would result in demand for mentoring outstripping demand for it. The ambassadors were happy for schools to select the students who would gain most benefit.

*“They see you as someone who is not part of the school...they view you as an independent”*

was a comment from an ambassador who felt that his first task was to build up a picture of the student’s plans as well as building a relationship.

Interestingly teachers were often reluctant to comment on the role of the ambassador, although I did receive these comments. In school B a teacher gave the assessment that the role of teacher and role of engineer were perceived as quite separate by students, even if the teacher was an ex-engineer and the ambassador engineer was retired.

However, all the schools involved were actively using ambassadors and staff stated their confidence in the ambassadors’ work and influence on the students. I received no comments from staff suggesting any negative issues arising, other than the problem of taking students away from other things to take part. Ambassadors were actively involved in learning though not, in most cases, teaching. A sporting analogy would be the difference between teaching and coaching. A teacher gives the learner the basic skills and knowledge whereas the coach enables the skills to be appropriately and effectively used. I feel that ambassadors were more coaches

than teachers enabling students with a variety of levels of knowledge, from the high flyers in school A to the under-achievers of school D, to apply their skills appropriately and with confidence. Where skills needed revising that was done but it was in the practical application of the skills that the ambassadors specialised.

**Aim 3. To investigate whether the work of the ambassadors was influential in the students' option choices and/or achievement at 14 and post 16. Does the work of the ambassadors inspire the young people with whom they work to take the subject(s) to a higher/further level of study?**

The third of my aims focused on the influence of the ambassadors' work on student option choices and/or career choices. This is clearly the most important for SETNET whose mission statement is,

*“Through partnership working, make an impact on the educational added-value and career choices of all young people, by demonstrating to them, their teachers and other appropriate professionals, the relevance of STEM in today's world and the superb opportunities it offers.”*

*“SETNET's function is to ensure that young people have a positive attitude to STEM so that they are more likely to choose STEM careers, at all levels, or recognise the value of STEM in the modern world. IT achieves this in two ways: The second is by linking those companies and other organisations who employ STEM-educated people, with schools, in such a way that young people can get a clear idea of the diverse range of careers available to them”*

*(SETNET Aims and Objectives. [www.setnet.org.uk](http://www.setnet.org.uk) 2007)*

**I found limited evidence of the scheme having any influence on option or career choices.**

In Stagg's (2007) section on career choices at year 9 he quotes a very relevant paragraph from a document produced by NFER for the Engineering and Technology Board (2005)

*“Students generally appeared to lack knowledge about the variety and range of SET careers, and understanding about what they might involve. (They did not) realise that engineering, for example, involves skills and knowledge that they already had or would like to acquire, and that its study can lead to an interesting and fulfilling career. This also applies to career opportunities for scientists and technologists”. (p32).*

Working with ambassadors had given students a much better view of the range of careers available in engineering. Exposure to a variety of inputs as in schools P and B had enabled students to see individuals who had chosen a STEM-related career path and had successfully followed it. In schools C and D the mentors had given the mentees a wider view of possible options, either re-enforcing previously held views or causing students to question them. It was the timing of such knowledge that I questioned in its ability to effect careers choices in the students.

In school P one student respondent said that the industry day had motivated her to work harder in science and mathematics. There was also a feeling that the role of girls in science and engineering was under-rated. There was a definite feeling that being given construction type tasks was redressing a balance in a gender oriented career area. This was most prevalent in the group interview, where the gender issue was more often mentioned, although one individual referred to it showing women in business.

Most of the interviewees had gained an insight into careers in science and engineering but only one expressed a desire to pursue such. She was very interested in marine biology but her motivation came more from her passion for water sports than any input from industry.

*“It’s just that I feel there are other things that I’m more interested in.” More typical was “There are other subjects that I prefer to Science.”*

In school A the students did not see engineering as a career path but had opted for the course for its difference to their other subjects and to *“get an idea of*

*what it was like*". They clearly saw something different as a challenge to their intellects, a challenge that the SEA was helping them to meet in a very practical way. It must be borne in mind that this was a very able group of students.

When students in school B were questioned about the influence on possible careers I could find little evidence of impact. From the interviews I carried out I formed the opinion that those who were considering/doing engineering had decided before the days and similarly those who weren't. The work with ambassadors had reinforced choices and had no negative effect.

*"It made me consider it as an option, but.."*

*"I know what I wanted to do..."* were two representative quotes from students in school B and reflected a similar point of view to those expressed by the majority of students in school P.

The connection between engineering and the armed forces as a way of learning was mentioned at least twice.

The students' concepts of what an engineer did and was were varied.

*"It can be fun," "there are lots of types of engineers."*

The work had, however, clearly broadened their idea of what engineers do.

*"It opened my eyes."*

It was still seen as a hands-on subject. One student who was intending to do science 'A' levels but not engineering gave this rationale,

*"...because I'm not very good with my hands."* All four girls interviewed in school B had a generally narrower view of engineering, associating it mainly with cars, engines and males.

Little evidence was found in school C of the work having any influence on option or career choices although one student now had the confidence to consider

a sixth form course, because of success at this level. The nature of the students selected for this programme was such that they had opted for it because of their limited academic skills and the career choice came before the programme not because of it.

In school D the sessions had widened the career planning options of some students although not necessarily in any of the STEM subjects. This often resulted in giving alternatives to a pre-conceived idea, although in some cases giving more conviction to a vocational idea.

*“I am thinking of going into the police force and my mentor got me information about it and about PCSOs (Police Community Support Officers). He helps me to find out information about careers.”*

Teaching staff in school P saw the scheme more as a careers guider through the delivery of ‘industry days’ or talks. The days had an awareness-raising theme of possible careers in engineering. The concept of the business people as role models was equally important. Despite this the take up for ‘A’ level Physics is low, even compared with Biology and Chemistry. (This reflected national trends). In school P there was no intention for the business people to be involved in learning in a curriculum sense.

*“I wouldn’t see their (ambassadors’) role as bringing anything to the learning. I see it more as bringing an awareness of careers”* said one of the organising teachers. The interview with students suggested that this aim was not being achieved. The timing of the input in the students’ lives was the major factor for this being so.

In my interview with a faculty leader in school B the topic of girls in engineering was discussed. His feeling was that perceptions will take a long time to change. He identified the absence of media role models promoting engineering as they did food. Inherent in this statement was his belief that the media impact onto a young person’s aspirations. Celebrity chefs were common in the media but where were the celebrity engineers? This had an impact on parents’ attitudes as well as

students. Pre-concepts of girls about engineering and resistant materials existed, despite very positive attitude in school towards DT. Facilities were second to none. Graphics attracted more able students.

The timing of year 9 activity days (robotics) was discussed. The subject leader felt it would be better placed prior to options. He was of the opinion that positive discrimination was needed if engineering is to get the greater numbers it needs to meet national targets.

Ambassadors generally had very clear views on any role they had to boost recruitment in STEM-related professions generally and their companies in particular. They saw themselves as ambassadors for engineering and to some extent their company. *“The way to get them is to get them young through apprenticeship schemes”* said one. His company valued the work being done by the ambassadors with internal awards for staff involved.

*“We need to give something back to the community and if that’s decent training and decent jobs then so be it”* was a comment from an ambassador in school C. This school had close links with major employer whose plant dominated the small town in which the school was sited. One mentor felt that students’ aspirations were quite narrow and this quote from one student in the school supported his argument..

*“My brother’s got an apprenticeship at a local company and that’s where I want to go.”*

In school D the ambassadors responded to the question about being an advocate for their profession and/or company by saying that their company was not to the forefront of their agenda during mentoring but that they would not take part if they did not feel their company was getting some benefit. The engineers working with school D wanted to promote engineering and where a student had shown an interest it gave the mentor a *“more comfortable, environment in which to develop a relationship”*. The engineers felt that engineering needed a higher profile. They did, however, have a much wider view of the scheme as being about life experiences.

One suggested that the original concept had been to promote engineering but it had *“soon become obvious that there was much more to it than that.”* Imparting employability skills was a big part of the work.

My research suggested that the ambassadors had made a real impact in schools in which they operated in relation to knowledge about STEM subjects and the possibly related career opportunities. So what were the barriers to stopping the drift of young people towards philosophy, sociology and media studies that Dyson (2008) lamented?

The first was that a large number of the students that I interviewed had already made choices about the likely area of their career aspirations prior to any contact with ambassadors. The CBI's concern that the decrease in numbers of students applying for engineering courses is partly caused by a lack of persuasive careers information encouraging young people to continue studying science at a higher level may be partly true. It could be better reworded 'a lack of early careers information' as the comment

*“It's just that I feel there are other things that I'm more interested in”* from a student in school P may hold the key to when the intervention takes place. The school B subject leader's concern about having information about STEM careers prior to option choices in year 9 may have been well founded.

Education has been in an era of competition between schools for over twenty years but competition between subjects has been in action for much longer. The key time for choices is year 9 for year 10 and 11 courses and year 11 for year 12 and 13 courses. Many schools have careers fairs and subject information sessions for both parents and students prior to these key decision points. However many have decided that it is fairer to all subjects to keep information (seen by some as indoctrination) to a minimum. The rationale being that the most popular subjects will be the ones that are marketed best and internal marketing is a concern for many head teachers and senior management teams. Internal marketing is constantly present as all teachers want to be enthusiastic about their own specialism and to get their students to share that enthusiasm. My personal

experiences in secondary schools suggests that, in the months prior to option choices, this can intensify as viable group sizes for the next year are sought by teachers.

Option decisions are made on the basis of a variety of information but from my experience in secondary schools of over thirty years the major amongst those are the enjoyment of the subject and the quality of teaching. A number of responses from students suggested that STEM subjects needed to be more interesting and consistently well taught in Key Stages 1 to 3 in schools for the trend in option choices to be reversed. The investigation of this feeling would involve a longitudinal study in a variety of schools, not just ones where good practice was identified in relation to STEM activities. Even where this was the case, as in my research, the activity may be too late to get the numbers opting for STEM subjects that Dyson, the CBI et al are wanting.

**Aim 4. To evaluate the role of the brokers, that is the schools and SETNET.**

***What is the role of the brokers in assuring quality learning experiences for the students?***

My final aim related to the role of the brokers in the work of ambassadors in schools. Education Business Partnerships (EBPs) were set up from the 1970's onwards but were formalised in the mid-nineties when they proliferated and became part of education in all parts of the United Kingdom.

- They aimed to
  - prepare young people for the world of work in particular and adult life in general
  - raise teacher awareness of the world of work and the work-related curriculum
  - contribute to the raising of standard achievement via work-related contents
  - support the business community in its need to create a world class

competitive

workforce for the future

- promote the benefit of lifelong learning

(Extract from my literature review, paraphrasing EBP aims)

**SETPOINTS acted initially as pump primers, obtaining a commitment from both schools and ambassadors. They carried out an important role in training of ambassadors and were involved in evaluation to varying degrees.**

**Schools, where committed, took much of the responsibility for the day to day organisation. They also took an active part in evaluation, particularly in respect of the effect on the students.**

Students were not usually aware of who organised the inputs they received but some comments on the role of the brokers did appear.

In school P the organisation of the day was perceived as good and teachers given the credit for this.

In school A SETPOINT's role had been to set up the school's access to the ambassadors. The school, in this case, had taken full advantage not just inviting ambassadors in, but actively involving them in direct, but well guided, contact with receptive students who were taking full advantage of the opportunities that this offered.

In school B SETPOINT was playing a role in brokering co-operation between the school and local employers but in this case the links were so well developed that the school was controlling their input.

In schools C and D, where the ambassador input was in the form of mentoring the students did not really know the organisational structure but saw the industrialists as giving up their time and knew that someone in the school was overseeing the process. They did, in most cases, feel that it was a direct communication between themselves and the ambassadors.

On this topic the SETPOINT co-ordinator interviews shed more light than the student interviews. All co-ordinators were clearly committed to the SEAs programme and had a variety of ways of running it. In Hertfordshire the programme was based on a few large companies such as Glaxo Smith Kline. The great majority of 'active' SEAs came from a few large companies who grouped employees for project work with schools. This reflected the nature of the industry in the area around Stevenage, where SETPOINT Hertfordshire was based. The co-ordinator's role was chiefly in training of the ambassadors and in quality control. The companies had established direct links with schools and pursued mutually agreed projects.

The picture of Ambassador activity in Cambridgeshire was completely different. The role perceived by the co-ordinator was of supporting small companies and their employees in being SEAs. The co-ordinator allowed SEAs to come up with ideas but had a role in modifying them for school use. She felt that set ideas can stifle student creativity.

In Essex and Norfolk, where day events were the most popular model, the co-ordinators' were there to get both sides on board and then to get them together. There was also a great deal of direct organisation for the days themselves.

The model in Suffolk was different again and a structured model based on one-to-one mentoring was in place. The scheme was called Passport2success. The first role of the broker was recruitment of ambassadors, which was done in two ways. Some individuals approached SETPOINT to offer help but most are recruited by corporate activity. This was SETPOINT being pro-active and running pre-induction sessions in large companies. Following an expression of interest from either of these routes, all potential mentors were interviewed. Successful candidates received a minimum of three hours training. This covered what is mentoring; why schools need mentors; what makes a good mentor; boundaries of mentorship; child protection issues; listening and communication skills and some case studies. Wherever possible, experienced mentors were involved in the training. A 32 page handbook accompanied this training and included headings such as formal v

informal; building rapport; agreeing boundaries; reviewing the relationship and when to end the relationship. Bespoke training in any of the areas was available on request.

The exception to this training model was the training of undergraduate ambassadors, which was longer and included far more on areas related to relationships and the needs of the school.

Prior to the Passport2success programme the county had around 70 business mentors active and these have been brought into the new scheme. The mentoring manager commented,

*“Passport2success has given them more structure. The programme is accessible to all 48 secondary schools in the county and 35 are active participants. There are 102 trained scheme mentors and an additional 63 business mentors who work with schools in other ways. The great majority of these are SEAs and the training for the two is now one.”*

The issue of capacity for growth, in what seemed to be a very successful scheme, brought the response that it was a common thread of feedback from schools, mentors and mentees that an earlier start would be welcome. Year 10 and possible year students could benefit greatly as well as year 11, who formed the majority of those involved so far.

*“We can place as many mentors as we can recruit”* was the scheme manager’s claim but she identified funding for training as the limiting factor. Funding so far had been through the Haven Gateway Programme aimed at the coastal region of East Suffolk.

Evaluation was a role which all Co-ordinators felt that they had, although how that evaluation was gathered was unclear. In the most common model of day events, this evaluation was usually in the form of a questionnaire designed by one of school, company or SETPOINT. The limitations of questionnaires have been debated in my own methodology. The drawback to further and more detailed evaluation was, of course, time. What happened to the evaluation was also unclear

although co-ordinators claimed it informed future programmes. They reported generally good feedback on ambassador schemes but I did not ask for detailed evidence. I wanted to acquire my evidence independently, and mainly from interviews with students. Primary data was more important to me as was entering the research stage with as open a mind as possible on the scheme's effectiveness.

The system of evaluation used in the Passport2success scheme was SOUL (Soft Outcomes for Universal Learners) and involved student questionnaires throughout the programme. These questionnaires addressed three skill areas: Attitude, Interpersonal and Practical. An analysis of these questionnaires resulted in individual worksheets being given to mentors for their session and this information being available to the schools. There was, in this process, a personalisation of learning and an ability to measure the impact of mentoring.

What of the ambassadors' view of brokering? For many, training was the key issue, that is what they felt that they most needed before embarking on any liaison work. In school C the ambassadors were working as mentors for individual students pursuing the technology course. The mentors with whom I spoke were very pleased with the support from their company and enjoyed working with the students. They also found the training satisfactory. *"The training clarified what a mentor is and the expectations of myself."*

In school D, in response to a question about training, the ambassadors felt, with hindsight, that it could have been more in-depth. *"Training told us what the Passport2success scheme was. It gave us the do's and the don'ts, it gave us a folder and that was it."* An insight into what the schools wanted and some techniques on how to talk to young people and coax information from them would have been useful. Those with a Human Resources background felt that they had an advantage over those in engineering.

One company's ambassadors wanted more dialogue with the schools about the 'end product' that was being produced. There was, they felt, a misconception that industry wanted every school leaver to have a degree. They did not feel there was enough opportunity to feed back on the scheme.

In Suffolk, the role of the brokers (SETPPOINT through the Education Business Partnership) was key in providing the structure that was making mentoring so effective. I can only echo the comments I made about this after visiting school C. The structure of the programme enabled mentors to have an identifiable impact on the students' attitude. I have avoided any comments about achievement or attainment, but some of the students involved in the passport2success scheme were clearly going to achieve results at GCSE far closer to their potential than they would without the intervention. However, I am sure that was true for many cases of one-to-one intervention of other kinds. The importance of the messages that all personal intervention gave, that the institution cared, that any potential should not be wasted and that the individual was important are not the sole property of this scheme. This scheme did, however, exhibit those attributes in a very distinct way. The fact that those messages were being given by a third party, not a teacher or a parent who may have had a history of conflict with the individual student, may have given it more power.

Schools too, were involved in the brokering process. There were two clear models. The first was the identification of a member of the teaching staff to oversee industrial liaison. In school B, where this was a senior member of staff, the concept of liaison was an integral part of whole school work across departments. In schools P and A, where the onus seemed to rest on departments it had become an integral part of departmental work. In schools C and D, where mentoring was the key issue, a member of the support staff had been appointed to handle all links with industry, be they mentoring, work experience or other single events. There was unanimous appreciation from ambassadors that where there was one contact in each of the schools they worked with, the liaison was more effective. In schools P, A and B the key brokers were teachers. In school B, in particular, a member of the senior management team was overseeing all industry links. This gave them an increased status within the school as they were clearly an integral part of the school's ethos. In schools C and D support staff had been identified as the link between school and industry, not just of the mentoring but for other links such as one-off events and work experience.

Clearly, SETPOINTS were acting in the role of brokers and their county coordinators perceived that role had been firstly facilitators and trainers, second quality controllers (or quality assurors) and lastly evaluators. All these roles were essential to, or parallel with, their role as fund raisers. The differences in the structure of evaluation differed as the difference in structure of the programmes. The role of all SETPOINTS included the recruitment and training of ambassadors. Ambassadors were satisfied with their training in general and accepted that there are certain aspects of working with young people that you cannot be trained for.

The schools' role was somewhat dependant on their reason for being involved but the general factors identified were as follows: The first was organisation, getting the student(s) and ambassadors together at a suitable time, in a suitable place. Secondly to, prepare the students to make the most of the opportunity. This was not always easy as the conversations between mentor and mentee were confidential and in one or two cases, it had been difficult to keep a record of when meetings had taken place. Thirdly, they assumed a role in quality control (ensuring that the experience was worthwhile). There was a difference in the degree of evaluation. Day events were evaluated by means of a simple questionnaire to students, whereas ongoing mentoring was more regularly and thoroughly evaluated. The role of evaluating its impact on student attitude to school in general was shared between school and SETPOINT. Similar differences emerged in the evaluation done by SETPOINT. Where day events were concerned they seemed content to work with schools (or leave it to schools) in producing simple questionnaires. In the case of the Passport2success scheme in Suffolk the evaluation was more sophisticated and more informing. The other major roles of the SETPOINTS were to get both schools and industrialists involved and to train the ambassadors, as well as prepare the schools.

**Sub-aim 1. To investigate the variety of models of practice that existed and to make an attempt to analyse their different impacts on students**

*Typical activities in which Ambassadors can be involved include:*

- 1. Supporting school activities such as science and engineering clubs*
- 2. Helping with school STEM competitions, events and awards*
- 3. Assisting in extra-curricular STEM experiences*
- 4. Offering mentoring, career guidance or role model examples*
- 5. Helping to provide work-based links for teachers and schools.*

*([www.setnet.org.uk](http://www.setnet.org.uk). 2007)*

**A variety of models existed and was dependent on a variety of factors. The nature of the counties was an initial issue. In Norfolk, for example, 87% of companies are small ones, whilst in Hertfordshire large companies dominate. One-off extra-curricular events were the most common model in most counties but in school A I saw an ambassador working within the curriculum and in Suffolk a structured programme of mentoring was in place.**

In **School P** the one day event per year was the model. A team of staff and industrialists, chaired by an ambassador, met regularly to plan these days. Not all employers involved are qualified SEAs but the events are valued by the students as part of the school's desire to make STEM subjects as relevant as possible to everyday life. There were gender issues about encouraging engineering in an all girls school and my perception was that this was mainly due to parental attitudes, which were not being challenged by the senior management of the school. The SEA had an overseeing, rather than hands-on, role and the links between his company and the school were developed to mutual benefit. It is my opinion that the school were not asking enough of either this company or parents, in widening school industry links.

In **School A**, however, the senior management, supported by a school governor, who was a female engineer, were positively discriminating in favour of engineering. The use of SEAs at this school adds to the popularity and success of the course. The innovative introduction of AS Engineering into KS4 will, I feel, make a difference to some career aspirations as the course was well run and being enjoyed by most of the group. The SEA influence in the popularity of the course was identifiable and the school uses SEAs widely to support students' studies.

The class teacher felt that using the ambassador was an excellent way of delivering the part of the course that needs to involve a real engineer. The department uses a variety of SEAs in a variety of ways. The teacher felt strongly that their presence motivates students and changes routine.

**School B** was committed to high quality school industry links and the ability to deliver such was built on the foundation of specialist school funding. The appointment of a senior member of staff, with adequate administrative backing, together with 'generous' capitation, directly from the school budget, had enabled the school to make a very large number of links with a host of firms across the curriculum but particularly in STEM subjects. The impact on students was not as great as the effort deserves. SEAs were involved in many of the activities, particularly the day workshops.

At **Schools C and D** the success was through the Passport2success programme and the structure it gave to the already established mentoring programmes. It was making a valuable contribution to the education of the students involved in it. The programme was making a contribution to the broader education of the young people improving their communication skills and enabling them to create a clearer future pathway focus in their own minds, which will inevitably lead to improved employment opportunities and a more mature attitude in all they do. I believe it had the potential to significantly change the attitudes of many students and suggest that its effect would only be limited by such issues as staffing and other resource matters.

Even with mentoring there was some discussion over the ideal model. Both schools had chosen a group of students with a commonality. In school C it was the engineering course they were pursuing, while in school D it was a group of underachievers. Business mentoring had begun at school D in the academic year 2006 – 2007 and targeted a small group of students who were underachieving academically and presenting some behavioural problems. The school concluded, after a year of the programme that the scheme should continue as it played a part in raising the self-esteem of some of the students and contributed to the increased self-confidence needed to become more engaged and successful learners.

There was also some discussion about the time scale for mentoring with students, mentors and staff. Many thought 12 weeks was not enough, indeed one of the students in school C was quite nervous about coping without the mentoring.

*“I need my mentor to help me because I don’t understand the questions sometimes.”*

Two others expressed minor concerns about the withdrawal of mentoring. The ambassadors in school C were willing to prolong the input, if required. They expressed a willingness to continue the mentoring with the present students, if asked, but were aware that time limitations were a major factor and that another cohort of students were coming through who would also require mentoring. As for the twelve-week timescale the mentors felt that it was up to them if they wanted to continue after that. They were not aware of any compunction to stop, although they accepted that there would have to be a limit, logistically. The SETPOINT co-ordinator felt that the twelve week period was appropriate both to enable the students to move on but also so that the mentors’ time could be re-allocated.

Two of the seven students in school D commented on the timing of the mentoring in their school life. They wished mentoring had started in year 10.

*“I wish it had been earlier.”*

*“My mentor is quite good at maths and if I had had him before I would probably have done better in my maths exam.”*

Another student from the same school felt that 30 minutes with their mentor was not long enough although the reasons for this may be related to what it was an alternative to. Initially the sessions were longer and lessons had to be missed but it was now registration and tutor time that was being missed. Mentors were prepared to give longer to students but that would mean students missing break time.

**Sub-aim 2. To identify factors that contributed to successful ambassador programmes.**

The second ancillary issue to arise was the identification of factors inherent in successful practice and, by implication, absent from unsuccessful practice.

*“All Ambassadors involved in the programme are volunteers employed across a broad spectrum of STEM disciplines and careers- at all levels. They represent over 1000 different employers, from large multi-nationals to SMEs and other organisations, like the NHS, and the Environment Agency. Many SEAs are also undergraduates studying at universities across the UK”*

*([www.setnet.org.uk](http://www.setnet.org.uk). 2008)*

**The willingness of the schools to involve ambassadors in their programmes was a more important factor than the willingness of the ambassadors to get involved.**

Engaging schools was not always easy. If the ambassador scheme was not working, it was usually because schools had not got involved. One SETPOINT co-ordinator noted that it was sometimes difficult to get schools to celebrate the successes of the scheme. The growth of the scheme would depend on demand and the number of schools requesting ambassadors would be the key. Availability of industrialists willing to become ambassadors was not seen as an issue but the funding required to train such volunteers and manage the programmes, especially with respect to quality control, was.

I concluded that the identification of a senior member of staff within the school is a key contributor to successful business links. If sufficient resources,

including a dedicated administrator, go with such an appointment, the success is more likely. Employers like to have one point of contact within schools and provision of this is crucial. Success is more likely where large companies, such as Glaxo, Smith Kline, British Nuclear Fuels, Port Authorities and Network Rail are committed to the concept.

The structure that Suffolk's Passport2success programme gave was appreciated by the schools and ambassadors alike. However in other counties successful work was being carried out with a slightly different model. One-off days were usually organised by SETPOINTS although School P's Insight into Industry Day was an exception. Regular input from ambassadors was down to schools and often individual members of staff.

It must be remembered that my research was done in schools where good practice had been identified by SETPOINT co-ordinators. It was also carried out in a region that puts the programme at the pinnacle of its activities, celebrating the work and giving full encouragement to schools and co-ordinators alike to get involved. This reduces the ability for the study's findings to be related to other schools and regions. The issue of generalisability is dealt with in the next chapter.

### **Sub-aim 3. Who and what are Ambassadors?**

*"The programme (Science and Engineering Ambassadors) is the epitome of effective partnership...with businesses of all sizes contributing enthusiastic and expert volunteers to serve as role models in schools."*

(Ian Pearson. Science Minister. Reported in the Times. 2008)

Nationally there were, in 2008, 18,000 ambassadors. The government hopes to expand this to 27,000 over the next three years. This announcement came in the speech from which the above is quoted.

**Ambassadors were drawn across the full age range from students to retired engineers. It was generally felt by SETPOINT co-ordinators that mid career engineers were the best role models and the most effective ambassadors.**

The support of companies was vital, particularly large companies who, in some cases virtually ran their own ambassador schemes with schools, with SETPOINT providing the training. In Hertfordshire one or two large companies, such as NAPP pharmaceuticals were involved but most of the 400 accredited ambassadors were from much smaller companies. The age range was large and many were students and researchers from the supportive Cambridge University. This was a major local resource for the SETPOINT co-ordinator.

In Essex there were around 700 registered ambassadors but only an estimated 250 were active. Two large companies were responsible for much of the work. Ford and Glaxo Smith Kline were both very supportive of their employees' involvement in the scheme. Students were little used as SEAs with the absence of an established University locally cited as a possible reason. There was also the question of who paid for the CRB (criminal Record Bureau) check for students, as Universities were reluctant and SETPOINT funds limited. In the case of industrialists as SEAs the company paid in most cases. Larger companies saw it as part of the professional development programme for employees.

The Suffolk co-ordinator clearly identified mid-career employees as the best role models in the SEAs programme in the county. Large companies were very supportive and British Nuclear Fuels (through Sizewell power station, EON, Talis and the Port of Felixstowe Authority, were examples of companies giving the scheme support.

Mentors were recruited in two ways. Some individuals approached SETPOINT to offer help but most were recruited by corporate activity. This was SETPOINT being pro-active and running pre-induction sessions in large companies. Following an expression of interest from either of these routes, all potential mentors were interviewed. Successful candidates received a minimum of three hours training.

In Norfolk the 130 registered SEAs covered the full age-range from students to retired engineers. The co-ordinator identified the major difficulty as engaging schools and the comparatively sparse population density made getting ambassadors and schools together far from easy.

In school P the support of parents was important. At open evenings parents were encouraged to join the team. There were clearly different levels of 'ambassadors'. The designated ambassador chaired the planning team and involved others from his company and other businesses in the city. I do not know how many of these are designated SEAs. There were also interested parents who had been invited to bring their expertise to the group. In other schools the involvement of parents was less. They were informed rather than consulted although school A had staged an open evening for the parents to be told about the engineering course for able students, therefore involving the parents in the choice, or not, of that option.

I interviewed forty-two students and found only two that had serious doubts about the scheme. One was, in school D, not engaging at all. He had no communication with his mentor and meetings were not taking place. As it was in a group interview I was not able to push him for reasons but he just seemed reluctant to get involved. One student, in school C, was engaged but resented missing lessons for mentoring sessions.

All twelve ambassadors were fully committed to the scheme. This was not a surprise as any ambassadors who did not see the value would, presumably, withdraw from the scheme. All ten school staff interviewed were also committed to the scheme as were the county co-ordinators. In respect of the latter, I have already indicated that this commitment was almost a pre-qualification as the ambassadors' scheme was an important element in the region's SETPOINT programme. This, together with my connection to the regional co-ordinator and the county co-ordinator's line manager, would have made it extremely surprising if any lack of commitment had been found.

## CHAPTER 7.

### Conclusions and Reflections

#### Reflections on fieldwork

#### Summary of achievement of research in relation to my aims and sub-aims

I had set out to evaluate the contribution of the Science and Engineering Ambassador Scheme, in the East of England region, to the attitude and motivation of students towards STEM subjects. I had four clear aims at the start of my research and during the early stages of my fieldwork developed three sub aims.

My fieldwork had consisted of interviews with five SETPOINT Co-ordinators; ten school staff; eleven ambassadors and over forty students. All were co-operative and helpful and I thank them for their part in informing this study.

My research was a fascinating experience, especially interviewing the students. I felt I had got responses that had not previously been sought, from the recipients of education, the students themselves. The background given by the SETPOINT co-ordinators was vital to my time management and focused me on appropriate issues for the region in which I carried out my study, the East of England. Issues related to more widespread conclusions that can be drawn from my limited research are dealt with later.

Interviews with staff, both teaching and support, in general gave me evidence that supported the student views of ambassador input. In other words, the influence of the ambassadors was not too far removed from the staff expectation of it. Interviewing the ambassadors had shown me that they approached the task with enthusiasm and professionalism.

**Main Aim 1: To investigate the impact of the ambassadors, both directly and indirectly, on students' perceptions of their learning. *Is learning enhanced (added value) by the presence of the ambassadors in the classroom/laboratory?***

**My study showed that the ambassadors were having a significant positive impact on the students' learning and attitudes.** Of the forty two students interviewed only one had not engaged and all the others identified some positive benefit from their work with the ambassadors. The one student who was not having his learning enhanced was the result of his unwillingness to participate in the programme. One other slightly sceptical student was benefiting but was doubtful about its cost in terms of lessons missed to take part in the mentoring.

This impact ranged from life changing (one student in school C) to helpful with my course (students in school A) Their impact varied dependent on the model used but in all schools clear evidence of ambassadors having a positive influence on student learning was obtained. In school A it was with a small group of students who were being guided in a very practical way through an examination project. The ambassador was acting as a personal tutor emphasising the practical aspects of their work. In school B, as well as in my pilot study school P, the ambassadors were having a less direct impact but still a positive one. This impact manifested itself in interviews in two related ways. The students showed an awareness of the applications of science and technology through their visits to industrial sites and talks and events in school involving people from industry and commerce. Evidence of students being given the opportunity to contextualise their classroom studies with visits to industry, visits from industrialists and hands-on task based days was found. In schools C and D, where the ambassadors were acting as one-to-one mentors it was clear that a positive effect on the students' motivation and general attitude to education was being influenced. My research included students of all abilities and with few exceptions their perceptions of learning in STEM subjects were being positively enhanced. For some the enhancement came through a more practical view of examination projects enabling them to produce more informed responses to problems. For others it gave them a view of the uses and applications for the knowledge they were accruing in school and for more it was enabling them to see a purpose for schooling and increasing their ability to put the place of education into the context of their own individual lives.

**Main aim 2: To critically analyse the roles played by these industrialists in the education of young people.** *What role do industrial visitors play in the learning process? Are they teachers per se?*

**In all the schools, with their variety of delivery models, the student-ambassador relationship certainly had flourished, bringing a variety of benefits to the young people involved as well as satisfaction, and a degree of personal development, to the ambassadors.**

Were the Ambassadors acting as teachers? Certainly none of the ambassadors that I spoke saw themselves as teachers. Indeed they identified that as one of the strengths of the scheme. All eleven Ambassadors I interviewed saw their role as one of guide or, mentor. In school A, where there was a course specific approach the role was perceived as course adviser and in school B, where days were arranged the ambassador was a facilitator. In schools c and D , where they acted as mentors, without exception they saw themselves as independent, neither parent nor teacher, more of a critical friend. I reminded myself of Hirst's (1973) writings on teaching as an activity. He maintains that teaching is characterised by its point or purpose and that it is intentional but learning can be unintentional, although schools, he felt, are only concerned with intentional learning. Learning, he suggested, is also polymorphous but defined by an intention or some specific achievement. On this basis it can be argued that Ambassadors are not, most of the time, teaching, but are involved in the process of learning. This seemed, on the face of it, a sensible and logical conclusion but in the passport2success scheme where there was a scheme of work for guidance and topics that the ambassador was asked to cover, there was an intention that teaching should be taking place. My conclusion is that in structured ambassador work they are involved in teaching per se but in less structured situations they are involved in the process of learning. Any teaching could only come from a pre-determination from the ambassador about what learning was intended.

The ambassadors' strengths were in having the experience and knowledge of the world of industry and commerce to react to the situations. Formalising the

process gave structure and the brokers, school staff and SETPOINT co-ordinators were responsible for giving that structure enabling the ambassadors' skills to be best utilised.

The roles were dependent on the model and varied from personal project tutor in school A through planning and delivering practical task days in schools B and P to personal learning mentors in schools C and D. An element of teaching was observed in the ambassadors' work but my brief exploration of teaching and learning earlier in this paper drew attention to the difference in definitions of teaching. It was Hirst (1973) who said it could take many different forms and for him the ambassadors would have been perceived as teaching. Ambassadors would certainly have had a clear place in Shulman's (2004) work on communities of learners and their work, particularly in the models found in schools A, C and D would have pleased Gattegno's aim of looking at learning starting with the learner, not the teacher, as quoted in Brown, Hewitt and Tahta (1989).

The role of 'teacher' however extends beyond the intended learning that defines teaching. The role of teacher is also seen as one of authority, of rule maker and enforcer. This is a role that may be seen as reflecting the needs of a large community, such as a school, to be well ordered, although it may be argued that such order is a preparation for being part of a society that has an established social code of behaviour. In such a society any challenge to the code can be seen as anti-social. The Ambassadors' role was, in this respect, neither teacher nor parent, both of whom are figures of authority where rules are made without discussion with the individual student. In the work with ambassadors rules were usually negotiated. This was inherently true with the mentoring role seen in schools C and D but also in school A, where the relationship between student and ambassador evolved. Any rules invoked by the ambassadors were for reasons of health and safety in the workplace, which were accepted without question by the students. This could be seen as a possible differentiation by the students between 'rules for children' and 'rules for adults'. My rationale for this statement is that most young people grow up with rules made by parents and teachers, many made for them before they reach the age of being able to rationalise the reasons for those rules. An example might

be the rule of not running in crowded areas, a health and safety rule made for children before they can assess for themselves the dangers of such action. However, a rule in an industrial setting such as wearing appropriate protective clothing is accepted for two reasons. Firstly it is made at an age where most young people have experienced situations in which pain results from the body being exposed to dangerous stimuli and that it is a rule that seems to be made for adults, not by adults for children. This development, rather than imposition, of a set of rules had the effect of reducing, indeed nearly eliminating, situations where students and ambassadors were involved in any confrontation. Such lack of confrontation enables both parties to focus on core issues, in these cases that being the education and development of the students.

**Main Aim 3: To investigate whether the work of the Ambassadors was influential in the students' option choices and/or achievement at 14 and post 16.**

*Does the work of the ambassadors inspire the young people with whom they work to take the subject(s) to a higher/further level of study?*

I found little evidence to support the achievement of this aim. Of the 42 students interviewed all those who wanted to enter engineering had taken engineering options at the start of year 10, before any contact with ambassadors. Half of the students taking the course (ten on course) intended to pursue engineering but all wanted to do that prior to the course commencement. The ambassadors had confirmed and supported the career choices. None of the three girls in school A were intending to enter engineering, nor any in school P. In school B 3 of the 13 students interviewed were looking at engineering careers, 2 of them through the armed forces. In school D none of the 7 students interviewed only 1 was considering engineering as a career.

I put forward in my field work findings section a variety of possible reasons for this with the age at which the input is given and the factors acting upon the students making the decisions, along with the internal competition within schools from subjects being to the fore, but more research needs to take place to find out what really does influence students' option choices and career choices and when.

Stagg's research (2007) suggested that students lacked knowledge about careers in the STEM subject area and my studies confirmed this to be generally true. Ambassadors were able to pass on information about their area of expertise and did add to the students' knowledge of the range of careers available to them. Most of the ambassadors to whom I spoke saw themselves as representative of their profession but their desire to guide the individual student in an appropriate direction was a greater priority. The mentoring system definitely included encouragement for students to widen their range of considered career paths. If a student showed an interest in pursuing a career in a STEM related subject, the ambassadors were able to give very clear advice about how to achieve such.

My research gave the very clear impression that any career aspirations had been formulated before meaningful contact with ambassadors. The CBI called for persuasive careers information to encourage students to study science at a higher level and that begged the questions what is persuasive and when is most persuasive? It is also the subject of a further debate as to whether there should be any positive guiding of students into certain option choices. This debate includes some of the philosophical viewpoints about the purpose of education discussed in chapter 2 and the vocational and liberal education divide. If, however, that debate were to end with the conclusion that education has a duty to train the workforce that society needs for economic well being, then there are a number of key issues that would need to be addressed. The timing of careers advice is one, but another is the source of careers advice. The media is a huge influence on young people in present society and any notion that it does not impact on career choices would have little foundation. The media spotlights many role models in catering, music, marketing, sport and its own industry but where are the role models for Science and Engineering?

Most of the students I spoke to were not critical of the teaching but many still found science boring, except when practical. It may not have been the quality of teaching that was at fault, although I have no evidence to suggest it was or was not, but the subject itself and its status and representation in society. The SEAs scheme has built bridges between education and industry which can be used to further

improve student perceptions of STEM subjects. Many schools involved in the SEAs programme are involved in other links with industry and the commitment exists on both sides to co-operate further. The SEAs programme must be seen as only part of education industry links, although an important part. Some of the strengths of the scheme could be applied to other forms of co-operation such as work experience and vocational courses.

**Main aim 4: To evaluate the role of the brokers, that is the schools and SETNET.** What is the role of the brokers in assuring quality learning experiences for the students?

SETPOINTS acted initially as pump primers, obtaining a commitment from both schools and ambassadors. They carried out an important role in training of ambassadors and were involved in evaluation to varying degrees. Schools, where committed, took much of the responsibility for the day to day organisation. They also took an active part in evaluation, particularly in respect of the effect on the students. Whether the ambassador programme would exist without SETPOINTS is extremely doubtful and whether it would continue if SETPOINTS ceased to support nearly as doubtful. In many ways schools and industry were still far apart, purely because their core functions are so different. I have examined earlier in this paper what they have in common but working together for the benefit of society as a whole is long term and both are driven by short term targets. In one case the target is profit whilst in the other examination results, league tables and hence student numbers.

I suggest that all schools should be asked to audit how they put vocational elements into their curriculum. It should, in my opinion, be a more important factor in OFSTED reports on schools. This is not the place to discuss the limitation of league tables but it is my opinion that vocational elements in education are important as I would argue, are extra-curricular activities. Incentives, financial being the most persuasive, should be made available for schools to get involved in some sort of link with industry and the SEAs scheme offers a very good model of co-

operation. Increased funding to SETPOINTS and/or EBPs would help that increase in activity to benefit the students.

**Sub aim 1: To identify factors that contributed to successful ambassador programmes.**

**The willingness of the schools to involve ambassadors in their programmes was a more important factor than the willingness of the ambassadors to get involved.** All five schools in which I carried out my research all had active ambassadors working with them in some way. They all had successful mechanisms for good communication with their ambassadors relevant to their model of practice. This included a well defined focal member of staff who acted as the conduit for communication with employers. In four of the schools a non-teaching member of staff was a key part of this communication link. In schools A, B, C and D the support of senior management for the work and the aims of the scheme was evident. In school P the impetus for the scheme came at middle management level.

I did find evidence to support Smith's (1992) statement,

*"It was, in every case, planning between someone on the school's management structure and the industrialist which helped the latter to understand the culture and climate of the school, perceive the role which would be expected of them by the school and contribute fully to the schemes and projects."* (P.50)

It would take further research to ascertain why some schools were more proactive about getting involved in the ambassador programme but I would suspect that leadership is a key issue. It is likely that all senior managers in schools, including head teachers, would have had an opinion on the liberal versus vocational education argument, and this would have influenced the emphasis, or lack of, on vocational education. There is also a point of view that, in an accountable education system with league tables a focus for judging achievement that schools that are under pressure may revert to what they see as core purposes. That in the eyes of some head teachers would mean less emphasis on vocational education. I personally know more than one head teacher who feels that work

experience is something that their school would be better off without. Clive Woodward (2004) the Rugby Union coach who led England to World Cup Victory in 2003 referred to what he called 'critical non-essentials' (p.195) and that is how I view vocational elements of education. They are not, in my opinion, strictly essential to the ability of students to gain pass grades in English, Mathematics and other subjects but are a critical element of the whole process of education that shapes a young person's mind. The measures I have suggested in reviewing my previous aim would also be of benefit in encouraging more schools to get involved.

**Sub aim 2: To investigate the variety of models of practice that existed and to make an attempt to analyse their different impacts on students.**

A variety of models existed and was dependent on a variety of factors. The nature of the counties was an initial issue. In Norfolk, for example, 87% of companies were small ones, whilst in Hertfordshire large companies dominated. One-off extra-curricular events were the most common model in most counties but in school A I saw an ambassador working within the curriculum and in Suffolk a structured programme of mentoring was in place. The model of practice was, in most cases, the choice of the school with the exception of the passport2success scheme in Suffolk where the county SETPOINT had been more prescriptive about what they felt was on offer. Participation in the scheme did not exclude other types of education-industry liaison. Indeed evidence was that schools using ambassadors had well developed links prior to the introduction of passport2success, which built on them. This has its roots in the argument that I pursued in the previous section, that of the attitude of the school, particularly the senior managers, towards vocational elements in the curriculum. A school with a positive ethos towards such initiatives will have developed its own links prior to any structured scheme such as Passport2success. This attitude together with existing links with local business would make involvement in a new scheme more likely and easier to achieve. In schools where education-business links exist an infrastructure is often in place to deal with such initiatives. This infrastructure is often a key member of the support

staff with responsibility to ensure such links are made and benefited from. Schools without such an infrastructure and ethos are, conversely, less likely to participate in such schemes. SETPOINTS and EBPs should work with schools to create such an infrastructure where it is absent and to best utilise it where it is present. Only if some of the measures that I have spoken about in reviewing previous aims of the research are implemented will schools be motivated to investigate what models of delivery suit them best. SETPOINTS and EBPs are already willing to work with schools, if asked.

### **Sub aim 3: Who and what were Ambassadors?**

Ambassadors were drawn from the complete range of industrialists from students to retired engineers. All the Ambassadors I saw were from the mid-career range and this supported the view of most SETPOINT co-ordinators that these were the most effective group. This was based on the fact that a mixture of experience and energy was needed in a good Ambassador. Where young Ambassadors, such as undergraduates, were used the relationship with the students could be different. Ambassadors closer in age to the students could exhibit a greater empathy and no lack of enthusiasm for the subject would show but a lack of experience in any industrial or business setting was a definite negative. More mature Ambassadors have 'been there and done it, or rather are there and doing it,' giving them greater credibility.

#### The Aims of the Ambassadors programme

In my literature review I cited Price (1992), who gave an account of the development of the Industrial Ambassadors Programme, which had the following aims:

- *“As a means of changing the attitudes of young people towards those who create wealth through industry.”*
- *To promote knowledge and understanding of industry among teachers, careers officers, parents and students.”*

- *Thirdly “to establish a new, catalytic force for liaison and effective communication between industry and education in a way which stimulates young people.”*
- *Fourthly “the programme is seen as an effective means of encouraging industrial concerns to form links with their local schools and colleges.”*
- *Finally, it “provides a real opportunity to develop the management potential of individual industrial ambassadors.” (Pp.30-31)*

So were these being achieved in the schools in my study? There was no evidence from my study to suggest that the SEAs programme had changed the attitude of young people towards those who create wealth through industry across the board, although there was evidence that this had happened to some individual students. The perception of who are the wealth creators in society is crucial here and I did not ask students about this so could only surmise based my own experiences. The media gives a great deal of attention to political leaders but much less to industrial leaders. If young people were to be asked about who creates wealth in the United Kingdom it is quite likely that responses would include politicians as well as industrialists. What vocational education can achieve is to enable young people to realise the role of business in wealth creation. This can only happen, however, if the young person’s experiences are such that this can be assimilated to create a more complete understanding of economics, even at a basic level. Those students working with ambassadors on real projects, such as I saw in school A, definitely had an insight into the importance of cost on project management. The example in this school was the student working on a task to stop pedestrians and vehicles getting onto level crossings. She suggested that a possible solution was that all trains be fitted with a sensor that set off visual and audible alarms when approaching crossings. The ambassador responded that this was technically feasible but financially totally impractical and that an alternative solution involving land based sensors would have to be considered. Whether this impacted on the student’s attitude to industry as a whole was unproven, at least in my research, and I had no cases of ambassadors talking to me about their role in economic wealth creation process. Their attitude was much more micro economic, in relation to their company and the community and the students’ focus even more

micro, with their main concern being themselves and their futures. I was aware that my questioning encouraged such by being very personal and a different focus would have been needed to establish any firm links between the programme and wealth creation in a more general sense.

A certain amount of promotion of industry amongst teachers, parents and students was evident, although I did not find any evidence of careers officers or careers advisors being involved in any of the versions of the programme. School staff, both teaching and support, were in all cases increasing their knowledge of the industries from which their school ambassadors came, as were students, and often in a much wider sense, as the ambassadors were often giving broad careers guidance. Whenever parents were mentioned they were supportive and seemed to appreciate the input of the local companies.

The issue of a catalytic force for liaison between schools and industry is debatable. The students involved in the programme were certainly benefiting from the links but the amount of benefit was diluted in the school trying to involve a majority of students in ambassador-led activity. In the schools where a few students were involved in a closer relationship the benefit was greater but for fewer students. In all the schools I studied the programme had either encouraged industrial concerns to form good links with the school or the programme had developed because of existing good links between the employers and the schools.

My discussions with ambassadors indicated that the role of ambassadors was one that aided personal development of the employee involved. This was specifically highlighted by a company working with students in school D where the human resources department were overseeing it. It was also mentioned by mentors in school C. Overall a mixed picture of achievement against Price's initial aims but it must be remembered that this initial Industrial Ambassadors' programme was replaced by the SEAS programme and the aims amended. My research was designed to test the achievement against the aims of the SEAs programme.

Benefits for students of education-industry links

What of Gifford and Howden's (1993) benefits for students of Education Business links?

Table 5.

A summary of research evidence against Gifford and Howden's suggested benefits for students in schools A to D..

		A	B	C	D
1	The experience of a different kind of learning	X	X	X	X
2	A sense of involvement in the 'real' world outside school	X	X	X	X
3	First hand experience of the kind of world their parents might be involved in				
4	A chance to meet experts	X	X	X	X
5	A chance to meet someone else in the role of teacher	X	X	X	X
6	Improved social skills				X
7	Potential to develop a useful range of new experiences	X	X	X	X
8	Chance to gain an insight into industry	X	X		
9	Access to a variety of materials and techniques	X			
10	Appreciation of some key economic issues	X			
11	Validation of work	X			
12	School's position in community		X	X	X
13	Increased enjoyment and motivation	X	X	X	X

The experience of a different kind of learning was evident by the responses from students about teachers and the routine that delivering the curriculum involves. Benefit 2 was more pronounced when students went out of school and visited businesses and was one of the greatest benefits of work experience. Benefit 3 is, in my opinion, a poorly defined concept. It is dependent on what world the parents might be involved in and without discussing the parents' employment and cultural backgrounds it would be difficult to ascertain. I cannot say that the other

benefits were not in existence but was unable to present examples of evidence of them from my research. Benefit 5 I have shown as evident but that was subject to the earlier discussion about the role of the ambassador as a teacher. I concluded that the roles are somewhat different but enough elements of teaching are in the ambassador's role for me to tick these boxes. Such tick boxes can only indicate evidence, not the depth of impact of the programme or the strength of evidence.

It is worth noting that school A, where a model of attempting to involve all students was working with ambassadors in some way, got more ticks than other more targeted schemes. The mentoring schemes observed in schools C and D had a more profound impact on fewer students.

#### Factors impacting on the success of education-industry links

In all schools visited planning was an important factor in successful ambassador work. Bridges (1993) found little evidence of impact on students when assessing the Neighbourhood Engineers Scheme citing four main reasons.

- ¼ to 1/3 of engineers related to teachers but not to the children.
- in many cases action had only recently started and many students had had no direct involvement with engineers
- most contact was a 'one-off' experience
- many of the children who were interacting with neighbourhood engineers did not realise they were engineers

These factors were not obvious from my research, particularly where ambassadors worked with students on a regular basis, either on a curriculum project, as in school A or as mentors as in schools C and D. The SEAs scheme has avoided these pitfalls by effective training for the ambassadors; ensuring direct contact between industrialists and students; planning, or encouraging the planning, of programmes, rather than one-off's. (Even when one-off's were the model of delivery they were repeated one-offs' included in the school calendar and integrated into the strategy.

Hillage, Barry and Pike (2002) identified the following constraints in analysing Education Business Clusters. I have paraphrased.

- Initiative fatigue
- Special measures
- Competition between schools limiting co-operation
- Teacher familiarity with EBL (Education-Business links) activities
- Teacher supply constraints

In the schools in which my research was carried out there was a common thread, the commitment to education-industry links. I did not include any schools which either were, or had been, in special measures so am unable to comment on that possible constraint. I felt that the way that the links had been developed and implemented in the schools in my study had overcome any feeling by staff of initiative overload. I did not receive any comments about such from any staff that I interviewed. Similarly, I received no comments from any staff, including senior managers and SETPOINT co-ordinators, about competition limiting co-operation. I do feel that Hillage, Barry and Pike's constraints had been overcome in the schools I studied by good organisation and deployment of staff resources. They also identified one employer based constraint, that of the dependency of successful links falling on a small number of people in any one company. I feel that this is inevitable as the core function of each of the companies is not to develop young people, or even to foster the workforce of the future, although I am sure many would include that in their sub-aims. I am also not sure that I would see that as a constraint. If a company involved a large number of people in the ambassador programme, it would be far harder to ensure that they all had the high level of commitment to the programme that the companies I talked with possessed. I was told that, in one of the counties in the region, a large pharmaceutical company had involved a lot of staff in ambassador work and it was successful and ostensibly run by that company, forming an integral part of their staff development programme. Unfortunately I did not get an opportunity to talk to anybody in that company to see how successful

their programme was. There was a clear risk of variable quality if companies involved employees who were not totally committed to the aims of the scheme.

The Rose study and follow up work by Jenkins and Pell and Bishop and Denley was important to me in that it made student views a crucial part of its work. They did not, however, look at any input into the student perceptions of industrialists. Stagg (2008) most definitely did and his recommendations can be summarised thus:

1. *Carry out more extensive research into where science teachers get their careers information.*
2. *Carry out research into the role and activity of external partners (e.g. Science and Engineering Ambassadors), focusing on the nature of the training they receive, the extent to which they provide careers 'messages' in their work, and the extent of untapped potential in this area;*
3. *Carry out research into techniques and strategies for incorporating science careers 'messages' into teaching and learning in a wider range of GCSE and GCE A level courses;*
4. *Carry out research into strategies for developing professional development programmes for science teachers that would incorporate science careers, whilst addressing other high priority issues for the teachers.*
5. *Consider setting up regionally based Science Careers Ambassadors to support teachers and careers professionals.* (P.6)

In the light of my research I would certainly support recommendation 1. The ambassador programme had improved the flow of careers information into the schools in my study by actually by-passing staff, but this was only applicable to the students involved, which except for school B was a small minority. I did not investigate whether there was any liaison between internal or external careers advisers and agree with Stagg that this could form part of a future study.

I hope that I have been able to at least begin the research that he refers to in 2. Indeed my third main aim, *to investigate whether the work of the ambassadors was influential in the students' option choices and/or achievement at 14 and post 16*, focused on the pre-cursor to possible career options. Indeed my interviews and my findings in the fieldwork section have shed some light on this. Indeed I summarized thus in that chapter, I found limited evidence of the scheme having any influence on option or career choices. I further discussed possible reasons for this and suggested the timing of any careers advice as one factor along with the marketing of subjects both within schools and in the media.

Directly related to my findings on this is Stagg's third recommendation. I am sure that this would do no harm but my research suggests that it may do little good, as the majority of the students that I spoke to had clear career aspirations before they started their GCSE courses. Often these aspirations were negative rather than positive. *"I like science but there are other subjects I like more"* was a typical comment indicating that subject preferences had been formed earlier than the start of Key Stage 4 (Year 10).

Stagg's fourth recommendation is also logical and fits with my research although I would strongly suggest that schools investigate when such influences are taking place. I would not necessarily propose that careers guidance is done as a block in Key Stage three but I hope to have raised the awareness that influences on young people's careers and option choices are penetrating much earlier that may have been previously thought and that schools are not responsible for as much of that influence as they might like to think. Parents and the society in which students live both have a very big impact.

As for recommendation five, I believe this is what has happened in the eastern region, with a good deal of success, according to my research.

### Summary of effectiveness of the scheme

The Ambassadors' programme has had a good deal of success and was making a positive impact on a varying number of students in the schools that I used in my research. It was also seen as a positive by the county SETPOINT co-ordinators I spoke to, although that conclusion must be tempered by the fact that they knew my interviews with them were sanctioned, indeed encouraged by their line manager and their central funding body. The impact on students, almost inevitably, was greatest when the ambassadors had worked with a small number of students, as in schools A, C and D. In school B, as well as school P, a large number of students had been influenced but in a less profound manner.

It must be remembered that I visited schools where ambassadors were, in the opinion of the SETPOINT co-ordinators, making a positive impact. There were many other schools where no work was taking place with the programme although it is a point worth noting that there were no co-ordinator highlighted schools where the Ambassadors programme was not working well. They felt that, where schools were involved with the programme, it was positive. My research supported this opinion although I am left with serious doubts about the programmes influence on career or option choices. Ambassadors working on large group events such as Industry days or project workshops were giving the students an understanding of the practical applications of STEM subjects and bringing a different approach to the learning. They were also acting as good role models and helping to give the students with whom they worked a greater understanding of the range of careers within the STEM field. Where the programme was focused on a smaller number of students the personal impact was greater, with the main gains for the students being increased self confidence and the ability to put education, as delivered by school, into the context of their life as a whole.

In a sample of five schools I had sought and found a variety of models of delivery. I consider this variety neither strength nor weakness but simply an inevitable characteristic. Schools are different in their structures and in their models of delivery, even within the constraints of a National Curriculum. Head teachers and others senior managers had a wide range of views about the place of vocational education, as previously discussed and the geographic situation would also have been a factor. In schools such as school C, where a local employer dominated, not just the job market of the locale but also the local political and community life it was almost inevitable that links would build. In rural areas of some of the less densely populated counties the nearest industry could be miles away and the gravitational pull of its influence on a school very weak.

The training for the ambassadors whose work I had directly or indirectly seen had been appropriate. The balance between prescription and flexibility was right and the training had focused on the ethical and legal issue related to working with young people. In my opinion it provided a good model for the involvement of adults other than teachers (AOTs) in the education process. Involving AOTs has always been difficult for schools and the role played by SETPOINTS in ensuring necessary checks and basic guidelines are in place has, without doubt, been a catalyst for success.

### Recommendations

In the light of all the previous research and my case studies I offered the following recommendations.

1. The Science and Engineering Ambassadors Scheme is supported and widened to involve more students.

2. Other counties give serious consideration to the adoption of the passport2success scheme, which operates in Suffolk.
3. Schools and local authorities re-assess their careers guidance programmes paying particular attention to external influences on students, especially those from the media, particularly television and the internet. The involvement of both parents and students in this re-assessment is suggested.
4. SETPOINTS and schools to be encouraged, by funding, to work together to put in place the necessary mechanisms, especially in relation to the staffing structure, to ensure that successful links with industry can flourish.
5. The role of regional co-ordination through STEMNET or similar organisations is supported to ensure quality control of education-industry links. This is in the light of the major differences between counties, even within a region.
6. Companies are encouraged to make the ambassador scheme and other education industry links an integral part of their staff development programmes.
7. The role of non-teaching staff in this process is analysed to identify transferable elements that could help other schemes involving adults other than teachers.
8. Schools are required to include vocational elements in their programmes of study. Financial support given to support this and schools' performances in this respect to be a key element in any OFSTED report.
9. Consideration is given to evaluation of the ambassador work. Whose job is it? How is it done? Should there be standard procedures such as SOUL (Soft outcomes for universal Learners as used in the passport2success scheme)
10. Part of the role of SETPOINTS, as brokers, is the standardisation of training for the ambassadors and the establishment of lines of communication so that ambassadors can feed back constructively.

Note on recommendation 1. The announcement in May 2008 of an expansion of the Ambassador initiative from 18,000 ambassadors to 27,000 in the next three years was warmly welcomed by me. The increase in funding by £2 million to £7.4 million was an endorsement of the scheme's success so far.

Contribution to knowledge.

*“Pupil commentaries on teaching and learning in school provide a practical agenda for change that can help fine tune or, more fundamentally, identify and shape improvement strategies. (Ruddick and Flutter. 2004. P.29)*

I feel that one of the most important contributions to knowledge in my work has been one of principle. The principle is that student perception and/or student achievement and their ability to explain such perceptions should be key elements in any evaluation of the impact of any educational initiative. I do not believe that any other research would omit the consumer from its findings, so why should it happen with education? I found education-industry links to be well researched but the overwhelming majority of literature focused on the role of the teachers or industrialists, not on the students. This was a gap that I wanted to fill and my interviews with the students were the most fascinating parts of my fieldwork. I am in no doubt that the choice of semi-structured interviews as my data collection method for the students was the right one. Drever (1995) guided me in this and his perceived advantages for this method were proven to be so. They were the ability to explain any ambiguities or correct misunderstanding of any questions. This is particularly easy when you are able to see the facial expression and body language of the person to whom you have asked the question. I was also able to interview students, teachers and some ambassadors in their own working environment. This relates to the elements of social acting in Bryman's (2004) definition of Constructionism. This conflicts in my work with Silverman's (2005) assertion that Constructionists' preferred data sources are observation, texts and tapes as compared with open-ended interviews favoured by Emotionalists. Previous assertions by Silverman based on the work by Gubrium and Holstein (1997)

connected the individual's point of view and the actor's perspective with the emotionalist model and the constructionist model with a priority of interaction over meaning. It is my opinion that I achieved an accurate insight into the perceptions of the students using semi-structured interviews. I accept that open-ended interviews are slightly different to semi-structured ones and my use of tapes, or digital recordings of my interviews blurred the definitions. Setting out determined to straddle divides between standpoints I still feel that I have a foot in both camps on the emotionalist/constructionalist argument. Yet again I conclude that such divisions are artificial and that there is more of a sliding scale between the two standpoints.

The work of Glassner and Loughlin (1987) shed some light on my argument saying that "*...the character of what the interviewee is saying can also be treated through a realist approach, as a factual statement...*" (p.35) they go on to argue that, if we treat the responses as a factual statement then we must ask the question 'can we believe the kids?' This highlights the issue of authenticity of experience, or how much can we take from the interviews. My response is that the promise of confidentiality is a major aid to authenticity, even though it is doubtful that students really believe that adults will not share information about them. What are the motivations for the interviewees not revealing the real perceptions? I suggest that students had the least motivation for embellishment of feelings. They will only, in my experience, adjust what they say to protect their own image, although many students were quite open with me about their own shortcomings. Teachers, ambassadors and SETPOINT co-ordinators had, in my opinion greater motivation for not revealing their true feelings. All the teachers and other school staff that I interviewed were involved in the scheme in some way and therefore had a vested interest in its success. Ambassadors, although believing in the scheme, had loyalties with their employers and would have been unlikely to say anything that reflected badly on their employers. County SETPOINT co-ordinators probably were the most guarded about what they said to me as, as previously mentioned, they knew that my visits were instigated by their line manager, who clearly strongly supported the scheme.

All of the students interviewed were helpful and the great majority very forthcoming and open. It could be that the students that I spoke to were 'selected' by the school, and indeed, to an extent that was true, but they were also self-selected because of their involvement in the scheme. In schools A, C and D I was able to speak to all students involved with ambassadors (subject to their attendance on the day of the interview). In school A these students were of high academic ability but the opposite was the case in schools C and D. I suggest that their willingness to be open with me was because I was spending time talking about them, about their progress, their attitudes and their futures. It is my experience that all people, not just the young, are happy to talk about themselves. It reflects that basic human need to be acknowledged as an individual with a role to play in society and young people have this need as much as anyone. They certainly demonstrated that to me repeatedly in the interviews.

The case for vocational education has been made and contradicted as discussed in chapter 2. After much reading Pring's assertion (1995) that liberal education and vocational preparation can co-exist within the same system seemed a logical stance for me to take. The Dearing Report (1996) supported Pring's view and the now embedded national curriculum has, in many ways, truncated the debate so that it only exists in the way head teachers interpret the requirements for vocational elements in the curriculum. The introduction of the National Diplomas may reignite the embers, but only time will tell.

I would argue that such expertise across disciplines displayed by Da Vinci is almost impossible to attain in the twenty first century. Knowledge has grown at exponential rates, especially in science, technology and engineering, meaning that the sheer volume of knowledge required to be at the leading edge of development is huge. Ironically at the same time, the amount of knowledge required to have a broad education can be argued to be less, as knowledge is now readily available electronically. Engineers today have to specialise more than those of the Victorian era, and in more fields. Information technology, environmental engineering and genetic engineering are now amongst widespread specialisms that did not exist until the twentieth century. The corollary of this is that secondary education today

cannot be truly vocational in that it can only prepare young people for the world of work by giving them transferable skills. Liberal and vocational education have both been replaced by skill based education, which reflects in many ways Bloom's (1956) spectrum of intellectual endeavour. Knowledge, now readily available, is only the foundation and comprehension, application, analysis and evaluation are the key skills that are needed to cope in the specialist world of today.

I had set out to investigate aspects of a specific scheme that had aims that could be identified as containing elements of both liberal and vocational, if the division is even necessary. To 'generate interest and inquiry' is a very altruistic educational objective whilst 'to act as invaluable role models to students' is somewhat more based on the need to recruit to the profession. Indeed the balance is further emphasised by the two ways in which STEMNET states it will achieve its aims.

Firstly *"by bringing science, technology, engineering and mathematical activities, experiences and excitement into classrooms throughout the UK, enhancing and enriching the national STEM experience."* ([www.stemnet.org.uk](http://www.stemnet.org.uk) 2008.)

Even the most ardent supporter of liberal education would, I suggest, find it difficult to challenge such a statement encouraging enhancement and enrichment of the national Curriculum. However move onto the second purported part of the methodology, "by linking those companies and other organisations that employ STEM educated people, and schools, in such a way that young people can get a clear idea of the diverse and exciting range of careers available to them." (op cit) is very much more vocationally orientated. Coffey's assertion (1992) reflecting on educational initiatives at the end of the nineteenth century when "there was a growing consensus that education needed to respond much more explicitly to economic demand" (P.60) through Callaghan (1976) to 2008 when the engineering bodies called for immediate action to reverse the trend away from STEM subjects in further education all supported the philosophy behind the ambassador programme.

My research shows that it was being more successful in generating interest and inquiry than in its career related aim.

The SEAs programme seemed to have a very limited effect on students' option and career choices. My research suggested it was not working in relation to the aim of encouraging more young people to take STEM subjects at post compulsory level or to enter professions where they are fundamental elements. Recommendation 3 suggests a re-evaluation of the schools' careers guidance programmes. I have already suggested reasons why this aim may not be being met but is it inherent in the nature of teachers to protect their students from any overt marketing for one particular group of careers? In chapter 2 I discussed Hirst's (1973) definition of education as a "*polymorphous activity. It quite literally takes different forms.*" (P.165). This definition is open to include indoctrination, preaching, advertising and propaganda proliferation but it is to the credit of the teaching profession and the highly ethical standards of the vast majority of its members to avoid such methods. I would suggest that the training of ambassadors includes warnings against such approaches. The Mentor's Handbook published by Suffolk Education Business Partnership gives guidance on the role of the mentor and under what the mentor does, lists, "*explore, suggest options*" and "*guide and offer alternatives*" (P.5) On the same page under the heading what the mentor does not, lists, "*Tell someone what to do, adopt a judgemental attitude.*" (op cit). My research suggested that ambassadors' attitudes seemed to fit with both the Shulmans' (2004) work on communities of learners and with Sikes, Measor and Woods (1995) writings on the stages of development of teachers. The ambassadors I met all displayed the attributes that Sikes, Measor and Woods gave to a 'proper' approach to teaching. That is they were appropriately dressed; they had a very positive and caring attitude to the students and they had very good relationships with the students and with staff in the schools. They also displayed many of the attributes that the Shulmans identified in teacher development such as understanding, respecting, persisting, enacting, articulating and initiating. Specifically on the ambassadors' role in influencing career or option choices their demonstration of teacher traits they had clear views. They saw themselves as

representative of both their profession and their companies but that they saw opening the students' minds to the opportunities available was the most important and then responding if the individual student wanted to ask further. They had a much wider view of the scheme despite the original concept to promote engineering. As one ambassador said to me, "*It soon became obvious that there was more to it than that.*" It is my opinion that the students would be less trusting of individuals whose priority was recruitment. The success of the scheme, like much in education, was in putting the student at the centre, not the ambassador, their company or their profession. It is a criticism of large schools that the individual voice is often not heard. This scheme ensures that the individuals' voices that most need to be heard are heard.

My research found strong evidence that one-to-one mentoring had a very positive impact on the students involved. In many cases it had transformed their attitudes to school and to their own futures. It raised the self-esteem of the young people enabling them to see the way to make a personally satisfying contribution to a society that they had often felt alienated from prior to the mentoring. It was very student orientated and this meant that, in the overwhelming majority of cases studied, that young people responded positively, in general, to being treated as special and the Passport2success programme, using ambassadors, was evidence of that. It is part of human nature, at all ages, to feel wanted and this mentoring answers this need.

Had the succession of initiatives had any apparent effect on student attitudes towards STEM subjects? My research suggested that students in general are more influenced by the way that the subjects are delivered in school, rather than the potential benefit of the subject to the economy of their community and the world in general. This finding is in line with the findings of both the ROSE project (2003) and Jenkins and Pell's (2006) follow up. It was still evident that the majority of students are not motivated by science and engineering enough to take up further study. A longitudinal study of the change of attitudes to science and technology during compulsory schooling as referred to by Jenkins (2006) would be more likely to give answers to the impact of school. In the snapshots that I have taken no

change in attitudes from individuals could be detected. As Bishop and Denley (2007) pointed out it is factors such as fun, enjoyment and involvement that are more likely to motivate students. The responses I got in school P indicated that the students enjoyed practical science much more than the theoretical lessons, giving clear support to Bishop and Denley's proposition. The development of Education Business Partnerships provided the structure from which many of the successful programmes today developed in organisational and administrative terms. Other schemes such as Industrialists in Residence and Neighbourhood Engineers had, in my view, two important long term effects. Firstly they gave schools an indication of what could be achieved by inviting industrialists into the classroom to partake in a structured programme. Second they gave companies a taste of the possible benefits, both personal and institutional, of their employees working with young people. Schools and companies that were involved in pre-ambassador work were more likely to get involved in it when it arrived as the benefits had been shown to both sides and the schools had developed philosophies in terms of their commitment to employer education links. The schools that I visited, where some successful ambassador work was in place, had all been committed to employer education links prior to the launch of the SEAs programme. SETNET's formation in 1996 built on such experiences as many of those in charge of the now SETPOINT programmes gained their experience of employer education links during the period of TVEI and early EBPs. This, together with the introduction of the National Curriculum and the previously discussed development of some sort of a marriage of liberal and vocational ideals enabled employer education links to enter a stage of maturity previously not reached. It remains to be seen whether the introduction of diplomas causes an imbalance towards vocationalism and if the liberalists raise their voices to fight their corner once more. I feel it may.

The variety of models of delivery was one of the most interesting facets of my study. Variables included geographical spread of industry; attitude of SETPOINT co-ordinators to the way that the scheme best operated; willingness of schools to get involved; structures and needs of individual schools involved and willingness of ambassadors to involve themselves. Each model brought different demands on the

ambassadors although some characteristics were seen across the study. The biggest demand on ambassadors was time and, in the cases of good practice that I observed, a clear and pre-agreed vision of how that time was to be spent was in evidence. Ambassadors wanted to use their time as productively as possible in direct help for the students, whether through industry days, working with subject specific groups or mentoring. This was best achieved through careful planning and SETPOINTS and schools (the brokers) were key agents. Ambassadors generally responded well to a structure in which they had little say in designing. This shows a consistent attitude from employers. They have always been adamant that more engineers are needed and that schools should service the economic needs of the country but have not got directly involved in curriculum design, at least until the diplomas. Their methods have been based on influencing government to influence education rather than direct intervention. Their involvement in the design of diploma courses was unique and it was this that led to my fear of a re-opening of the liberal versus vocational debate.

The balance between structuring a programme and allowing flexibility to cater for the different profiles of different areas was crucial. This was best achieved, in my experience, in the use of a brokering body (SETPOINT in this case) to encourage co-operation and to design suitable programmes where appropriate and most importantly to evaluate the quality of what the programme delivers and amended accordingly. I had also been able to re-inforce some previous conceptions. Firstly, that a well defined channel of communication between an individual school and its industrial partners is essential to successful liaison. Often this channel is most effective when it is one individual point of contact in the school, although the dangers of such a narrow channel are to be guarded against.

The programme clearly had strengths beyond its aims. Its ability to give variety to the way that the learning diet is delivered; its ability to respond to individual needs; its succinct yet appropriate training programmes; its use of the strengths of employers without involving them in unnecessary time commitments; the positive attitude of students to the input and its use of non-teaching staff in key

roles were all evident. Study of these could be of benefit to other schemes that use adults other than teachers to aid the development of young people.

### Reflections on method

As stated earlier my main concern in this thesis, unlike most other studies of this topic, was with student perceptions of the Ambassadors scheme. Perhaps the concentration of existing research on the teachers and industrialists was because it is they who had to be convinced of the benefits of education-industry links. Their time and efforts had to be justified and articles such as those by Bridges (1993) and Hillage, Barry and Pike (2002) illustrated this 'benefit to school' slant. Gifford and Howden (1992) listed fourteen benefits for students, yet they were identified by teachers and no input from the students themselves was involved. Up to 2003 the opinions of the students were rarely sought and if they were, it was in a superficial way such as Jameson and Lightfoot (1982) discussed in chapter 3.

The initiatives since Callaghan's 1976 speech have been numerous. From the HMI reports of 1977 on the 11 to 16 curriculum (DES. 1977) to the 2007 report on 11 to 18 Education introducing the diploma scheme, each had a different impact on students' education. Schemes such as SCIP, TVEI and Neighbourhood Engineers all attempted to bridge the gap between schools and industry and the introduction of the Science and Engineering Ambassadors scheme in 2002 was just one of these, but it was the one I set out to look at, but in a different way from the evaluations of other schemes, which had involved students very little, or not at all. Jameson and Lightfoot (1982) reported on SCIP with only three of the research questions asked of students. Miller's (1989) work on education-industry failed to document any evaluation and Price's (1992) account of the development of the Industrial Ambassadors programme, a forerunner of the Science and Engineering Ambassadors' Programme, which was my focus, featured little feedback from students. This was echoed by Bridges' (1993) work when he concluded that it was good value for money and developed both teachers and engineers. Smith's (1992) work on the Industrialists in Residence scheme focused on the industrialist. Not

until 2003, with the ROSE project led by Sjoberg and Schreiner was any significant input from students documented. This study covered thirty five countries and aimed to shed light on students' attitudes to science and technology teaching.

Jenkins and Pell (2006) followed up the ROSE project with a focus on English students but still used questionnaires to collect data. Bishop and Denley (2007) interviewed students in more work to follow ROSE but their focus was the teaching of science and the book was aimed at helping early career science teachers. In Stagg's research (2007) focus groups of students were used but the focus was science generally and careers in science specifically with the role of any ambassadors not an isolated variable in any of the questions, hence my focus on student perceptions and choice of approach. The importance of semi-structured interviews, particularly with students developed from this.

This did, however, raise a number of issues, the first of which was the breadth of the study. On reflection my study developed breadth as my research identified aspects of ambassador work that fed my curiosity and extended my study from the four major aims. Had I adhered to the four initial aims I feel that my task would have been easier and possibly more focused. However the enthusiasm I had for exploring the topic overwhelmed any desire to limit my research. The interviews with students, and indeed with adults, gave rise to a number of related issues that I felt reluctant to ignore if I was to carry out as full a study as possible into the impact of the SEAs on student attitudes.

At the end of my work I acknowledge that my research, as with others, would be of little benefit if not recorded. Recording research needs some formality, some structure and it was the study of theory that gave me that.

My methodology chapter explored a variety of theoretical approaches and what I believe I have done is combined some of the facets of each to suit a piece of research that had a complex, perhaps over complex, set of aims and sub-aims.

Silverman (2005) gave a simplified model of grounded theory.

- *An initial attempt to develop categories which illuminate the data*

- *An attempt to ‘saturate’ these categories with as many appropriate cases in order to demonstrate their relevance.*
- *Developing these categories into more general analytic frameworks with relevance outside the setting.* (P.179)

My methodology was based on some of the principles of grounded theory and analytic induction, although not fitting the purist view of either. It was also a series of case studies and I use this term in its broadest sense as Punch (1998) put it:

*The basic idea is that one case (or perhaps a small number of cases) will be studied in detail, using whatever methods seem appropriate.” (1998. P.150)*

In Stake’s (2000) classification of case studies his description of a *...collective case study, where a number of cases are studied in order to investigate some general phenomenon.” (p.437-438)* best fitted my research. It was not an intrinsic case study, just for the sake of description, but a study of cases to look for common factors relevant to my research aims and fundamentally the claim by STEMNET that initiated my work.

Returning again to Bryman (1988) .

*“The prior specification of a theory tends to be disfavoured because of the possibility of introducing a premature closure on the issues to be investigated, as well as the possibility of the theoretical constructs departing excessively from the views of the participants in a social setting.” (P.81).*

This fits well with my attitude to theory and, although I was aware of different models before commencing, it was only during and after finishing my fieldwork that I really attempted to locate my work in existing models of theory.

For my four major aims I had no preconceptions about the outcomes and therefore did not formulate theories until after my data had been collected. I could have reworded my aims to become hypotheses, to fit the theoretical model of analytic induction. Indeed it would have been easy to have had these aims:

1. Ambassadors enhance the learning of the student with whom they work.
2. The ambassadors play a key role in the education of the students.
3. The Ambassadors have a key role in inspiring the students to study the subjects further.
4. The brokers play a key role in assuring quality experiences for the students.

I chose not to do so, however, as I felt it would encourage me to search for justification for such hypotheses and not leave my mind open. I felt that this approach would be conducive to 'black and white' conclusions. I wanted to be open to explore any grey areas.

Even more clearly my three sub-aims did not lend themselves to the pre-supposition of theories. Neither models of delivery nor factors effecting success could be hypothesised nor did I not want to go into the exploration of the ambassador profile with any pre-conceptions, especially in the light of the SETPOINT co-ordinators indicating that they were extremely varied.

My second aim, relating to the roles played by the ambassadors was the one most suited to analytic induction as the hypothesis that all ambassadors are teachers was in my mind. In this case alone I was aware that I had the basis of a theory before carrying out my fieldwork. In the other six cases I did not. I see no reason, in hindsight, to amend my approach and going into the fieldwork with as open a mind as possible increased my chances of being objective. This was even more important because of the context that had brought me to this area of research. There was never any doubt that STEMNET would be happier if a positive report resulted and formulating positive hypotheses prior to fieldwork would, in my opinion, have made that more likely.

My contribution to theory is therefore, to show that Bryman's assertion is correct, particularly relating to the possible conflicts between the views of the participants and any constructs I may have made prior to the interviews. I chose semi-structured interviews as my main data collection tool and it was vital to their

success that I went in with as open a mind as possible. Any theoretical constructs may have subconsciously influenced my questioning, particularly my follow-up questions. The credibility of this data collection was the key to the validity of my research findings and its maintenance more important than any adherence to a pre-planned theoretical framework.

### Limitations

As discussed in my methodology chapter this study was never designed to, and could never hope to, measure either student achievement or attainment. The design and timescale of such a study would have had to be dramatically different. I focused on student attitudes and perceptions.

My study was limited to one region of the country and then to four schools within that region. How much can my findings be generalised and applied to other schools within the region and to other regions? I do not have an answer to that question. On one hand one could argue that factors across the country are similar. The school curriculum across England and Wales is similar; young people across the country of the age I was researching are similar in attitudes with similar external influences; the desire amongst teachers and industrialists to co-operate for the benefit of the students is similar and that the SEAs scheme is a national scheme with presumed similarities in funding levels across the country.

However it could also be argued that differences exist. Different regions have different industrial bases and therefore different economic needs. Even at a micro level the influence of a dominant single employer on school C in my sample contrasted with schools and B particularly, where no such factor existed. Different schools have different attitudes to education-industry links and I have already noted that the organisation of the school in respect of such issues as staffing can impact on the scheme. It was also clear that different SETPOINTS operated in different ways, even in the region in my study. Some were integrated with Education Business Partnerships, whilst others were not. The demographic nature of the

counties also had an impact on the models of delivery and, therefore, the impact on the students. Finally the huge variety of models of delivery is itself the most limiting factor on generalisation.

Inductive methods in case studies, such as the ones I used in most of my work, are inevitably limited in the ability of the conclusions to be applied unilaterally. However they do give a real insight into the cases studied and proffer themselves to be tested in other cases.

### Personal reflections

This thesis is the story of not just my research but of a personal journey through theory and practicality that has impacted on me as an individual. The beauty of my work is in its variety. One day I would be engrossed in reading a highly theoretical article on an aspect of theory and the next I would be in a school asking teenagers about their lives, or in a workshop inviting workers to tell me why they were involved and what they thought were the major benefits. The only person that was involved in it all was me and I am, therefore, the connecting parameter and it was important that this parameter was as constant as possible, to ensure valid results. This was particularly important in the light of my chosen data collection methods.

This consistency came through strict adherence to the ethical guidelines but more, it came from adherence to my own personal values of Integrity, social justice, humanity, respect, loyalty, commitment and a clear distinction between right and wrong.

It is important to understand that values and beliefs are not expendable, even in a competitive and accountable environment. It is my firm belief that they must not be compromised in the search for success, either personal or institutional. These values were important for ethical reasons. I was working in an environment with young people and despite my years of experience in education, or perhaps because of them, I was continually conscious of the need to adhere to strict ethical

guidelines. I have dealt with these earlier in my work but these personal values underpin any ethical practices. Indeed with clear personal values and beliefs ethics becomes more procedural than philosophical.

I believe that it is my personal values, as reflected in my work that hold the most significance for my research. My integrity held me to the belief, gained at an early stage of my reading, that the students' views were crucial to the work. The views of the adults involved could only add to the consumer opinion, not replace it or pretend to stand for it. Respect for the views of all those that I interviewed was crucial. At no time did I allow any view to become more or less significant than any other, irrespective of whom from whose mouth it originated. Only views expressed repeatedly gained increased importance.

Social justice was represented by the view that all young people deserve the most that we can offer them in terms of personalised programmes but, more fundamentally, they deserve the most time and thought that we can give them to help them develop personally as well as enabling them to make a positive contribution to the society in which they live. Loyalty to my research aims and a commitment to explore them in as much depth as I could were core values and echoed the R in Swann and Pratt's (2003) PRICE mantra (see P.76).

For 'Care for Others' I could use the words Respect and Humanity and under the heading 'Rigour' I could include my value of the Distinction between right and wrong. My personal values were reflected in the way I carried out my research from start to finish.

As I near the end of my journey I cannot help but reflect on how it has impacted on me. I have always tried to keep in mind the goal at the end. The light at the end of the tunnel analogy is totally inappropriate as I rarely felt confined or restricted. The analogy I feel best describes my journey is that of a steeplechase, with a beginning and an end. The obstacles that I have had to get over have been numerous and varied but looking back the clearance of each one has been an achievement in itself but also an essential part of achieving the goal of crossing the finishing line. There was no point in questioning the relevance of any obstacles, if

they were there they had to be crossed, although I worked hard at times to avoid creating any obstacles of my own which were unnecessary.

I have tried throughout to keep a pragmatic attitude to my work. Theory gave me the structure that I needed to ensure my research had validity and that it was accurately recorded and analysed but the purpose of my research was always to illuminate, with young people's perceptions, the path being taken by an initiative. The research will be wasted if that light fails to lead to further improvements in the scheme focused on improving individual students' education and development.

The single moment that epitomises my work is not any theoretical reading, nor any notable piece of previous research. It will be the interview with a student who told me how much the ambassador had impacted on her, how her self confidence had been lifted from a very low level, how the ambassador supported her through her coursework, helped her with presentation skills and shown her that she had the potential to make a valuable contribution to society despite a record of low academic achievement.

#### Possible areas for future research

I hope that this study will be the catalyst for wider research but time and, inevitably, money will be the most important parameters in defining if and how that will happen. My research can only be a snapshot of what was happening in those schools at the time of my visits. A series of case studies that highlighted some issues relating to the Science and Engineering Ambassadors Scheme that I hope will be valuable in refining the scheme for the benefit of students in future. I hope it will also enable those who run the scheme to make some conclusions about what it does and does not achieve.

In the light of my work I suggest that the following areas of research may be useful in the future:

- It would be interesting to carry out further case studies in other regions to ascertain whether my comments on generalisations above are valid.
- That a more detailed evaluation of the passport2success scheme is carried out.
- That research into the effectiveness and timing of careers guidance in schools is undertaken with a wide brief enabling the research to look at other factors that effect careers options.
- How can the factors that have made this programme effective help other schemes involving adults other than teachers?

### The last word

As Science minister Ian Pearson said when announcing the expansion of the scheme, *“The programme is the epitome of effective partnership...with businesses of all sizes contributing enthusiastic and expert volunteers to serve as role models in schools.”*

(Time Higher Education. 29 May 2008. P.17)

In his keynote speech at the House of Lords event in April 2009 celebrating the Ambassadors’ scheme, Roger Highfield, Editor of New Scientist, said:

*“It is a no-brainer that our economy is going to be ever more dependent on STEM subjects but it is a matter of some angst just how we get young people animated by science and engineering. I love the STEM Ambassador idea. It sends out a signal that science, engineering, technology and maths are useful and relevant. It shows the human face of science (not the crazy, white-haired, old bloke). It gives teachers much needed support. There's no better way to turn kids on to STEM than to connect them with people who have a genuine passion for the subject.’*

My praise for the scheme is not quite so unqualified but my research supports his positive statement. I am confident, if the experience of the last few

hundred years is anything to go by, that the scheme will be amended and replaced and I am sure many will debate its underlying aims in the future. I hope that my research has helped to put the students' perceptions clearly at the heart of that debate.

It is entirely appropriate that the final quote in my work refers to the participation of students in developing their own education.

*"It is time that we count students among those with the authority to participate both in the critique and in the reform of education. This call to authorise student perspectives is a call to count students among those who have the knowledge and the position to shape what counts."* (Cook-Sather. 2002. P.3)

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## **APPENDIX 1. READER GUIDE**

Some terms and acronyms are used frequently in this study and it will help the reader if they are clarified at this stage.

**ACE (The Association for Consultancy in Engineering)** ACE represents the business interests of the consultancy and engineering industry in the UK.

**AMBASSADOR (Science and Engineering Ambassadors (SEAs))** An ambassador is a member of STEMNET's flagship scheme and has undergone training in issues related to confidentiality; formal and informal; building rapport; agreeing boundaries; reviewing the relationship and when to end the relationship. All ambassadors are volunteers and have the support of their companies.

**BECTA (British Educational and Communications technology Agency)** A Government agency promoting the use of information and communications technology; news, projects and resources on lifelong and special education.

**CBI (Confederation of British Industry)** The Confederation of British Industry is one of the UK's leading independent employers' organisation, representing public and private sector companies.

**DES (Department of Education and Science)** In 2009 the Department for Children, Schools and Families (DCSF). It was previously called the Department for Education and Science (DfES)

**EBP (Education Business Partnership)** One of a series of organisations, usually organised on a county or local authority basis, whose purpose is to encourage closer links between businesses and schools and colleges.

**HMI (Her Majesty's Inspectorate)** Superseded on April 1<sup>st</sup>. 2007 by the Office for Standards in Education (OFSTED) and responsible for promoting standards of education in England and Wales

**IET (Institute for Engineering and Technology)** is a worldwide professional society for the engineering and technology community. The IET provides a global knowledge network to facilitate the exchange of ideas and promote the positive role of science, engineering and technology in the world.

**MENTOR** In Suffolk, ambassadors are trained as mentors, to act as such in the Passport2success programme. The training is similar to that of ambassador but includes more detail on the scheme itself giving the mentor a content guide for their work with students. Mentors work on a one-to-one basis with students.

**NFER (National Foundation for Educational Research)** Aims to improve education nationally and internationally by undertaking research and dissemination activities.

**SEAs Management** contract holders coordinate the Science and Engineering Ambassadors programme on a local level. They engage with STEM employers and professionals to extend the range of Ambassadors. And they link Ambassadors with local schools and colleges.

**STEMNET (previously SETNET)** STEMNET aims to ensure that more young people in the UK make a choice to enter science, technology, engineering and mathematics (STEM) related careers at all levels, and future generations are properly informed about the science and technology that surrounds them.

**STEMPOINT (Previously SETPOINT)** STEMPOINT contract holders provide impartial brokerage on STEM Enhancement and Enrichment activities, to all schools and colleges in their local area. They are not contracted by STEMNET to deliver activities, but they may do so for other organisations that they work with.

**TVEI (Technical and Vocational Education Initiative)** This was a pilot scheme to encourage vocational education in schools. It was later rolled out to include all secondary schools under state control and was called TVEX (Technical and Vocational Education Extension)

## **APPENDIX 2. Letter to Schools.**

This is a generic letter sent by STEMNET to schools in Suffolk I wanted to visit. Similar letters to schools in other counties were sent but omitting specific reference to Passport2success.

Dear

The passport2success scheme in which your students are involved is proving very successful and attracting a lot of interest. A crucial element is the involvement of business expertise. I am asking if you would be willing to be involved in the evaluation of the Science and Engineering Ambassador's programme. The person carrying out the research will be David Cowley, an ex senior manager in East Sussex schools and now doing post-graduate research at the University of Brighton. He has an up to date CRB clearance, which he will bring with him. He is doing this research at the request of STEMNET Eastern region, specifically \_\_\_\_\_, the regional co-ordinator.

He would like to spend some part of a day in your school during December talking to those involved in the passport2success scheme. During his visit he would like to interview students who work with the ambassador and, if possible, the member of staff involved. If an observation of the ambassador at work with the students can be arranged this would be excellent. A possible programme might be:

Introduction with senior member of staff. (30 mins)

Group interview of students. (30 minutes) x2 or x3.

Observation of session (45 mins)

Feedback to staff member (30 mins)

This is for guidance only and can be varied.

This is a total of between 2 hrs 45 mins. and 3 hrs 15 mins. during a school day. A room in which he can interview groups of 4 to 6 students I all that is needed. As an ex-teacher, David is well aware of the pressures under which you are working. David will give information letters and consent forms for you to give to all interviewees.

He has already visited schools in Hertfordshire, Essex and Cambridgeshire and is keen to loom at Suffolk's flagship programme, as an example of good practice.

SETNET Eastern will publish the final report and you should contact them if you wish to receive a copy. SETNET will be using the results of this research to continue to improve the Ambassadors scheme, helping to ensure that your valuable time is used most efficiently for the educational benefit of the children. The findings will also form a core part of his thesis for an Educational Doctorate, which is being studied under the auspices of the University of Brighton.

Please contact David directly by e-mail at [djcowley@hotmail.com](mailto:djcowley@hotmail.com) or by telephone on 01424 854561 to tell him your preferred dates and discuss the programme and requirements with him. I know he is looking forward to hearing from you.

Thank you for your co-operation, etc, etc.

### Appendix 3. Student and parent consent form

Industrial Ambassadors.

- I agree to take part in this research, which is to explore the educational value of the Science and Engineering Ambassadors programme.
- The researcher has explained to my satisfaction the purpose of the study and the possible risks involved
- I have had the principles and the procedure explained to me and I have also read the information sheet. I understand the principles and procedures fully.
- I am aware that I will be required to answer some questions, but can decline to answer any, if I so choose.
- I understand that any confidential information will be seen only by the researcher and will not be revealed to anyone else.
- I understand that I am free to withdraw from this research at any time

Name:

Signed:

Date:

(For those under 18)

I am happy for my child, \_\_\_\_\_, to take part in this research.

Parent/guardian.

Name:

Signed:

Date:

#### **Appendix 4. Letter to adult participant.**

Dear \_\_\_\_\_,

I am carrying out research into the effectiveness of the SETNET (Science, Engineering and Technology Network) Eastern region's Science and Engineering Ambassador programme and would be pleased if you could spare some time to answer some questions about it. This research is being done at the request of the Eastern regional Co-ordinator of SETNET.

The interview should last about 30 to 45 minutes. The answers that you give will be confidential. If, at any time during the interview you want to stop answering questions then you may do so with any such withdrawal remaining confidential. Similarly if I ask you a question you do not want to answer then you have the right to say so.

SETNET Eastern will publish the final report and you should contact them if you wish to receive a copy. SETNET will be using the results of this research to continue to improve the Ambassadors scheme, helping to ensure that your valuable time is used most efficiently for the educational benefit of the children and the promotion of your company and profession.

The findings will also form a core part of my thesis for an Educational Doctorate, which is being studied under the auspices of the University of Brighton.

I will contact you shortly to arrange a convenient time and venue and

Thank you in advance for your co-operation.

David Cowley

Researcher

07967 159376

[djcowley@hotmail.com](mailto:djcowley@hotmail.com)

## Appendix 5. Letter to student participant, and parents of such.

Dear \_\_\_\_\_,

I know that you have, in the past, had contact with visitors who have come in from industry to your lessons. I am interested to find out how you feel about their contribution to your education and would like to ask you a few questions about this.

- The interview should last about 30 minutes.
- The interview will take place in school.
- The answers that you give will be totally anonymous.
- If, at any time during the interview you want to stop answering questions then you may do so. The school has agreed that this will not be held against you in any way.
- Similarly if I ask you a question you do not want to answer then you have the right not to answer.
- The head teacher has approved my visit to your school.

If you or your parents have any questions about this please contact me at [djcowley@hotmail.com](mailto:djcowley@hotmail.com).

The results of my research, including the confidential interview with you, will be published in a report by SETNET, an organisation that organises the ambassador programme helping to bring people from industry into your classroom.

The results will also, anonymously, be used as part of a piece of research I am doing under the supervision of the University of Brighton.

I enclose a consent form, which I would ask you, and your parents, to complete and bring to the interview please.

David Cowley  
Researcher

## APPENDIX 6. Interview Schedules.

### For students.

Example Question 1. Initial question. Do you enjoy Science lessons? Possible response: sometimes. Prompt: tell me about one you did like. (Subject enjoyment)

Example Question 2. Do you remember any adults, other than your teacher, coming to work with you in Science lessons? Possible response: Yes. Possible prompts: Did you enjoy that lesson? Why? What did the visitor do during the lesson? Did he/she speak to you individually or to the group you were in? (Role of ambassador in enjoyment of lesson)

Other possible questions.

- Has your opinion of Science lessons changed since the ambassador started coming in? (Influence of ambassador on lessons)
- Does he/she help you to relate your science lessons to real life situations? (Ability of ambassador contextualise learning)
- Do you think he/she worked hard in science lessons when he/she was at school? (Role model)
- Would you like to work in a job that uses science when you leave school? (Influence on future career plans)
- What subjects are you going to choose/have chosen to do next year? (Options)

It was important for me to be flexible and listen and prompt, not to dominate the interview with very direct and/or complex questions. It is in these situations that my experience of over 30 years dealing with young people, as a listener rather than as a teacher, was invaluable.

Questions for teachers:

- What did you think the ambassador brought to the lesson that would not have been there otherwise? (Why is ambassador there?)
- Was the ambassador involved in the planning of the lesson, and if so, how? (Involvement of ambassador in planning process)
- Would you like to have he/she in more often?
- Are there particular lessons when he/she would contribute more successfully? (More detail on planning of ambassador's role)
- Do you think that the students like him/her in? (Perception of student attitude)

Questions for ambassadors:

- What do you think the students learnt from your presence in the lesson that they could not have learnt from their teacher? (Why is ambassador there?)
- Were you involved in the planning of the lesson? What information did you have about today's lesson? (Involvement of ambassador in planning process)
- Why do you think it is important for you to be going into schools to help young people? (Motivation of ambassador)

## APPENDIX 7. Sample transcript.

### Interview with \*\*\*\*\*, year 9 girl at School P.

I I'm now talking to \*\* Sorry, \*\*\*\*. I've already explained to \*\*\*\* that this interview is, that she's here of her own free will and that if she wants to stop or doesn't answer any questions she can do. And I've explained that her name will not be used in the final document and that she'll be given the anonymity she's been promised. So, thank you for giving up your time Lily. What do you think about science lessons generally?

R They're all right but some are a bit boring. I like the experiments, they're good. because you get to join in and go and test.

I So, you like the doing bit of science rather than the writing bit of it?

R Yeah.

I Tell me of a lesson recently that's been a good lesson, an interesting lesson for you.

R I think it was Tuesday period 3 we done this [experiment thing], we had to drop and measure how long it took to go down with one paper clip [ ].

I What made that interesting? What do you think it was that made that an interesting lesson?

R You've got to have fun, you've got to stand on the table and you had to drop it and then just to measure, it wasn't just sitting there writing. You ought to enjoy [ ]...

I So it brings me onto it then if that's an interesting lesson, what's your definition, what's a lesson that's a boring science lesson?

R You have to write equations and you have to answer questions from a textbook.

I So do you enjoy working with other students?

R Yeah.

I Yeah, you prefer working in groups or with pairs than you do on your own?

R Yeah.

I What about the other side of the experiments? Do you like an experiment where you don't know what's going to happen?

R Yeah, because then it's a bit of a mystery.

I Right, so you like to find things out for yourself rather than told them?

R Yeah.

I Okay. I want to talk a bit now about the insight into industry day, do you remember that?

R Yeah.

I What did you think of it?

R I think it was good, except from the bank ones were boring.

I Right. What did you do during that day Ally? Lily, sorry, I must stop calling you Ally.

R one we had to build, I can't remember what, but we had to build a building [ ] something had to stay on the top without it falling through. You had to get it really high and the highest one and then I didn't do some of them because of, we only had like a certain amount of time so we only got to do three or something like that.

I So that was one of them. Banking was another, which you weren't so keen on. What about the other one?

R Can't remember that one.

I Right. And did you work on your own or in groups?

R In groups. You got to choose who you're with.

I You got to choose who you were with.

R Yeah, but we were sorted into like colour codes and then in that group we got to decide who we were with.

I Okay. And were there just teachers running this day or were there other people there as well?

R There were people from outside school.

I Okay, and what did those people do?

R They helped to, they like say things to you and then you got prizes for winning and the best person to [ ] something like that and you get to do all your experiments and stuff.

I And were these people who were actually doing the jobs for real in the outside world?

R Yeah.

I So what sort of people were they? We obviously we had somebody from banking or....

R Building industry or something.

I Building industry yeah.

R There was this [lego] one but I didn't do that one. There were loads of office ones but I can't remember.

I And were they men and women or both?

R Men and women.

I Both. And what did you think about those people? What's your opinion about those people?

R They were very kind and helpful.

I Kind and helpful. And they gave up their time for you as well. And do you think they were good at their jobs?

R Yeah.

I And what, why do think that they wanted to work with some Year 9s, some young ladies from Year 9 what...

R We're now choosing our options, to help and for like later in your life to help you decide what you want to do.

I So you think that they were trying to persuade you to do their job or just trying to show you how interesting...?

R See how interesting it is and to give a vague idea of what it would be like.

I So what did you learn about in terms of careers and jobs from that day that you didn't know beforehand?

R There was loads of different jobs and [ ] buildings it's not so boring, you get to design it and how you have structure it well and stuff like that.

I And are you somebody who is considering doing a job that's something to do with science or not?

R I did want to be a vet but I'm not sure yet, or a nurse, but I don't know.

I And did you want to do that before the day?

R Yeah.

I Did you have a chance to find out any more about vets or nurses, or medical?

R No, most [ ] were dentists.

I Right, he's dentist so you got somebody in there.

R Yeah.

I I think they do do days, so what I'm trying to get to here Lily is what difference did that day make to you in terms of...

R It helped you more, it helped you find different jobs and different ways of doing things.

I Right. Were these people, now would you think the people that were there were people that you respected as people?

R Yeah.

I Were they people that you would consider to be a role model?

R Not as much as a role model.

I No, but you respected them. You thought they were doing it to try and help you?

R Yeah.

I You all have to do science next year don't you?

R Yeah.

I Are you looking forward to science next year?

R No.

I No, because?

R I do like experiments side of them yeah, but not the other side don't really like.

I So you like the doing?

R Yeah, I don't like doing the investigation when you have to write it all down and the aim and the method and the apparatus.

I So would you like to see more hopefully when you're in Year 10, would it be good if there were more days like that insight into industry day?

R Yeah.

I Was that day just about science or was it about, it's about maths or something...

R Yeah, science and math.

I It was just science and maths. Do you have anything, any days like that are about other subjects?

R No.

I Okay, so it's just them ones. I've already talked to you about your job. What's sort of job, you talked about vet or medicine. What other jobs are you thinking about when you leave? Or is it too early to tell yet?

R Well, just to do with that really. I don't really know yet.

I So science is important to you isn't it?

R Well yeah a bit. Not too much.

I If you're going to go and be a vet or a medical it is a bit.

R Yeah.

I So [ ] put you off. Lily that's really good. So let me ask you what to say about IP insight into day or about science lessons or about what you're going to do in the future...

R No.

I Okay, just one thing has occurred to me. Was that insight into industry day, in your opinion, was it well organised?

R Yeah I think it was.

I And who do you think should take the credit for it being well organised?

R The school.

I The school. The teachers?

R Yeah.

I All right. Anything else \*\*\*\*?

R No.

I In that case, thank you very much for your time \*\*\*\*.

R Thank you.

I I wish you all the best in the future.

*[End of Interview]*

## APPENDIX 8. E-mail response from Ambassador in School P.

My questions are in black and the ambassador's responses in blue.

\*\*\*\*,

Thank you for your help.

Perhaps you would like to give me your thoughts on the following questions.

1. What do you think the ambassador scheme brings to the students learning/motivation that teachers cannot bring?

The main thing is demonstrating how skills learned in the classroom are applied to real life, and explaining the relevance of science and maths subjects in day to day life.

We also tend to bring more up to date information to the pupils, for example new technologies and innovations, and a depth of specialisms that teachers may not be fully aware of. An example would be when we go to schools and assist in lessons on renewable energy and sustainability.

2. Why do you think it is important for people from the business world/industry to go into schools?

There is a need for pupils to be able to apply their learning to real-life problems as above. The transition from full-time education to professional careers is still one that many people struggle with, even for university graduates. Companies getting involved with schools at an early stage, be it helping with activities or financial support such as sponsorship, helps to smooth this transition.

3. What do you think the business people as individuals and the companies that they represent get from the scheme?

The main value is developing awareness of what our professions involve. Faber Maunsell have employed a number of people from schools with whom we have worked in the past on EES schemes, and more recently STEP. These are often people who might otherwise not have considered engineering as a career.

As individuals it is motivating for us to see people being enthusiastic about our work, and doing presentations and running activities is excellent experience for younger engineers' personal development.

Many thanks in advance.

David Cowley