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- ▲ independent schools;
- ▲ further education;
- ▲ independent specialist colleges;
- ▲ adult community learning;
- ▲ local authority education services for children and young people;
- ▲ teacher education and training;
- ▲ work-based learning;
- ▲ careers companies; and
- ▲ offender learning.

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- ▲ makes public good practice based on inspection evidence.

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Introduction

- 1 The purpose of this survey is to provide the Welsh Government with advice on the current standards and the quality of provision for engineering in further education (FE) colleges and work-based learning (WBL) providers, as requested in the annual ministerial remit to Estyn.
- 2 For the purpose of this report, 'engineering' refers to the technical skills and professional training and education in engineering delivered by colleges and WBL providers. The report focuses on engineering and engineering manufacture within the learning area of 'engineering and manufacturing technologies'.
- 3 In undertaking their survey, inspectors sent a questionnaire to all FE colleges and WBL providers that offer education and training in engineering. On the basis of the analysis of the returned questionnaires, inspectors visited five colleges of further education and five WBL providers. They observed learning sessions in workshops, engineering laboratories and classrooms. In addition they talked to learners, teachers, leaders of the engineering provision and senior leaders. The WBL providers visited included the work-based provision within colleges.
- 4 Inspectors considered data on the performance of engineering learners in colleges and WBL providers. They reviewed current information relating to education and training in engineering and in particular the importance of engineering for economic regeneration.
- 5 Inspectors used performance data and Estyn inspection reports to analyse:
 - completion, attainment and success rates of learners on engineering programmes in comparison with other learning areas; and
 - trends in enrolment onto engineering programmes.
- 6 Inspectors asked colleges and WBL providers to carry out a strengths, weaknesses, opportunities and threats (SWOT) analysis and to provide information on:
 - the range of engineering disciplines available;
 - areas of advanced or specialised technology provision;
 - how provision relates to Welsh Government initiatives or programmes;
 - the destinations of engineering learners; and
 - how they engage with industry and employers.

Background

- 7 Engineering makes a significant contribution to the economy of Wales. All manufacturing, service and infrastructure sectors rely heavily on technical and engineering-trained staff to design, manufacture and maintain our products and services.
- 8 The engineering sector in Wales employs around 80,000 people working in about 5,000 establishments. About 91% of these employ fewer than 50 people. The engineering sector is male dominated with females accounting for less than 20% of the workforce.
- 9 In Wales the industry is mainly focused on the sectors of basic metals and aerospace. The geographical centres of employment in engineering are around Flintshire, Neath Port Talbot, Newport, Rhondda Cynon Taff, Bridgend and Wrexham. In 2008, data indicated that the engineering sector accounted for 13% of the total Gross Value Added (GVA)¹ in Wales.
- 10 About 10% of the engineering workforce in Wales is between 16 and 24 years of age. Despite an anticipated decline in employment in the engineering sector, projections point to a net requirement of over 12,000 new employees in the next few years to replace those who leave their jobs due to retirement and other reasons. However, it is expected that these jobs will require a more skilled and multi-skilled employee working in more managerial and professional/technical areas, such as advanced manufacturing, renewable energy and composite materials areas of engineering.² There is an increasing requirement for employers to improve the skills of their existing workforce in order to maintain and improve their competitive edge in a competitive world marketplace.
- 11 The Welsh Government working with SEMTA (the sector skills council for science, engineering, manufacture and technology) has, in recent years, developed projects designed to encourage employers, particularly those in the engineering industry, to employ more apprentices and to design programmes that more closely meet their business needs. Other projects are designed to encourage developments with schools that enable school pupils to gain qualifications and experience in engineering topics that will help to prepare them for potential apprenticeships. This also provides pupils with additional information on career choices and helps to put their traditional school work in more of a vocational context.
- 12 Traditionally, FE colleges and WBL providers have offered education and training programmes for 16 to 19-year-old learners, as part of an engineering apprenticeship or pre-apprenticeship programme. They provide education and training programmes for adults as well as bespoke training and consultancy services for industry, enterprises and other organisations. The provision of higher education engineering

¹ GVA – Gross Value Added is a measure in economics of the value of goods and services in an area, industry or sector of the economy. (It has a relationship with GDP (Gross Domestic Product) i.e. $GVA + \text{taxes on products} - \text{subsidies on products} = \text{GDP}$.)

² SEMTA Engineering Skills Balance Sheet Wales (2008) – An analysis of Supply and Demand issues.

programmes in FE colleges is expanding through franchise arrangements with the university sector. Also, there is an increase in training in the workplace through WBL providers.

- 13 The range of engineering disciplines offered by colleges and WBL providers across Wales include:
- aeronautical and aerospace engineering, including avionics;
 - marine engineering;
 - manufacturing engineering including robotics and quality assurance;
 - engineering design, including computer aided design (CAD);
 - mechanical maintenance and repair;
 - electrical maintenance and repair;
 - mechanical machining and tool-making, including computerised numerical control (CNC);
 - fabrication and welding;
 - electronics and microelectronics including programmable logic controllers (PLCs);
 - motor vehicle maintenance and repair including body repair;
 - mine engineering;
 - environmental engineering; and
 - computing and software engineering.
- 14 Typically, learners will follow a main programme of study, but many also take advantage of opportunities to develop additional skills and qualifications in other disciplines within engineering. This provides learners with opportunities to improve their usefulness to future employers.
- 15 FE colleges and WBL providers also offer programmes to update and improve the skill levels of qualified tradesmen and engineers through the use of advanced technology and specialised programmes. More recently, engineering courses, especially in motor vehicle maintenance and repair, have become a popular choice for 14 to 16-year-old pupils as a result of the links between colleges, work-based providers and schools. These links are often driven by area networks and the area network development plans (ANDPs) of local authorities.
- 16 Many colleges have developed their equipment, facilities and expertise to be able to offer progression onto higher education (HE) programmes such as higher national certificates and diplomas (HNC (D)). The financial implications for students in following HE programmes direct from school have led to the development in some areas of higher apprenticeship programmes for young adults. Many learners who leave school at 16 consider an apprenticeship as a cost effective way to gain qualifications, possibly to HNC (D) level, particularly when it includes gaining practical industrial experience and qualifications while earning a salary.

Main findings

- 17 FE colleges and WBL providers have many examples of good and sometimes excellent practice. This includes examples of work with industry to develop advancing technology, the provision of novel engineering training opportunities for learners and companies, and the development of more effective links with schools to introduce pupils to engineering technologies.
- 18 The rate at which engineering learners in FE colleges and WBL providers complete and attain their qualifications is close to the average for all learning areas within the FE sector and above average within the WBL sector. The rate of improvement over recent years is similar to the improvement in all learning areas during the same period.
- 19 In 2009-2010, FE engineering programmes were ranked joint 11th of the 20 learning areas in terms of learners' success rates. In WBL, engineering programmes were ranked 3rd of the 11 learning areas in terms of learners' framework success rates³.
- 20 In the lessons and sessions observed during the survey, the quality of teaching and learning was generally of good quality and sometimes excellent. Learners study in accommodation of good quality and mostly have enough materials and equipment.
- 21 The majority of engineering learners progress well from one level of study to the next. Most learners progress onto programmes at a higher level, and gain apprenticeships or employment of an engineering or technical nature. However, the proportion of engineering learners who leave programmes to unknown destinations, at 30% for FE and 21% for WBL, is too high, although this is generally consistent with other learning areas. Because of this, it is difficult to judge how successful the outcomes of engineering programmes are in terms of the career paths of all learners after they have finished their courses.
- 22 The curriculum offered by engineering providers mainly reflects a balance between the aspirations of learners and the needs of local and regional industry. Courses in motor vehicle maintenance attract learners into engineering in schools and colleges, with many progressing onto other engineering programmes.
- 23 In the majority of providers, learners are able to progress onto specialist HE programmes at level 4 through franchise arrangements with the university sector. However, many of the franchise arrangements for these programmes are overly bureaucratic and restrictive.
- 24 Providers have extended their full-time programmes and often include the Welsh Baccalaureate Qualification (WBQ). The pathway to apprenticeship programme (PtA) is becoming a successful programme in preparing learners for apprenticeship programmes. The principal learning programme, in partnership with the schools'

³ In WBL, the framework qualification consists of learners NVQ and key skills at the appropriate level and their technical certificate. All parts of the framework have to be achieved for the learner to gain framework success.

WBQ programme, is improving the opportunities for learners and forging better links between providers and schools.

- 25 FE colleges have started to provide engineering programmes that embrace a number of the emerging, newer technologies, such as photonics, composite materials and technologies associated with the energy industry. However, the extent of this involvement is small overall.
- 26 Not enough colleges and WBL providers challenge their learners to take part in external competitions such as regional and national skills competitions. Although there have been some improvements, Wales remains under-represented in the UK team for the Skills Olympics.
- 27 Engineering learners benefit from their provider's links with the engineering industry. They benefit from teaching and assessing staff's contribution to 'live' industrial projects, particularly when they see the practical application of the latest technologies. With only 5% of enrolments in FE colleges, engineering contributes around 23% of commercial activity. The engineering route in work-based engineering contributes well in relation to the total provider activity. Courses represent only 16% of leavers, with engineering contributing 44% of the total business activity normally.
- 28 Engineering learners generally express a strong degree of satisfaction with their programme of study, particularly the practical sessions. They express lower levels of satisfaction with formal theory classes, particularly those that require more advanced levels of mathematics, literacy and science. Too many underestimate the importance of skills in these areas to success in their engineering programmes.
- 29 There is increased competition for places on some engineering programmes by learners. This is particularly the case when the provider has good links with employers. Although the performance of local area networks and the schools/colleges/WBL provider links are generally improving, not all providers are able to attract enough school leavers with the right skills into engineering careers. Too often an engineering career is seen by schools as an option for the less able pupils, mainly boys.
- 30 Despite various projects over the years, such as Women into Science and Engineering (WISE), female learners remain under-represented on engineering programmes, where they typically make up less than 10% of learners.
- 31 The links between FE colleges and WBL providers and industry are a particular strength. However, both FE and WBL sectors are mindful of competition from other providers in terms of their business activity and their ability to retain technical staff, teachers and assessors of high quality. This can have a negative impact on the extent of collaboration.

Recommendations

- 32 In order to continue to improve standards and the quality of provision for engineering education and training in FE colleges and WBL providers:

The Welsh Government should:

- R1 review arrangements to allow colleges and other providers to offer HNC (D) programmes in their specialist areas without the need to enter franchising arrangements with the university sector; and
- R2 consider subsuming the various Wales-wide engineering-based initiatives and projects within an overall national engineering education and training strategy for Wales, which can be supported by the engineering industry and all other stakeholders.

Further education colleges and work-based learning providers should:

- R3 improve the rate at which learners complete and attain their qualifications;
- R4 monitor more closely the destinations of all learners when they leave their programmes;
- R5 improve partnership arrangements with schools so that all pupils can:
- have better access to information on education, training and career opportunities in engineering; and
 - understand that, to succeed in engineering, pupils need numeracy, literacy and physical science skills at an appropriate level;
- R6 continue to develop the curriculum to ensure that all learners, including females, who are interested in engineering-based careers can enter programmes at a level that are most appropriate for them;
- R7 develop strategies to enable a quicker, more appropriate response to the needs of industry for bespoke training and employer-led consultancy; and
- R8 encourage more learners to enter regional and national competitions of their engineering skills and improve the Welsh representation in the UK team for the Skills Olympics.

Performance in engineering

Standards in further education colleges

- 33 Between 2002 and 2010, 17 engineering learning areas in FE colleges were inspected. Inspectors awarded the highest grade for teaching and learning, grade 1 (good with outstanding features), to six colleges (35%). They awarded a grade 2 (many good features with no important shortcomings) to a further six colleges (35%). The remaining five colleges (30%) were awarded a grade 3 (good features outweigh any shortcomings).
- 34 In 2009-2010, engineering accounted for around 5% of the all learners in FE colleges.
- 35 Between 2007 and 2010, overall enrolments in engineering in FE colleges fell from 17,998 in 2007-2008 to 17,361 in 2009-2010, a decline of 4%. However, this reflected a lesser decline than in enrolments in colleges as a whole.
- 36 In 2009-2010, the rate at which engineering learners completed their programme in FE colleges was 90%. This is similar to the average rate for all learning areas.
- 37 In 2009-2010, the rate at which engineering learners attained their qualification in FE colleges was 88%. Again, this is similar to the average for all learning areas.
- 38 In 2009-2010, the overall success rate for engineering learners in FE colleges was 80%. This is similar to the average for all learning areas.
- 39 Between 2007 and 2010, overall completion, attainment and success rates for engineering improved at roughly the same rate as they did in other learning areas.

Standards in work-based learning providers

- 40 Between 2002 and 2010, 38 engineering learning areas in WBL providers were inspected. Inspectors awarded the highest grade for teaching and learning, grade 1 (good with outstanding features), to 14 providers (37%). They awarded a grade 2 (many good features with no important shortcomings) to 17 providers (45%). Inspectors awarded a grade 3 (good features outweigh shortcomings) to four providers (11%). The remaining three providers (8%) were awarded a grade 4 (some good features but shortcomings in important areas).
- 41 In 2009-2010, the overall framework success rate for engineering learners in WBL providers was 84%. This was above the average for all learning areas. Between 2007 and 2010, the overall frameworks success rate for engineering improved by 12 percentage points, which is slightly below the average rate for all learning areas.

Engineering learner destinations

- 42 In FE colleges, the destination of learners following the completion of the academic year varies widely. It is also difficult to interpret the data on destinations because the information does not identify just those who finish their courses, but includes those who stay on to continue them from one year to the next. Also, the destination for too many leavers is classed in the data as 'unknown'. In 2009-2010 this was at 31% of the cohort.
- 43 In the same year, almost a third (32%) continued on their full-time engineering programme, 10% continued on part-time programmes and 8% progressed to engineering related employment. About 7% progressed onto HE programmes with 6% progressing onto an engineering apprenticeship. A total of 4% gained employment outside engineering or technical fields. The remaining 3% were actively seeking employment and not attending college.
- 44 In WBL providers, the destination of learners following the completion of their year of training varies widely. Almost a half (45%) of learners continued on their programme at the same level. These learners are mostly on two-year programmes or widening their experience to provide multi-skilled employment opportunities. Around a fifth (18%) progressed to engineering related employment (not apprenticeship) and 8% progressed to a higher level programme. About 5% progressed to an engineering apprenticeship or other technical occupation with 3% of learners progressing to employment of a non-engineering nature. The data on destinations for too many learners (21%) is 'unknown'.

Comparison of engineering standards with other learning areas

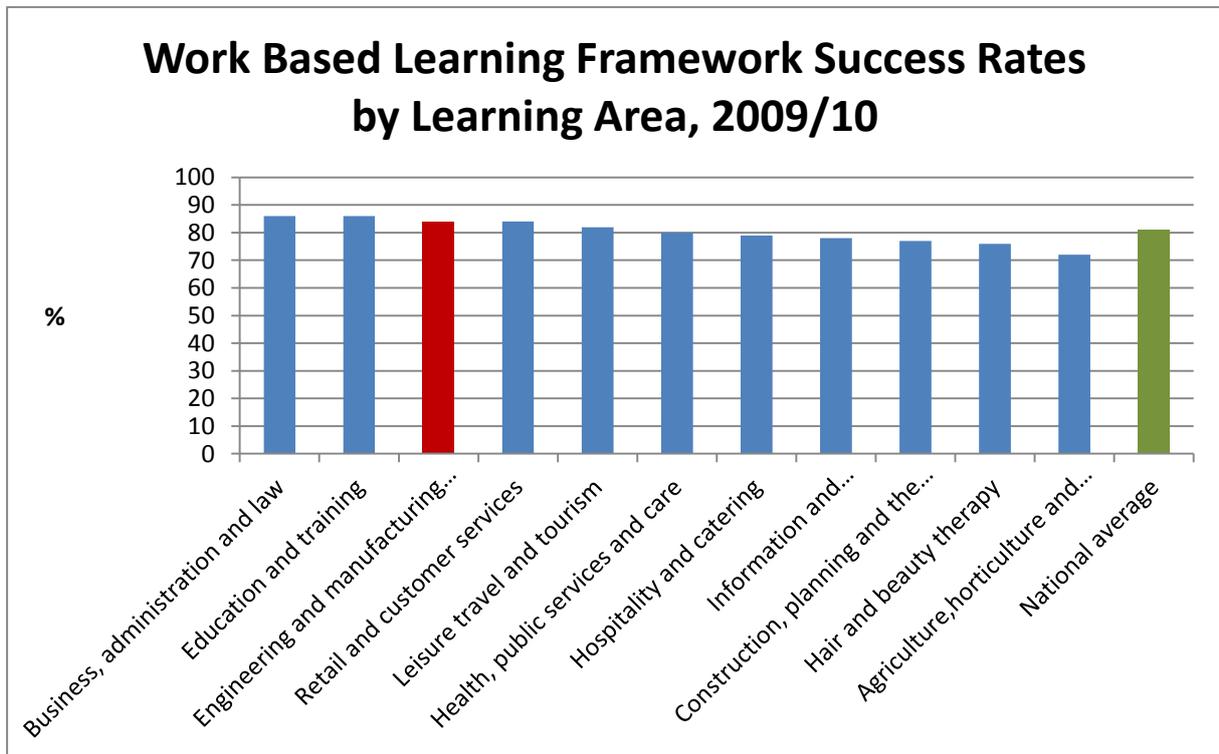
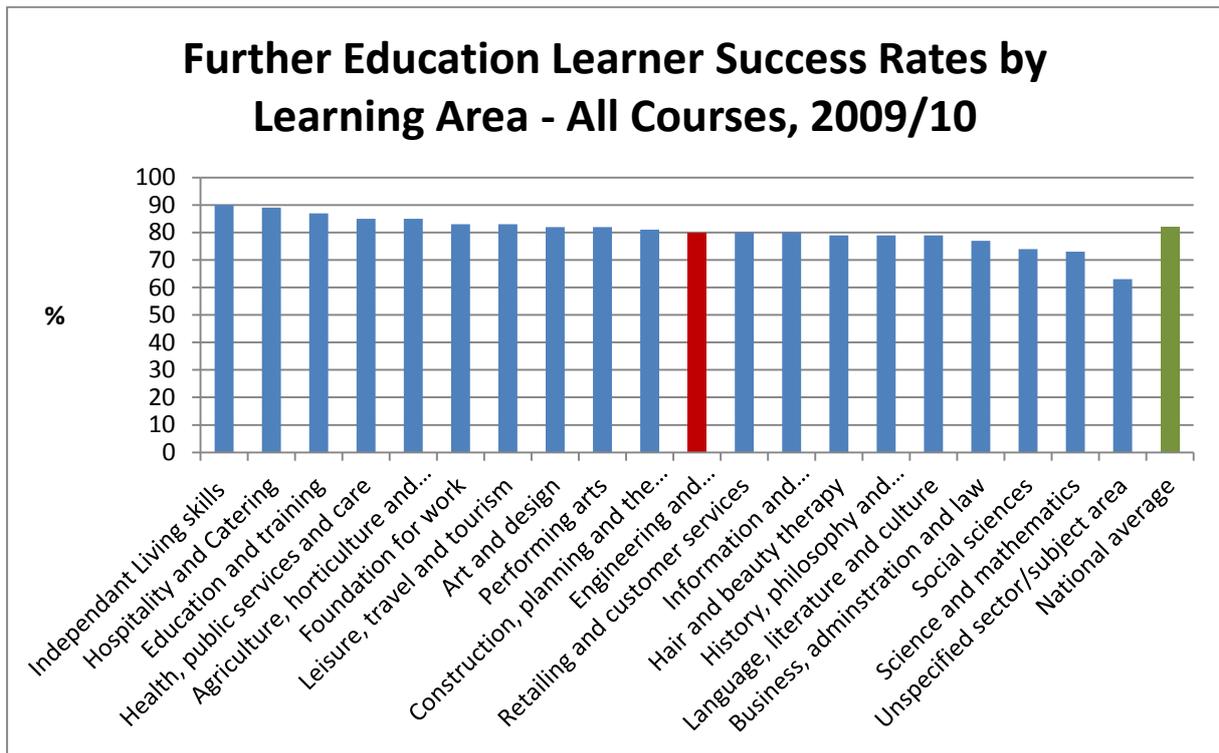
Further education

- 45 The performance of learners in engineering in FE improved between 2007 and 2010. The rate of improvement was similar to the average rate of improvement for all learning areas. However, in 2009-2010, success rates for engineering ranked only joint 11th of the 20 learning areas.

Work-based learning

- 46 The performance of engineering learners in WBL providers improved between 2007 and 2010. The rate of improvement was similar to the average rate of improvement achieved in all learning areas over the same period. In 2009-2010, framework success in engineering ranked 3rd of the 11 specified learning areas.

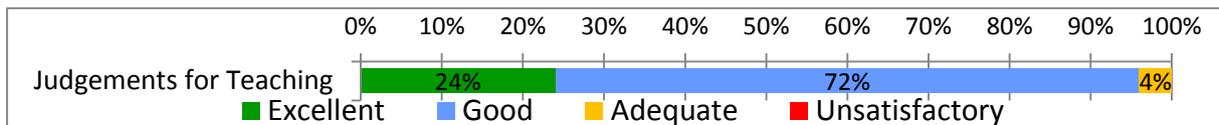
47 Learner success rates for FE and WBL are illustrated below.



The quality of teaching, training and learning in engineering sessions

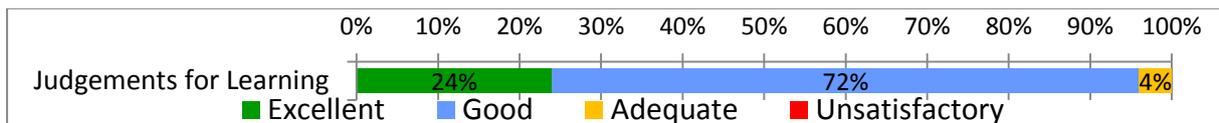
48 Inspectors observed a total of 54 sessions during the survey. Inspectors observed a good range of engineering classes, from 14-16 school link sessions to higher national diplomas/foundation degrees, and included work-based learners. Classes and assessor sessions visited included motor vehicle, advanced manufacturing systems, CAD, fabrication and welding, general engineering workshops, mechanical plant maintenance, and aeronautical engineering as well as tutorial and essential skills sessions.

49 The overall standards for teaching in the sessions observed are illustrated below.



50 The quality of work produced by learners in the 54 sessions observed was good and occasionally excellent. Learners in workshop sessions work to high level of technical precision showing good dexterity and practical skill in handling tools and equipment. Learners in classes and tutorial sessions engage actively in sessions. They ask questions and seek help when needed. Learners are good at helping one another in group activity. Learners who are new to their programme are beginning to understand the importance of producing well-presented written work on the first occasion and to take responsibility for their own learning. In assessment sessions, learners work well on the task in hand. Employed learners work well with their employers to focus on the work they need to complete for assessment. Most learners behave well in observed sessions and collaborate well with teachers, assessors and other learners in the group.

51 The overall standards for learning in the sessions observed are illustrated below.

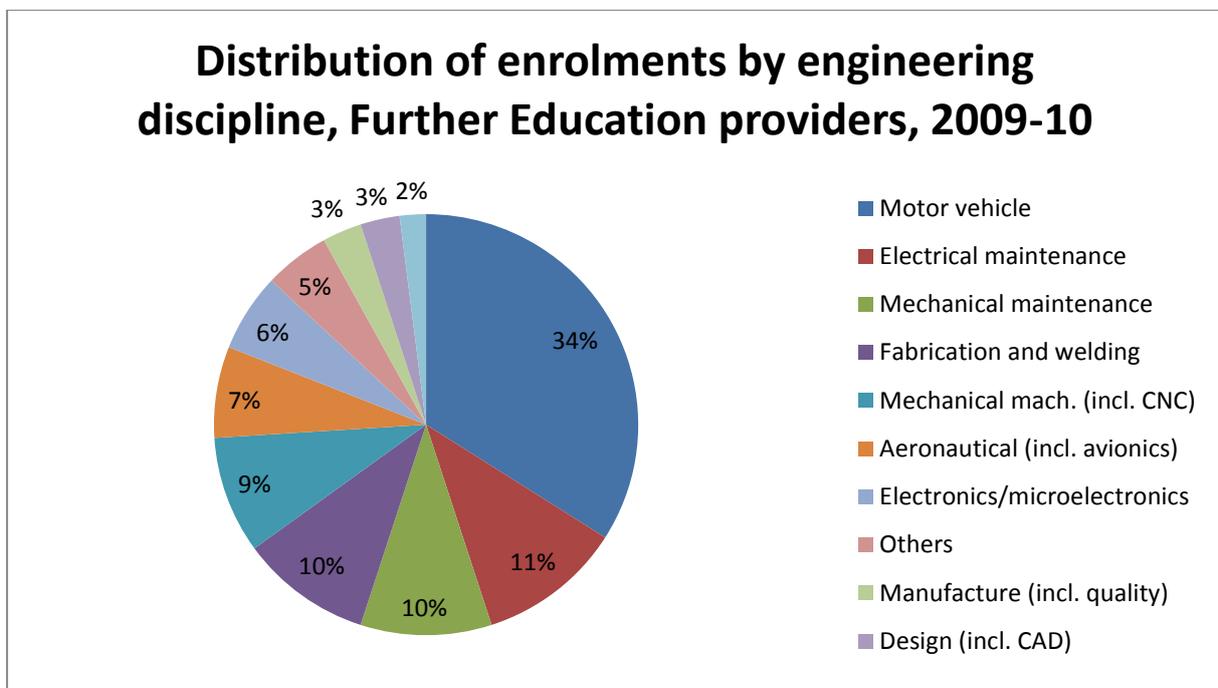


52 In the sessions observed, teachers and assessors plan and structure the sessions well. They engage well with learners and encourage learners to produce their best work. Teachers and assessors use a wide range of teaching strategies including individual tasks, group and paired work. They make good use of technology. Teachers and assessors use visual aids well (including ICT), particularly when describing engineering parts and equipment. They match technical theory sessions well to the practical work by taking learners into workshops to see parts and equipment on site. All teachers and assessors use their experience, skills and expertise as engineers effectively for the benefit of learners.

The quality of engineering provision

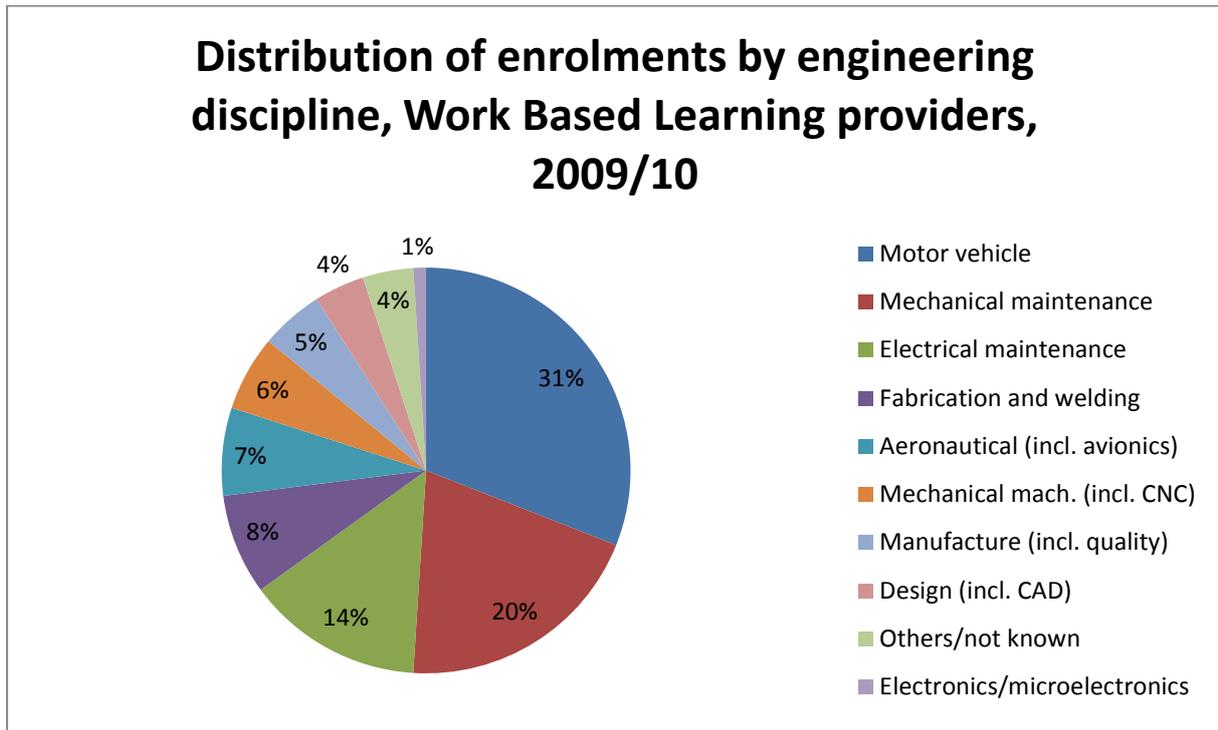
Range of engineering courses

- 53 FE colleges generally provide a wide range of courses, which cover many types of technology. In 2010-2011, around 9,000 learners enrolled on engineering programmes.
- 54 Of these, around 3,000 learners (34% of all engineering learners), enrolled onto motor vehicle maintenance and repair programmes at various levels. This reflects the interest young learners have in motor vehicles and motor sport and is particularly popular with school pupils following 14-16 taster sessions and introductory vocational programmes. For many motor vehicle learners this is their first taste of engineering. Many of these learners will remain in the vehicle maintenance fields but will progress their careers into related areas such as mobile plant and agricultural machinery repair, vehicle body repair and fabrication, heavy goods vehicle repair, auto-electrics/electronics and vehicle diagnostics and testing. A minority of learners will retrain into other engineering areas as employment opportunities occur.
- 55 The next largest learner enrolment is electrical maintenance with 990 enrolments (11%), followed by mechanical maintenance with 940 enrolments (11%). Fabrication and welding programmes are becoming more popular with around 878 enrolments (10%) followed by mechanical machining (including CNC) with around 812 enrolments (9%).
- 56 The chart below shows the distribution of engineering enrolments in FE colleges.



- 57 The above engineering disciplines are required throughout the engineering industry and require learners to develop their basic engineering skills in each discipline before moving on to the more up-to-date techniques, practices and materials. They are typically supported by employers and industry. However, the business needs of industry are continually changing and it is not always possible for engineering learning areas to respond quickly enough.
- 58 Engineering programmes offered by FE colleges have been developed to support the newer and economically important industries. Typically, they reflect the nature of the local and regional industries. In particular, this is shown by the aerospace enrolments, numbering 606 (7%), and electronics and microelectronics with 521 enrolments (6%). The disciplines that attract the smaller number of enrolment include computer-aided design (CAD), numbering 265 enrolments (3%), manufacture, with 257 enrolments (3%), and marine engineering enrolments, numbering 138 (2%).
- 59 Other disciplines total around 400 enrolments (408). These include learners following landbased industries, and specialist multi-skilling and laboratory operation programmes. This includes a small number of learners following the engineering AS/A level programme.
- 60 Learners on all engineering programmes typically undertake some work across all engineering disciplines. This enables learners to gain valuable multiskilling experience and extra employability skills. For example, mechanical maintenance learners will gain experience in operating machine tools and prepare and work from CAD drawings. There will be aspects of electronics and microelectronics in electrical maintenance. Many of the technical skills used in marine engineering require the same skill sets that are developed by motor vehicle maintenance and fabrication and welding learners.
- 61 WBL providers generally provide engineering programmes in a wide range of disciplines or types of technology. In 2010-2011, around 1,808 learners started on engineering programmes. Over 550 learners (31% of all engineering learners) started some form of motor vehicle maintenance and repair programmes at various levels. This reflects the interest young learners have in motor vehicles and motor sport and who wish to follow a career in this area. Many of these learners develop their skills into other engineering disciplines. The next largest in terms of learner starts is mechanical maintenance with 366 starts (20%), followed by electrical maintenance with 247 starts (14%). Fabrication and welding programmes are the next popular, with around 143 starts (8%).

62 The chart below shows the distribution of enrolments in engineering disciplines in WBL providers.



63 Engineering programmes offered by WBL providers have developed to support the training requirements of local and regional businesses and economically important industries. This is shown by the aerospace starts, around 100 (7%) and mechanical machining also around 100 (7%). The disciplines that attract the smaller number of starts include manufacture at 95 (5%), CAD at under 100 (4%) and electronics and micro-electronics at around 12 (1%). The remainder follow programmes in landbased engineering, refinery operation and engineering management.

64 FE colleges and WBL providers have developed strategies and programmes over many years to support learners with basic skills needs. This has included providing lower level programmes at level 1 and pre-entry level, in-class support, and access to basic skills workshops. However, this support is also needed at higher levels, even when the learners have good GCSE results.

65 A good alternative to university degree courses for engineers is available in the form of higher apprenticeships. The potential to expand the higher apprenticeships with their links to major industry is a major opportunity to develop and encourage more able and talented learners into engineering.

66 In colleges where they work closely with the university sector to develop HE provision through franchise arrangements, learners' progression to level 4 is good. The work-based foundation degrees between colleges, major industry and the university sector are developing well. However, despite the good working relationships with the university sector, the process of obtaining franchise arrangements takes too long and is too bureaucratic, particularly if the college wishes to respond quickly to a particular industry need. In some cases, the university sector has restricted the HE provision in

colleges. FE colleges in other UK countries are able to provide HE programmes below degree level, without reference to the university sector. The FE sector takes the view that accreditation for these programmes might be more effectively and efficiently achieved if colleges are allowed to work directly with the awarding bodies.

Advanced or specialised programmes

- 67 In FE colleges, over a 1,000 learners in engineering are involved in developing their skills, knowledge and understanding on advanced or specialised programmes. FE colleges are good at introducing these technologies throughout their provision.
- 68 Around 440 (44% of all learners involved with these advanced programmes) are following programmes in the manufacture and application of composite materials, mostly for the aviation industry. This is followed by 205 learners (21%) on programmes in world-class manufacturing and advanced manufacturing technology, 150 learners (15%) on environmental management, 141 (14%) on advanced vehicle diagnostics and 52 learners (5%) on programmes in photonics. Other areas include developments in the mining industry, advanced electronics and special laboratory operations.
- 69 Projects within engineering programmes in FE colleges designed to encourage learners to pit their skills and technical knowledge in competition with other learners within their own college, regionally and throughout the whole of Wales have existed for many years. These offer learners a real focus for them to produce their very best work. Typically these projects are embedded into the curriculum thereby improving learners' motivation and improving their overall performance. However, more specific projects to prepare learners for UK wide competitions, such as the Skills Olympics, have been unsatisfactory. Although recently there is an improvement in the co-ordination across Wales and improved projects have emerged, Wales currently remains unrepresented in the UK team for the Skills Olympics in engineering.

Learners', teachers' and assessors' responses

- 70 Inspectors held meetings with learners at the end of almost all observed sessions. Discussions centred on the learners' opinions and experiences at the college or provider. Separate meetings with teachers and assessors were also held.
- 71 Learners generally express high levels of satisfaction with their education and training. They appreciate the good to excellent resources and the overall quality of the teachers and assessors. Learners value the engineering experience and expertise of their teachers and assessors. Learners see the benefit in studying at a college/provider that has a good reputation because this enhances their job prospects.
- 72 Learners also identify weaker aspects of their courses. In particular, most learners find mathematics and science difficult and many dislike the writing aspect of their programme. They understand that providers have developed a range of lower level programmes, in-class support and drop-in workshops to assist them. However, most learners want to spend more time on practical work.

- 73 The majority of learners who enter engineering programmes involving high levels of skills in mathematics and science find them demanding even with A*-C grades at GCSE in mathematics and science. Learners on introductory engineering programmes are particularly surprised at the numeracy, literacy and science knowledge demands of their programme. A few part-time learners are not convinced that the science content of their programme is currently relevant to their work.
- 74 Teachers and assessors also maintain that the majority of learners prefer and enjoy practical work. In their view, too many learners have difficulty with numeracy and literacy. In one example, about three quarters of learners on level 1 and level 2 programmes required basic skills support.
- 75 Learners are supported well by the college/provider staff who, learners say, are approachable. Learners know who their course/programme tutor/leader is and know they can get help from them even with a personal problem. All learners consider staff to be enthusiastic, polite and respectful.
- 76 Most teachers and assessors are well motivated and enjoy passing on their knowledge, skills and experience to a new generation of engineering learners. At the same time, they want to improve the quality of their teaching and assessing. Teachers and assessors enjoy being active learners as they keep up-to-date with new developing technologies.
- 77 All learners would recommend their programmes at the college/provider to their family and friends if they were considering a career in engineering.

Liaison with employers

- 78 Generally, providers offer a wide range of engineering provision that reflects the needs and aspirations of learners and local and regional industry. However, in more rural colleges and WBL providers, leaders have to work hard to bring together micro SMEs to establish group and shared apprenticeship schemes. Despite this, engineering learning areas in colleges and WBL providers have established and maintain many useful links with industry.
- 79 Colleges have established many good working relationships with engineering employers. In many cases, they provide bespoke and full cost-recovery programmes for industry. This contributes much needed additional funds into the colleges. In the best cases, the employer will sponsor the college by providing equipment free or at a reduced rate. Colleges will sometimes carry out technical research and testing to aid an employer as they develop their business. These relationships work best when joint activities involve, and are for, the benefit of learners.
- 80 Leaders in WBL providers rely on their engineering employers heavily. They are valued direct customers and WBL providers cannot provide any engineering apprenticeship programme without them. There is an expanding portfolio of commercial work with employers in the engineering industry despite the current economic difficulties.

- 81 In general, employers consider the support they receive from their local provider to be good. These include both SMEs and the larger multi-national 'blue-chip' businesses. Employers who have long standing relationships with their local education and training providers confirm that they use them as a 'first-stop' shop for all their education, training and consultancy needs. In many cases, they are confident that, if their local provider is unable to meet their needs, the provider would arrange for an alternative provider to carry out the work. There are occasions when providers are unable to respond quickly enough to an urgent need. In most cases this is due to funding issues and/or the unavailability of technical staff due to teaching or assessing commitments.
- 82 Employers would like providers to be more responsive to their training needs. This includes the need for more bespoke training programmes. Education and training needs to be more 'employer led'. However, employers are not always sure about the training programmes they need and are often dependent on the advice from the colleges and WBL providers. Other employers know exactly what they want and when they want it, so a close partnership with providers of programmes is essential.
- 83 Employers believe that FE colleges with up-to-date specialist engineering provision, together with appropriately qualified teaching and support staff, are well placed to deliver programmes up to degree level. Although industry is supportive of good partnership working between the FE and HE sectors, many question the current need for colleges to franchise with HE institutions for HNC and HND programmes. They believe that FE colleges and WBL providers need to be able to offer employers higher level programmes quickly by working directly with the awarding bodies.
- 84 Employers are frustrated with the poor basic skills levels of many school leavers entering employment. They question their role in improving the basic skills of their workforce when they really should be using their resources on improving business performance.

Professional networks

- 85 FE colleges and WBL providers work very well with engineering awarding bodies. They work well together when developing new programmes and providers benefit from visits from external verifiers. In the best instances, leaders have worked with awarding bodies to develop innovative training programmes like the Pathways to Apprenticeship. Awarding bodies have been proactive in supporting college leaders when providers of all types make bids for external grant funding.
- 86 Leaders of engineering learning areas are well supported by their Wales-wide networks. In colleges, the Colegau Cymru heads of engineering group meets several times a year and has a very well attended annual conference. This group operates very well to share good practice and to discuss how to improve poor practice. In WBL providers, engineering leaders have similar networks, working within the National Training Federation for Wales (NTFW). They use the support from the awarding body well, particularly during visits from the external verifiers to bring about continuous improvement. The Engineering Education Scheme – Wales operates in partnership with the Royal Academy of Engineering. Its primary role is to encourage the best talent in schools to take up engineering as a career and follow a university degree in an engineering discipline.

Resources

- 87 Generally, engineering accommodation is good and has benefitted from considerable investment in recent years following a long period of decline. At the same time, there has been a corresponding investment in tools and equipment, much of which is new technology. These together have established a more professional image for college and WBL providers. This in turn has encouraged more employers to be involved with the providers in addition to using the facilities for the training of their employees. In the best examples, employers have loaned and/or donated equipment and materials to providers.
- 88 Staff issues are one of the most common concerns of engineering leaders in FE colleges and WBL providers. The recruitment and retention of technically competent engineers has always been difficult. Providers have to compete with engineering employers for the services of well-qualified and experienced engineers. Many providers have an aging workforce and find it difficult to recruit new staff to replace experienced staff who are retiring. However, it is quite common for retired staff to return to their previous college or provider to teach on a part-time basis.
- 89 Engineering providers continuously look to improve their estate, facilities and equipment. Resources for engineering are expensive and need to be maintained and kept safe for learners and staff. Running costs are relatively high. Providers work well with the Welsh Government, industry and other stakeholders to make improvements to engineering estates and facilities. The challenge now is to continue the investment so that learners have opportunities to improve their engineering skills and teachers and assessors can provide better training to better meet higher qualifications and industry needs.

Annex 1: Examples of good and excellent practice in engineering

- 90 FE colleges and WBL providers have established examples of good and sometimes excellent practice. This includes working with industry to develop advancing technology, arranging novel engineering training opportunities for learners and companies and developing effective links with schools. The following examples are some of the current good and excellent practices.
- 91 **Coleg Llandrillo Cymru** marine engineering learners at their **Pwllheli campus** in partnership with Communities First and Pwllheli Sailing club have built and commissioned rigid inflatable boats. These boats are used as part of community-based projects and at the local sailing club during international sailing events. A few learners use the craft at the sailing club and gain useful work-based experience through part-time employment there. The marine engineering learners have embarked on a similar scheme to build a 28 foot sailing yacht.
- 92 Working with the sector skills council for motor vehicle and the Welsh Government, the college at the **Rhyl campus** developed a Hybrid Technology Awareness and Air Conditioning qualification for SME dealers and independent garages. The programme required college staff to run the programme at the employers' premises. The college easily met its 50 garages target. Rural purchasers of hybrid vehicles need to have confidence that their local garage can maintain these vehicles. (The college worked with the **Trowbridge campus** of the **Cardiff and Vale College** to provide the same programme in south Wales.)
- 93 **Coleg Menai** has set up an Apprentice Employment Agency (Cwmni Prentis Menai – CPM) to ensure that the region continues to provide engineering apprenticeships to meet the future needs of the Energy Island (Ynys Ynni) initiative. The college identified a gap in engineering training opportunities due to the economic downturn and the closure of large key employers in the area. CPM works in collaboration with local SMEs to offer work placements. This initiative was set up with CPM as the legal employer so as to minimise the employment responsibilities of the host SMEs. The number of training places has been maintained during a period of relative economic inactivity, ensuring that learners can be assessed in a real working environment. Also 'Canolfan Ynni' was developed specifically to meet the emerging training needs of the energy sector. An innovative funding package resulted in establishing a state-of-the-art energy training centre, designed with input from 'blue-chip' companies. The centre at the **Llangefni campus** provides a hub for the National Nuclear Skills Academy in Wales. Coleg Menai is the first training provider in Wales to develop and deliver specialist nuclear programmes such as the Radiation Protection NVQs and the Nuclear Power Generation Foundation degree.
- 94 **Coleg Morgannwg's** apprentice training is delivered as a result of very close partnership working with a wide range of 'blue-chip' and SMEs employers. The ethos of the relationship is one of an 'employer-led' partnership. The college services the needs of one particular employer, a major aerospace maintenance facility through the operation of the steering committee that meets every six weeks. At these meetings the programme is rigorously reviewed and the progress of each apprentice discussed in detail. This requires a high level of commitment from the company and

the college. This model has been so successful that another major aerospace 'blue-chip' company approached the college to service the needs of their apprentices in the same way. This model has expanded into the Pathways to Apprenticeship programme (PtA). The college again established a steering group with a membership of around 16 employers prepared to work placement opportunities for learners. In 2010-2011, of the 30 learners on the programme, 28 apprentices obtained full-time employment with their work placement providers and achieved their vocational qualification.

- 95 **Coleg Sir Gar** established the Carmarthenshire Manufacturing Group, a network of over 70 engineering manufacturing companies in south west Wales. The network not only ensures appropriate training is delivered but also allows the group to work for mutual benefit in areas such as purchasing and development of new technologies. Conservative estimates suggest that some £18M of internal business within the group has been generated since the inception of the group a few years ago. The network provides good work experience opportunities for learners, many of which lead to permanent employment. Also the college continues to invest in 'integrated manufacturing systems' to support the needs of the manufacturing sector in south west Wales. Further to significant investment in automation and computerised numerical control (CNC) equipment, the college has recently acquired rapid prototyping technology for design realisation. Linking the rapid prototyping equipment to the college's laser measuring system facilitates reverse engineering practice. Both technologies dramatically reduce the time-to-market for engineering manufacturers who access the support provided by college's staff.
- 96 **Deeside College** has a long-standing and very effective partnership with an international 'blue chip' manufacturer in the aerospace industry and their supply chain. The partnership is mature with college staff permanently located within the plant. The college holds the training contract and provides the assessors, essential skills tutors and the technical certificate programme. Internal verification is carried out by the employer's trained staff. The college and employer worked well together to develop its apprenticeship training and now include a higher engineering apprenticeships (HEA) and adult apprenticeships. Learners entering the HEA programme are, typically, successful A level learners in appropriate subjects and a few post graduate learners seeking a career change. Adult apprentices are current employees who have shown potential and wish to gain skilled engineering status. The college has developed a very effective curriculum for all learners, with clear progression routes. It starts with the principal learning qualification working with local school pupils to support their Welsh Baccalaureate programme. Learners can then progress to the college's successful PtA and eventually, if successful, on to employment and the modern apprenticeship. Modern apprentices at the college are able to progress onto HE programmes under a franchise arrangement the college has with the university sector. The PtA is a very successful programme. In the period 2009-2010 and 2010-2011, 130 learners enrolled on the programme, with a success rate at around 95%. Of these, around a third progressed into full-time education and the other two thirds gained employment and/or modern apprenticeships. This success has required the college to encourage around 25 new employers to the scheme every year. PtA learners benefit from training at the Advanced Material Centre for Composites operated by the college in collaboration with a local university and the major aerospace manufacturer.

- 97 **Neath Port Talbot College** has well established links with partner schools as part of the 14-19 partnership. This provision is strong and has grown to over 130 learners participating from seven local schools each year. This provision has been further supported by the college's new well-equipped, industry standard motor vehicle centre. This has been achieved in partnership and sponsorship with a national supplier of garage equipment. The new facilities provide opportunities for learners to gain higher experiences and qualifications, with the centre developing the operation to simulate that of a main dealership.
- 98 **Newport and District Group Training Association** is a small specialised engineering WBL provider that services the apprentice needs of a relatively small group of engineering manufacture and maintenance SMEs. In the last few years, at a time of tight financial restraint, it established its own training facilities, consisting of workshops, laboratories and a computer suite. It customises its programmes to the specific needs of each company and each of its apprentices. This includes the provision of both academic and WBL programmes. The provider carries out all the administration, testing, recruitment and selection of apprentices for its companies. It has more recently expanded its premises and facilities, attracting training contracts from major Welsh-based and international 'blue-chip' companies and providing taster sessions for local schools.
- 99 **North Wales Training** has recently established new and well equipped, industry standard, motor vehicle training facilities including workshops, an ICT suite, a classroom and a mock testing capability. This enables the provider to extend its integrated and customised service for its companies and the individual support for its learners. Most of its companies are small independent garages, with a small number of larger SMEs and main dealerships. It delivers a very flexible approach to match the business demands of its companies.
- 100 **Pembrokeshire College** has developed very strong links with the energy industry based around the Milford Haven waterway. Working closely with the Pembrokeshire Energy Sector Employers Group, the college has developed its curriculum, resulting in improved recruitment, course outcomes and greater progression to apprenticeships. Welsh Government grant funding supported the creation of a dedicated refinery training facility including the only Virtual Control Room in the west of the UK. An innovative Foundation Degree in Process Operations Maintenance has been validated, which offers Refinery apprentices, progression to HE and includes accreditation of WBL at HE level for the first time.

Annex 2: Further education colleges and work-based learning providers visited as part of the survey

Coleg Menai (now part of Llandrillo Menai Group) (FE and WBL)
Coleg Morgannwg (FE)
College Sir Gar (FE and WBL)
Deeside College (FE and WBL)
Neath Port Talbot College (FE and WBL)
Newport and District Group Training Association (WBL)

Additional information was supplied by:

Coleg Llandrillo Cymru (now part of Llandrillo Menai Group)
Engineering Education Scheme-Wales
North Wales Training
Pembrokeshire College
SEMTA (Sector Skills Council for Science, Engineering, Manufacture and Technology)
Wales Manufacturing Forum

Glossary/references

ANDP	The Area Network development Plan is a formal document drawn up by a local authority in collaboration with partner providers (schools, colleges, WBL providers) setting out the strategic plans and vision for the education and training development of the area network.
Area Networks	A network of providers in various sectors (school, colleges, WBL providers and local education authorities) working together to provide a wider curriculum for learners, both academic and vocational
Attainment rates	These show the proportion of learners who gain the qualification after completing a course.
Blue-chip companies	A term used to describe nationally and/or internationally recognised, well-established and financially sound companies that typically employ large numbers of people. These companies generally manufacture/sell high-quality, widely accepted, products and services. Less than 10% of companies based in Wales fall into this category.

CAD	Computer-aided Design or Computer-aided Draughting
CNC	Computerised Numerical Control
Completion rates	These show the proportion of learners who complete a course after enrolling on it.
Engineering	The technical skills and professional training and education delivered by colleges and WBL providers under the learning area of 'engineering and manufacturing technologies'
Enrolments	The number of learners who sign up to a programme of study or course
GVA	Gross Value Added
HEA	Higher Engineering Apprenticeships
HNC	Higher National Certificate
HND	Higher National Diploma
NTFW	National Training Federation for Wales
PtA	Pathways to apprenticeship
PLCs	Programmable Logic controllers
SME	Small to medium-sized enterprises
Success rates	The proportion of learners who gain the qualification after enrolling on a course

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