THE APPLIANCE OF SCIENCE

Applied Science, Science Technicians and the Science Diploma

July 2008

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The New Engineering Foundation (NEF) was established in 2004 as a grant awarding charity that supports the development of vocational education in science, engineering and technology through providing policy advice and advocacy, undertaking and commissioning research studies and impact analyses, and developing and delivering educational programmes and resources.

As well as the work on knowledge exchange detailed in this report, recent projects include the establishment of on-line master classes in science and engineering, and programmes designed to help Higher Education fulfil the economic potential of Work-Based Learning.

The NEF also provides financial support of up to £12,000 per time for further education lecturers to take up secondments with local engineering and technology companies and improve their current knowledge of industry best-practice and cutting-edge developments.

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A WORD FROM LORD SAINSBURY

Lord Sainsbury of Turville

The way wealth is created is changing, with science, innovation and skills playing an increasingly important role. In particular, a high level of Science, Engineering and Technology skills is crucial to the economy So, we need to build a sustainable pool of people with these skills to ensure that the UK remains an economic world leader.

At no time since the Industrial Revolution has the restructuring of global economic activity been so great, with Asia moving from the fringes of the new world economic order to the centre; at no point has the speed of technological change been so fast and so pervasive.

We have a responsibility to show our young people that technical and vocational education in science offer exciting and rewarding career opportunities in sectors such as aerospace, opto-electronics, nanotechnology, bio-technology amongst others. We need to show them that Science, Engineering and Technology are part of the 'new economy' and not the old one, and that they can play a vital part in building the world of tomorrow.

WELCOME

This latest report from the New Engineering Foundation is a combination of survey, research and our own experience of and involvement in technological businesses, and science and engineering pedagogy.

The NEF believes that science, engineering and technology (SET) skills gaps and skills shortages present serious barriers to the fulfilment of potential; on a personal level, with individuals gaining greatly from the study and application of SET; on a societal level, with everyone benefitting from scientific progress; and on an economic level, with technological innovation forming the foundation for our competitiveness in a globalised market.

We see the challenges as threefold. Some will require action by Government. Some require buisnesses to act. And others will mean change in the education sector.

In 'The Appliance of Science', we have identified the promotion of Science Technicians as a major step in meeting these challenges. The Government's 2007 National Employers Skills Survey identified significant Skills-Shortage Vacancies at the technician level. Lecturers surveyed have illustrated how teaching environments need to match the rapidly evolving real-world science arena. And business contributors have highlighted the need to address the current confusion and a lack of clarity in qualifications at levels 3 and 4.

As well as discussing and defining the various roles that Science Technicians cover, 'The Appliance of Science' proposes a specific Science Diploma within the current National Diploma system, established with input from policy-makers, educators, and entrepreneurs.

ACKNOWLEDGEMENTS

We acknowledge with gratitude the support received from the Gatsby Charitable Foundation.

We are very grateful for the invaluable contributions and feedback received from senior managers and representatives of:

- FE Colleges
- Business and industry
- Regional Development Agencies
- Government Departments and Agencies
- Higher education institutions
- Learning and Skills Council (national and local)
- Sector Skills Councils
- National Skills Academies
- Professional networks

We would particularly like to thank Nick Jagger from the Institute for Employment Studies and Iain Nixon from the KSA Partnership for their invaluable contributions.

Finally, we would also like to thank all the members of Applied Science Think Tank (full list is shown in Annex A) and the New Engineering Foundation Advisory Panel[1] for their continued enthusiasm and helpful contribution.

1 The New Engineering Advisory Panel consists of representatives from the following organisations: Association of Colleges; BBC; Bournemouth University; BASF; Bournemouth University; CBI; EEF; Foundation Degree Forward; Gatsby Charitable Foundation; Higher Education Academy; Institute of Directors; London Development Agency; North West Development Agency; OFSTED; Qualifications and Curriculum Authority; Royal Society of Chemistry; SEMTA.

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For decades, there have been artificial demarcations between science, engineering and technology...

In today's digital world, these lines have long since blurred.

– Professor Sa'ad Medhat PhD MPhil
CEng FIET FCIM FCMI FRSA MIoD,
Chief Executive,
New Engineering Foundation

THE SCIENCE DIPLOMA: A TECHNICAL SKILLS ROUTE TO INDUSTRY?

The Government's vision is to give all learners the opportunity to choose and successfully pursue all forms of science and its applications as their field of study and career, thereby helping the UK's industries to innovate and prosper in the global economy.

However, education today suffers from a lack of suitable provision to equip learners with relevant scientific and technical skills that meet employers' needs, as well as providing practical learning alternatives in a learners' educational development.

The current educational landscape shows a significant chasm in technical education, and it is a chasm that has been created by the education sector itself. For decades, there have been artificial demarcations between science, engineering and technology (SET), created ostensibly for policy and funding purposes. In today's digital world, these lines have long since blurred and the SET sector embraces all kinds of multi-disciplined elements and emerging technologies.

Learners today know this already, as this is a world in which they have grown up. Everything is application driven, and science is no different. The decline in science in general is not down to a learners' lack of interest in science, only their disinterest in the more traditional scientific routes. Therefore, more practical, real and relevant application-driven science is needed to ignite their latent interest.

Technician level skills gaps and shortages

Technician level skills gaps and shortages are often cited by employers as a serious problem in England. However, there has so far been relatively little evidence to show these technician level skill shortages in the context of the overall skills gap and employment shortages in other areas. It is here that the 2007 National Employers Skills Survey (NESS) is able to shed some light. Problematically, the occupational classification used in the survey, although mapping onto other official statistics, does not directly relate to technicians. However, as those with technician level skills are to be found within the Skilled Trades and Associate Professionals Standard Occupations Classifications, a useful proxy for technician level skills can be gained from these occupational groups.

Table 1, below, shows data provided by the 2007 NESS, which illustrates that Skilled Trades and Associate Professionals account for just over a quarter (25.8 per cent) of all vacancies. However, they account for over a third (34.3 per cent) of all vacancies resulting from Skill Shortages. Skill Shortage Vacancies (SSVs) are positions that are hard to fill as there is a lack of applicants with the required skills to do the job. This indicates that there is a concentration of SSVs in the occupational groups associated with technician level skills. On this basis, it can be argued that there is a particular skills shortage in technician level jobs.

Table 2, right, shows the reasons why vacancies are hard to fill amongst Associate Professional and Skilled Trade groups. Employers explained that the main reasons for the hard to fill vacancies are down to skills issues rather than other reasons. As respondents were allowed to give more than one response, the percentages do not add to 100.

It is interesting to note that a lack of suitable qualifications comes in lower than experience as a reason for vacancies being hard to fill in the two occupational groups. As the age profile of those in Associate Professionals and

TABLE 1: Vacancies and skill shortage vacancies in technician level related occupational groups

	Vacancies	Percentage of all vacancies	Skill shortage vacancies	Percentage of all SSVs	SSVs per 1000 employees
Associate professionals	100,800	16.3%	22,600	17.4%	14
Skilled trades	58,775	9.5%	21,925	16.9%	14
All	619.675	100.0%	130,000	100.0%	6

Source: 2007 National Employers Skills Survey (Table 3.4 page 35)

Skilled Trades tended to be younger than average, the deficiencies, in part, may be regarded as age related.

Table 3, below, shows that amongst Associate Professionals the most important relative skill deficiency is Oral Communication skills, mentioned by 37 per cent of employers reporting skill shortages amongst this group. Technical and Practical skills were also mentioned by 52 per cent of employers in the Associate Professional group. The relative skills gap amongst Skilled Trades was found to be Technical and Practical skills cited by 65 per cent of employers in this occupational group.

TABLE 2: Reasons for hard to fill vacancies in technician level related occupational groups

	Lack of appropriate...		
	...skills	...experience	...qualifications
Associate professionals	67%	40%	22%
Skilled trades	71%	34%	26%
All	48%	29%	18%

Source: 2007 National Employers Skills Survey (Figure 3.4 page 37 and Figure 3.5 page 38)

TABLE 3: Main skills lacking where skill shortages exist in technician level related occupational groups

	Technical and practical skills	Oral communication skills	Customer handling skills
Associate professionals	52%	37%	29%
Skilled trades	65%	28%	26%
All	52%	33%	32%

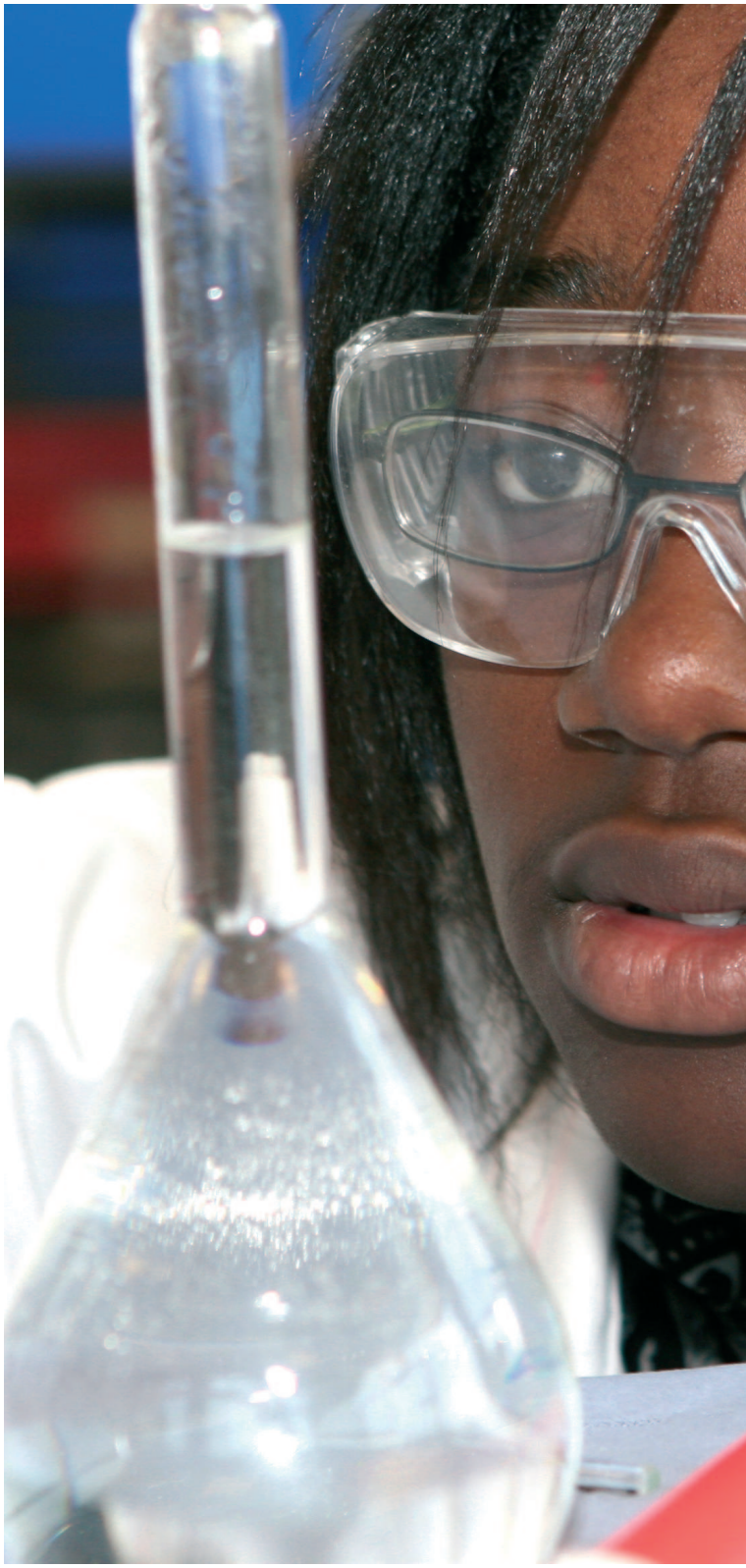
Source: 2007 National Employers Skills Survey (Table 3.5 page 41)

WHAT IS APPLIED SCIENCE?

Applied (or vocational) science covers a broad spectrum of occupational subjects including:

physical science applications; chemistry applications; biological and microbiological systems; bio-materials; environmental science; cosmetics and toiletries; surfactant and detergents science; forensic science; food and agricultural science; agri-chemical science; science in medicine; genetics and genetic engineering; physiological measurements; and scientific principles and instrumentations.

However, there is a general lack of clarity over what applied and vocational sciences mean to schools and colleges, policy makers, and government agencies.



THE CHALLENGE

There is a clear disconnect between the way in which the fast moving scientific arena is evolving and transforming itself, and the way in which educationalists and policy makers are addressing the education and training provision, particularly at level 3.

One of the indicators that can demonstrate this misalignment is the small number of learners undertaking A-level Applied Science in any one year which, according to the DCSF's National Statistics website, was only 801 in 2007 (404 females and 297 males, with a pass rate of 87.4 per cent).

Whilst it is acceptable for educationalists to focus on teaching the fundamentals of science, there is also a need to include industrially contextualised knowledge of scientific applications and transferable and employability skills that recognise the multi-disciplinary aspects of science today.

Presently, industry demands high-quality individuals with modern technical and transferable skills, together with an appreciation of a multi-disciplinary approach to working. However, the pool of such individuals is limited and, therefore, those companies that have the financial and resource abilities (such as the large multi-nationals) employ science graduates and place them on in-house re-skilling programmes to effectively 'transform' graduates into technicians.

This course of action, although seemingly sound, has flaws, in that the graduates themselves are

not necessarily fit to be technicians. They have different skills sets, capabilities and knowledge bases to begin with. They are thus more adept at professional scientific work and find the 'reskilling' at odds with the reasons why they engaged in a graduate science career. The result is that the graduates become demotivated and companies have to develop morale-building programmes to retain their graduates. However, more often, the nett effect is that graduates leave the science profession and the sector loses valuable talent.

Of course, the reskilling of graduates is mainly within the reach of large companies. Smaller companies often have to consider other alternatives such as utilising temporary staff or sourcing expertise from overseas, again as a transient measure. Both of these measures offer limited control on IPR and constrain a company's innovative progress.

In a recent study conducted by NEF, it was found that the range and type of applied/vocational science provision was limited in subject matter, lacked a strong vocational element, in terms of industrial applications and standards, and in some cases, was out of date.[1]

Due to emphasis in the FE sector on being qualification-facing, and driven in the main by funding and targets, much of the provision of the applied science programmes has been developed to appeal to prospective learners, creating repetition in courses (forensics, sports science) and a glut of students with the same skills-sets and knowledge not currently in demand by industry. This furthers the 'imbalance' between the supply of applied/vocational science courses and the real needs of the economy.

The study identified a healthy focus by colleges on Science Access to higher education degree courses, as these carry more attractive HEFCE funding and offer good opportunities to expand colleges' HE provision.

These higher education Access courses, however, do not provide learners with the higher level multi-disciplinary technical skills much needed by industry. The failure of colleges to deliver appropriate technical skills is an unintended consequence of a number of barriers to progression, including:

- lecturers can only teach at lower levels (due to lack of experience, knowledge and skills);
- laboratory space taken by other programmes more in demand in colleges (hairdressing/beauty);
- lack of specialist or up-to-date equipment needed to deliver higher standard training and education programmes.

1 The New Engineering Foundation is conducting a quantitative and qualitative study to review the profile and capability of applied/vocational science provision at level 3 and progression to level 4 in further education. The study is seeking to establish a baseline position on the extent of, and the current strengths in, the provision of applied/vocational science at NQF levels 3 and 4 in FE colleges in England.

The study consists of four interrelated elements – desk research to gather and analyse policy and statistical data, a survey of FE colleges to ascertain current and future needs, focus groups and interviews with key national and regional stakeholders.

This lack of both capability and capacity to respond to industrial needs has resulted in colleges losing out to private training providers, who are more flexible about, responsive to and appreciative of rapid industrial changes.

Given the current lack of appropriate technical provision to meet the technician level skills shortage made evident in the 2007 National Employers Skills Survey, and through the various qualitative studies conducted by NEF, it is considered that the proposed Science Diploma could fulfil these apparent shortages, and provide a **valuable technical alternative** to the traditional A-level qualification. This would provide those learners who would prefer to follow a more practical progression route with the ability to secure the skills needed to give them sound career opportunities to achieve a good standard of living.

WHAT ARE SCIENCE TECHNICIANS?

Science technicians use their skills in a wide range of industries, from food and health, to nuclear decommissioning and agriculture.

Science technicians[2] employ broad scientific knowledge and experience to provide:

- effective problem-solving and synthesis;
- interpretation of scientific results;
- specific technical, IT, presentational, mathematical and other relevant scientific support;
- effective interaction with professionals in various science disciplines.

Science technicians use the principles and theories of science and mathematics to solve problems in research and development, and to help invent and improve products and processes. However, their jobs are more practically-oriented than those of scientists. Technicians set up, operate, and maintain laboratory instruments, monitor experiments, make observations, calculate and record results, and often develop conclusions. They usually maintain detailed logs of all their work. Those who perform production work also monitor manufacturing processes and may ensure quality by testing products for proper proportions of ingredients, for purity, or for strength and durability (for example, in the perfumery and pharmaceutical industries).

2 Other technicians who apply scientific principles include engineering technicians, broadcast and sound engineering technicians and radio operators, health technologists and technicians – especially clinical laboratory technologists and technicians, diagnostic medical radiographers, and radiological technologists and technicians.

As laboratory instrumentation and procedures have become more complex, the role of science technicians in research and development has expanded. In addition to performing routine tasks, many technicians, under the direction of scientists, now develop and adapt laboratory procedures to achieve the best results, interpret data, and devise solutions to problems. Technicians must develop expert knowledge of laboratory equipment so that they can adjust settings when necessary and recognise when equipment is malfunctioning.

Most science technicians specialise and have occupational titles that tend to follow the same structure as those for scientists.[3]

Agricultural and food science technicians work with related scientists to conduct research, development, and testing on food and other agricultural products. Agricultural technicians are involved in food, fibre, and animal research, production and processing. Some conduct tests and experiments to improve the yield and quality of crops, or to increase the resistance of plants and animals to disease, insects, or other hazards. Other agricultural technicians breed animals for the purpose of investigating nutrition. Food science technicians assist food scientists and technologists in research and development, production technology, and quality control. For example, food science technicians may conduct tests on food additives and preservatives to ensure compliance with the Food Standards Agency and the Medicines and Healthcare Products Regulatory Agency, regarding colour, texture, and nutrients. These technicians analyse, record, and compile test results; order supplies to maintain laboratory inventory; and clean and sterilise laboratory equipment.

Biological technicians work with biologists studying living organisms. Many assist scientists who conduct medical research – helping to find a cure for cancer or AIDS, for example. Those who work in pharmaceutical companies help develop and manufacture medicine. Those working in the field of microbiology generally work as laboratory assistants, studying living organisms and infectious agents. Biological technicians also analyse organic substances, such as blood and food as well as non-organic substances such as drugs. Biological technicians working in biotechnology apply knowledge and techniques gained from basic research, including gene splicing and recombinant DNA, and apply them to product development.

Chemical technicians work with chemists and chemical engineers, developing and using chemicals and related products and equipment. Generally, there are two types of chemical technicians: research technicians who work in experimental laboratories; and process control technicians who work in manufacturing or other industrial plants. Many chemical technicians working in research and development conduct a variety of laboratory procedures, from routine process control to complex research projects.

For example, they may collect and analyse samples of air and water to monitor pollution levels, or they may produce compounds through complex organic synthesis. Most process technicians work in manufacturing, testing packaging for design, integrity of materials, and environmental acceptability. Often, process technicians who work in plants focus on quality assurance, monitoring product quality or production processes and developing new production techniques. A few work in shipping to provide technical support and expertise.

3 Source: US Government's Bureau of Labor Statistics

Environmental science and protection technicians perform laboratory and field tests to monitor environmental resources and determine the contaminants and sources of pollution in the environment. They may collect samples for testing or be involved in abating and controlling sources of environmental pollution. Some are responsible for waste management operations, control and management of hazardous materials inventory, or general activities involving regulatory compliance. Many environmental science technicians employed at private consulting firms work directly under the supervision of an environmental scientist.

Forensic science technicians investigate crimes by collecting and analysing physical evidence. Often, they specialise in areas such as DNA analysis or firearm examination, performing tests on weapons or on substances such as fibre, glass, hair, tissue, and body fluids to determine their significance to the investigation. Proper collection and storage methods are important to protect the evidence. Forensic science technicians also prepare reports to document their findings and the laboratory techniques used, and they may provide information and expert opinions to investigators. When criminal cases come to trial, forensic science technicians often give testimony as expert witnesses on laboratory findings by identifying and classifying substances, materials, and other evidence collected at the scene of a crime. Some work closely with other experts or technicians. For example, they may consult either a medical expert about the exact time and cause of a death or another technician who specialises in DNA typing in hopes of matching a type to a suspect.

Forest and conservation technicians compile data on the size, content, and condition of forest land. These workers usually work in a forest under the supervision of a forester or a land-based engineer, doing specific tasks such as measuring timber, supervising harvesting operations, assisting in road building operations, and locating property lines and features. They also may gather basic information, such as data on populations of trees, disease and insect damage, tree seedling mortality, and conditions that may pose a fire hazard. In addition, forest and conservation technicians train and lead forest and conservation workers in seasonal activities, such as planting tree seedlings, and maintaining recreational facilities. Increasing numbers of forest and conservation technicians work in urban forestry – the study of individual trees in cities – and other non-traditional specialties, rather than in forests or rural areas.

Geological and petroleum technicians measure and record physical and geological conditions in oil or gas wells using advanced instruments lowered into the wells or analysing the mud from the wells. In oil and gas exploration, technicians collect and examine geological data or test geological samples to determine their petroleum content and their mineral and element composition. Some petroleum technicians collect information about oil and gas well drilling operations, geological and geophysical prospecting, and land or lease contracts.

Nuclear technicians operate nuclear test and research equipment, monitor radiation, and assist nuclear engineers and physicists in research. Some handle key roles in decommissioning nuclear power stations. For example, they operate remote controlled equipment to manipulate radioactive materials or materials exposed to radioactivity.

Other science technicians perform a wide range of activities. Some collect weather information or assist oceanographers; others work as laser technicians or radiographers and audiologists.

Advances in automation, information technology and nanoscale technologies (and other forms of emerging technologies) require technicians to operate in more sophisticated multidisciplinary instrumentation and measurement settings.

Science technicians make extensive use of the latest computing and electronic measuring equipment as well as utilising conventional experimental apparatus.

Employment outlook

In addition to meeting the existing vacancies that are due to the shortages in skills outlined in the 2007 National Employers Skills Survey, the overall employment of science technicians is expected to grow by 12 per cent annually during the next decade (about as fast as the average for all occupations). The continued growth of scientific and medical research – particularly related to biotechnology – will be the primary driver of employment growth, but the development and production of technical products should also stimulate demand for science technicians in many industries.

With the increasing proliferation of all types of nano-based materials, technologies and applications, previous conventional production processes and materials will be no longer be appropriate, and as such, the skills associated with these processes will be out of date. Instead, in the very near future, demand will be on particular skills-sets focused on nano-technology that we currently have no awareness of, and, more importantly, have no provision to meet. In order that we as a nation are not left straggling behind in this emerging nanotech economy, recognition is needed now of what these developments will mean to technical education, and the Diploma should be developed to meet the anticipated demands of the dynamic and complex world that the future promises to be.

Industry leaders help shape the Science Diploma

On 11 April 2008, the NEF convened a think tank with representation from all key stakeholders, as well as a number of industry leaders, in order to 'establish a baseline position in Applied Science provision at level 3 and progression to level 4'. The proposed Science Diploma formed a key agenda item.

A common theme in the discussion was the 'clarity of purpose' of the new Science Diploma. Who is asking for it? And who are the target audiences? These remain fundamental questions that will inform and shape how the Science Diploma will be introduced and what it will look like.

However, positioned correctly, it is envisaged that the Diploma will offer an opportunity for more young people to be attracted into STEM disciplines and careers, presenting the chance for schools, colleges and companies to work collaboratively on the development of the Diploma, thereby creating an environment for learners that is stimulating and motivating and builds understanding and confidence in practical science.

Presently, employers are 'confused' about the qualifications nomenclature available. Qualifications such as A-levels are well understood, and they hold some currency with less

technical market sectors. However, in the main, A-levels are regarded as a stepping stone to university entry.

It is widely acknowledged that the A-level system is not meeting the needs of employers and higher education institutions, and is deemed by many stakeholders as being 'not fit for the purpose'. For example, employers who take on individuals with A-levels often have to re-train them, as they have little practical, hands-on capability to actually do the job straightaway. Likewise, higher education institutions frequently have had to resort to providing remedial studies to bring entrants to the required level of degree entry standard.

However, it is important to 'decouple' these issues (associated with the failing A-level system), from those arising out of the need to address the provision of an effective practical route to applied science education and training.

Employers understood the old technical qualifications, such as the ONC/D and HNC/D, as they knew what to expect from individuals holding these qualifications. In the current array of qualifications, employers, when recruiting post-16 school leavers, often feel lost as to whom they should be employing as the candidates' qualifications do not reflect the occupational requirements and the requisite skills needed to undertake the job at hand.

It is therefore imperative that the Diploma and the associated labelling of its levels (Foundation, Higher, Progression and Advanced), and its contents therein, be meaningful and readily understandable by employers and other stakeholders (parents, learners, teachers, HEIs, etc).

Employers have cited, on numerous occasions, the need for individuals to have good rounded skills in science, as well as presentation and communication abilities, time management, problem-solving skills, and the ability to work on their own initiative without instruction. These transferable and life skills should be embedded into the Diploma's curriculum, thereby giving individuals taking the Diploma a higher level of value-added employability.

It is important, when considering the curriculum for the proposed Science Diploma, to learn from the experience of the Engineering Diploma, and avoid developing a curriculum that is in tune with neither the employers nor learners, and is not flexible enough to meet the changing needs in modern and future science. A key facet that will differentiate the Science Diploma and establish its technical standing will be the involvement of employers/companies to help contextualise the curriculum to reflect current industrial practices and knowledge. However, once again learning from the pitfalls of the Engineering Diploma, the employer involvement should be framed in such a way as to concentrate on examples, applications and case-studies to contextualise and bring learning to life, as opposed to dominating the content structure to meet specific and narrow training needs, thus creating a potpourri of subjects delivered in a piecemeal fashion that lack coherency and overall programme integrity, which would only serve to devalue the currency of the Diploma.

The cornerstone of the newly proposed Science Diploma is to develop it so that it is

seen as a **valuable technical alternative** to the traditional A-levels. The Diploma should be seen as **equal** in stature but **different** in purpose to the A-levels. In addition, the proposed Science Diploma could also serve to fill the vacuum in Applied Science Modern Apprenticeships that exists today.

The current and on-going argument between 'academic' versus 'vocational' is meaningless to parents, learners and employers, and is being kept alive by people entrenched in old-fashioned attitudes. From our extensive school and college visits, it has become apparent that what a parent wants for their child is to be sure that they have a good education, that they can achieve and can secure a good career at the end of their education. Equally, many 16-18 year-old learners want the opportunity to get a good, industrially-recognised qualification so that they can get a good job and have decent earning potential. An employer wants to be able to recruit someone who has a good level of technical capability with transferable and life skills, who does not require significant retraining and who can do their job efficiently and effectively. Therefore, the proposed Science Diploma should be perceived as the qualification that delivers on these needs, and is seen as the **good, valuable alternative**.

The Diploma development needs to be underpinned with clear and coherent progression routes, in terms of further technical study and careers. A current lack of clarity in technical progression routes and poor careers advice is a major barrier than needs to be overcome to ensure that the Diploma is seen with equal currency to the A-level.

Whilst the proposed Diploma could be the answer to addressing the skills shortage in science, particularly at technician level education, **the Diploma should not be considered as a one-size-fits-all solution to address the overall reforms required in this important area**.

Suggestions

The New Engineering Foundation suggests the creation of two Review Panels should be considered to address the following:

- Technical and Scientific Skills Review (Qualifications, Provision, Progression) with a view to clearly defining the core purpose of a new Diploma in Applied Science; and
- The A-Level Plus Review (to consider how to refresh the A-level qualifications' system and add the necessary transferable and life skills and the related assessment strategies. The Review could also include a comparative analysis with the International Baccalaureate approach).

ANNEX A
Think tank, 11th April. Applied/vocational science provision

Physical Sciences Subject Centre	Paul Chin
Association of Colleges	Roger Woods
Barnet College	Dr Terrence Thomas
BASF Ltd	Dr Rosie Bryson
City of Sunderland College	Chris Wagstaffe
Cogent - SSC	John Holton
Cornwall College	Dr Michael Hunt
DIUS	Ian Pegg
East of England Development Agency	Carole Edwards
EU Skills	Tony Hicks
Gatsby Charitable Foundation	Dr John Williams
HE Academy / New Engineering Foundation	Malcolm Carr-West
National Skills Academy to the Process Industry	Clive Parker
New Engineering Foundation	Prof Sa'ad Medhat
New Engineering Foundation	Iain Nixon (Facilitator)
New College, Nottingham	David Thrower
Newcastle College	Jim Hubbard
Ofsted	Alex Falconer
Procter and Gamble	John Crompton
Royal Society for Chemistry	Dr Wendy Crocker
SEMTA	John Harris
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