Written evidence submitted by The Design and Technology Association (GAP0065)

Introduction

The Design and Technology Association provides design and technology (D&T) school teachers with specialist advice, teaching resources, CPD and membership networking opportunities, to support all aspects of their professional D&T education practice. It has significant experience running Government and other funded STEM based projects in schools involving links with industry. Woking with schools on programmes, we are aware of the skills STEM skills required by industry both locally and nationally. D&T is a National Curriculum subject, with newly reformed public examinations at GCSE and post 16 level and ideally placed to address many of the issues in terms of addressing the skills gap.

“Design and Technology is a key subject in drawing the next generation towards engineering. It makes a critical link between science and mathematics and provides real-world contexts in which these subjects can be applied through design. But D&T is not just about future engineers. By teaching D&T we are ensuring that all children are not passive bystanders in our increasingly technology driven world but are informed citizens who understand how design impacts on their quality of life and how technology can be used for the benefit of mankind.” – Dr Rhys Morgan, Director of Education, Royal Academy of Engineering,

Experience of developing STEM learning and promoting skills for industry schools

The Design and Technology Association experience is particularly focussed on the area of developing and supporting teachers of D&T in schools, to ensure that the curriculum they provide equips young people with the skills, values, attitudes, knowledge and understanding to enable them to embark on further specialist education in the wide range of commercial and manufacturing industries. It is widely recognised that children begin to express interest in possible career pathways very early on in their primary education making it vital that the link between a workforce, sufficiently skilled to meet our current and future needs and the opportunities to develop these interests in schools are made.

Studying D&T provides exposure to the type of activity that has direct bearing on industry. Typically, it involves working with the technologies, materials and processes that albeit on a smaller scale, replicate those that are used in industry. It also engages students in working with real not hypothetical problems where the practical results of their actions can be tried, tested and evaluated, often involving visiting experts from local employers and businesses. Specific examples of this are provided below as illustrations of the Skills Gap Programme run by the D&T Association.

Between 1999 and 2015, six D&T specific curriculum development and support projects have concentrated on modernising and developing those skills, identified by the manufacturing and engineering sector. (Table 1) These were funded largely by Department for Education, as either three or, one year programmes with extensions. During this period of considerable change in schools, those that were able to engage were able to radically change the nature of the experience provided for students and utilise industry standard software and manufacturing processes opening the door for progression at ages 16 and 18. The withdrawal of funding combined with additional factors impacting negatively on the subject in schools, has resulted in significant stagnation and in the worst cases, complete cessation of this type of activity in individual schools. In a growing number of schools, specialist rooms and facilities including expensively well-equipped engineering workshops, are being converted in to classrooms and resources sold.

Since 2015 no external funding, no funding has been secured to enable similar programmes to continue.
Table 1 D&T Association major STEM projects run between 1999 - 2015

**STEM career pipeline curtailment**

Britain’s manufacturing, engineering and creative sectors make up 29% of the UK economy or £500 billion. Research suggests that since the introduction of D&T in the 1989, 80% of engineers, designers, digital creatives, and architects in industry studied D&T at GCSE and above.

Students having access to D&T teachers familiar with industry and engineering, their needs and potential career opportunities, are more likely to be able to make informed decisions about options available. They are also able to be receptive to entering the shortage areas when encouraged by those they know and respect and who can provide guidance based on greater understanding and experience.

However the marginalisation of design & technology in schools resulting from the Government’s emphasis on league tables, accountability measures, is significantly impacting on access to experts. Schools are shifting investment accordingly. As D&T teachers and workshops are expensive to train and maintain, there has been a slow but steady withdrawal of support for the subject.

A survey of D&T Association members conducted in the summer of 2015 received just over 1,000 responses. 86% of these stated that Ebacc performance measures were resulting in decreased pupil numbers opting for the subject and/or decreasing group numbers, either of which, in some cases, were resulting in the loss of design and technology (D&T) teachers. Even more worrying was the 46% who reported that they were also seeing a reduction in curriculum time in KS3. This is illustrated by the fall in entry at GCSE form 2014 when the requirement to study D&T beyond age 14 was removed and accelerated further by the impact of performance measures.
Table 2 GCSE Entry figures 2000 -2016

Figures published in 2016 show that take up of A-level Design & Technology courses also dropped for the fifth year in a row by 6%. Part of the reason for the decline is likely to be the government’s focus on core academic subjects, which have all seen an increase in the last year. http://www.designcouncil.org.uk/news-opinion/falling-level-numbers-could-create-critical-shortage-designers

A 59% recruitment shortfall in trainee design and technology teachers (recruitment into D&T Initial Teacher Training (ITT) is also reducing the capability of schools to deliver D&T education programmes. Recruitment has been 50% below target for the past 4 years. In September 2015, only 430 D&T trainee teachers were recruited. It is anticipated that some of these will withdraw and others already in work will leave the profession, further increasing the shortfall.

Based on DfE target recruitment figures, we believe there is a shortfall in the system, of over 2000 secondary D&T teachers necessary to meet staffing requirements. The reasons for the shortage of qualified D&T teachers are the uncertainties around the future valuing of D&T as a curriculum subject, status, little access to CPD and perceived limited career prospects.
The Skills Gap programme combined a very successful series of projects, each delivered between one engineering company and one secondary school. The idea behind the programme was to support teachers and students to understand more accurately what happens in industry, the multitude and variety of careers available in the design and technology related sectors, and the skills required to succeed. For schools, it was to help develop stronger local industry links and support the development of industry-embedded curriculum as well as a more strategic role and a higher profile for industry within the school community so that all students are aware of careers (opportunities) and the company is aware of the talent available.
Company partners ranged from the SME to the multi-national conglomerate. Our largest company partner was Airbus who stated that "We are looking forward to partnering with Ysgol Clywedog [their school partner] to raise skills among D&T teachers. We employ approximately 100 apprentices each year in the UK and as well as finding ways to engage more closely with teachers and young people, we also look to provide interesting and fulfilling personal development opportunities for our apprentices and Direct Entry Graduates which help them to develop other skills. Coaching teachers and young people is a good challenge for our apprentices and graduates as well as an excellent way for schools to access some of our technical capability."

As an SME, Alucast had already begun to develop links with its local schools and this programme was a natural next step for them; "As an SME, we wanted to get involved in the Skills Gap programme to ensure it develops to be a scheme which small companies can engage with. We at Alucast want to invest in the skills of young people to ensure we feed the talent pipeline for our future and the future of our local community."

Business coaches from all six projects reported that they:
- Learnt new skills in both coaching and working with young people
- Increased understanding of how D&T is taught in schools
- Developed a connection with the local school
- Developed some additional skills themselves including buggy building and programming
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Other qualitative feedback from business coaches included:

- “Really enjoyed working with the pupils and especially their visit to the factory.....I found it rewarding. Good working with kids who may not have a strong academic background to show that you can still do well with basic D&T skills.”
- “Working with the teachers was very good and we were able to understand the difficulties schools face and where possible we can help.”
- “I enjoyed seeing the excitement on the pupils faces when they got the buggies working! Helping the teachers out all the problems and seeing them close their buggy building “Skills Gap”.
- “Programme order seemed spot-on and was well delivered.”

Section 1.2: Examples of individual company outcomes

**Alucast**

For Alucast’s project, students designed and made a product (a table centre piece), comprising several modular components, which were batch-produced using a metal casting process. Simulating industrial metal casting procedures, the project focused upon the quality control requirements when manufacturing in quantity and translated these into a classroom environment.

Alucast has worked with their school partner on numerous occasions since their Skills Gap project finished in Spring 2014; continuing to deliver the Skills Gap project and also supporting the school to reversion it for other age groups, namely sixth form students.

As a result of this, Alucast has been able to talent spot for its future employees. They have just recruited a student from the Skills Gap group as an apprentice. The sixth form student who they worked with on his A Level project, produced exceptional results, and they offered him a higher-level apprenticeship. They also talent spotted a year 11 girl who they felt had excellent D&T skills and offered her an apprenticeship also.

**Renishaw**

Renishaw developed a skills-based project with their school partner, enabling students to understand how more advanced electrical and electronic systems can be programmed and used through designing and making a robot ‘buggy’.

Jon Fuge, a technical fellow at Renishaw, had this to say about the teacher training elements of the project: “It was a very positive and enjoyable experience. I wanted to make the information accessible and it was very pleasing to see the smiles of achievement during the session.” He added that the teachers’ questions during workshops gave him ideas about how Renishaw might further improve and tailor its future engagement with education, concluding “Skills Gap has enabled me to share the skills which our industry needs whilst understanding the challenges in school.”
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Renishaw also continued to work with its school partner, Marling School, after their project finished, helping the teacher to reversion the Skills Gap project with other programming software for use with older and younger students. They have since taken on one student from the school as an apprentice.

Renishaw went on to deliver an additional programme of support for schools using the teaching resources created through the Skills Gap programme. An invitation for new schools to sign up for support was presented at a Design and Technology Association branch meeting, hosted at Renishaw’s Gloucestershire head office. 24 teachers attended this meeting, two of which responded immediately to the business offer, and who went on to work with Renishaw on its Skills Gap project.

A Senior Software Engineer from Renishaw had the following to say at the end of the project:

“Having been involved in the development of the original resources with the Skills Gap team, it’s great to see these used by other schools and for more of my colleagues to have the opportunity to work with the students. I am impressed with how the students have used their initiative to produce such excellent results. There’s scope for the current project to be expanded to make it more challenging for older students and used as a dedicated software project to help teach children coding.”

Renishaw now also provides a service for Marling School students, being able to 3D print objects they design.

Thomas Dudley Ltd

Thomas Dudley Ltd worked with Highfields School in 2014 on a project that tasked students and teachers to 3D model and prototype a handle suitable for a toddler to flush the toilet independently. The company has continued to work closely with Highfields Schools, and is now working with two year groups; year 8 and year 9. They are developing ‘Careers in the Classroom’ activities for students, organising foundry visits and competitions, and developing a video of their work.
The ADI Group worked with Handsworth Wood Girls Academy on a project, which provided an authentic industrial reference and context in which to develop CAD (SketchUp) skills, both in terms of design development and visualisation skills for client presentations. The project simulated the processes used in industry when responding to an ‘interior design’ brief and was based on the user-centered design approach.

The Group Communications Manager at ADI Group said of their project: “We are pleased to be working with the Skills Gap team for the benefit of Year 8 students at Handsworth Wood Girls Academy and schools throughout the UK. We have now given the teachers new CAD skills, which they are using with students. We have been so impressed by the girls’ designs and excitement to learn CAD skills.”

ADI carried on working with the school after the project, taking part in the schools Year 5 Transitioning Project with the theme ‘Getting Girls Into Engineering’ in which pupils designed and built their very own gravity racers. ADI attended the school’s ‘Gravity Racer Celebration Day’ to help with judging and present students with prizes.

Section Two: Schools

There were six state secondary schools who took part in the Skills Gap programme. These were:

<table>
<thead>
<tr>
<th>School name</th>
<th>Start date</th>
<th>End date</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Academy</td>
<td>October 2013</td>
<td>November 2014</td>
</tr>
<tr>
<td>Ysgol Clywedog</td>
<td>October 2013</td>
<td>December 2014</td>
</tr>
<tr>
<td>Marling School</td>
<td>February 2014</td>
<td>April 2015</td>
</tr>
<tr>
<td>Handsworth Wood Girls Academy</td>
<td>May 2014</td>
<td>April 2015</td>
</tr>
<tr>
<td>Highfields School</td>
<td>June 2014</td>
<td>July 2015</td>
</tr>
<tr>
<td>St Albans Academy</td>
<td>July 2014</td>
<td>August 2015</td>
</tr>
</tbody>
</table>
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All schools worked with Year 8 D&T students apart from Ysgol Clywedog who worked with a group of their Year 10 students who were studying a BTEC in Engineering.

During the Skills Gap programme, the Design and Technology Association:
- Supported teachers to develop their teaching resources;
- Provided them with technical training;
- Supported classroom delivery of resources and engagement with company ambassadors;
- Organised other events such as a celebration event at the end of each project.
Section 2.2: Immediate feedback

At the end of each project we gathered feedback from each of the schools to find out how they benefitted from taking part in the programme. Below is a table outlining the feedback:

<table>
<thead>
<tr>
<th>Pupil feedback</th>
<th>As a % number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Those who found the project interesting</td>
<td>81%</td>
</tr>
<tr>
<td>Those who found the project useful</td>
<td>73%</td>
</tr>
<tr>
<td>Those who enjoyed working with industry</td>
<td>81%</td>
</tr>
<tr>
<td>Those who found working with industry useful</td>
<td>76%</td>
</tr>
<tr>
<td>Those who have learnt a lot of new skill(s)</td>
<td>79%</td>
</tr>
<tr>
<td>Those who have used these new skill(s)</td>
<td>85%</td>
</tr>
<tr>
<td>Those who enjoy studying D&amp;T</td>
<td>76%</td>
</tr>
<tr>
<td>Those who would like to continue D&amp;T next year</td>
<td>55%</td>
</tr>
<tr>
<td>Those who would consider a D&amp;T related job in the future</td>
<td>40%</td>
</tr>
<tr>
<td>Those who developed additional skills</td>
<td></td>
</tr>
<tr>
<td>• Teamwork skills</td>
<td>64%</td>
</tr>
<tr>
<td>• Leadership skills</td>
<td>42%</td>
</tr>
<tr>
<td>• Reflection skills</td>
<td>48%</td>
</tr>
<tr>
<td>• Presentation skills</td>
<td>50%</td>
</tr>
</tbody>
</table>

Students were also asked to provide qualitative feedback on the project and the below provide a cross-section of quotes:

- “Brilliant project.”
- “I have really enjoyed this topic and because of it I might look at going into D&T as a career.”
- “This project has been great! Everything has been fun and not too easy. It had lots of room for expansion, which was great.”
- “I really like our project result and would love to do something like this again.”

The lead teachers on the programme reported:

- A high level of knowledge and skills in the key focus areas through delivery of the project
- Increased skills in creative lesson planning linked to the curriculum and local business needs
- Increased skills in giving careers advice
- Renewed enthusiasm to create new projects such as
  - Linking several skills and putting these into practice rather than in isolation
  - Delivering a genuine ‘design and make’ project which was not ‘dumbed down’
- Career progression opportunities
- Increased team working and peer learning with teachers and other with external people
- Greater D&T profile in schools.

We also asked teachers to provide feedback on the benefits to their students of participating in our programme. These included:

- Increased resilience and enjoyment of the challenge
- Improved team working skills
- Better use of initiative and ability to work things out for themselves
- Awareness of up-to-date engineering
- Confidence and ability to work with an external team
• Change in attitude to the importance and perception of D&T, in particular for girls who would not normally like ‘getting their hands dirty’ but enjoyed the practical aspects of the project.

2.3: Longer term feedback

Since the last project was completed in August 2015, we have been gathering school feedback on the longer term impact of the Skills Gap programme, for example the impact it had on student choices and academic attainment.

Of the three schools who have provided us with data on D&T GCSE uptake, one went from 10 students to 75 students the year after the project took place and the other went from 14 to 32 students. Another school had 66% of its Skills Gap class (of which five were girls) compared with only 20% of the whole year group choosing the subject as a GCSE.

<table>
<thead>
<tr>
<th>School name</th>
<th>Number of students choosing D&amp;T as a GCSE before the programme</th>
<th>Number of students choosing D&amp;T as a GCSE after the programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Academy</td>
<td>48</td>
<td>50</td>
</tr>
<tr>
<td>Marling School</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td>Highfields School</td>
<td>10</td>
<td>75</td>
</tr>
<tr>
<td>Handsworth Wood Girls Academy</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>St Albans Academy</td>
<td>44</td>
<td>58</td>
</tr>
</tbody>
</table>

Skills Gap students from Ysgol Clywedog and ACE Academy have now completed their Level 2 (GCSE) examinations and both schools have provided statistical feedback on results. Ysgol Clywedog only ran the BTEC in Engineering for one year so it is not comparable against previous performance, however across other STEM subjects there was a significant increase in Level 2 passes.

ACE Academy,

11 students from ACE Academy chose Resistant Materials (a specific topic within D&T) from a total of 23 students, 6 of the 11 (55%) achieved a grade C or higher at GCSE, compared with only 4 of the 40 (10%) non skills gap students.

<table>
<thead>
<tr>
<th>School name</th>
<th>% increase of Level 2 passes in D&amp;T</th>
<th>% increase of Level 2 passes in Maths</th>
<th>% increase of Level 2 passes in Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Academy</td>
<td>N/A</td>
<td>10</td>
<td>47¹</td>
</tr>
<tr>
<td>Ysgol Clywedog</td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Qualitative data gathered from student questionnaires completed since October demonstrates the below:
• 88% of students' experience of the Skills Gap programme was very positive, with comments such as 'excellent' and 'interesting to be exposed to new technologies'
• 50% felt it had an influence on their academic performance

¹ In 2015 when Skills Gap students took their examinations there were more students studying Science subjects than in 2014, which has affected the level of increase.
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- All the students asked went on to a D&T related GCSE and 63% commented that the Skills Gap programme influenced them to do this
- 25% stated that the Skills Gap programme influenced their A-Level choices.

Summary key message

1. The National Curriculum re-emphasises the importance of design and technology and how this can help provide young people with the skills, knowledge and understanding likely to encourage them to explore STEM related careers. The new qualifications in D&T at both GCSE and GCE A level are being made available for first teaching in September 2017. There is an obvious connection between studying for a qualification in D&T and pursuing further design and technological education. Unfortunately, because of Government performance measures, the number of young people being encouraged to study the D&T is dropping drastically.

**Action**: Ministers needs to include D&T within a revised EBacc and promote the value of studying the subject.

2. The shortage of D&T teachers is significantly impacting on the ability of schools to provide an education that encourages young people to enter the full range of STEM related careers. Some students as it is the start of a career path.

**Action**: Investment in initial teacher education including a review of bursary grants made available to teacher trainees needs to be completed.

Programmes of STEM based CPD for teachers that includes commitment to the provision of ongoing CPD for all, that will encourage new entrants to enter and help retain them within the profession.

3. Industry is supportive when it understands of education in school but programmes that develop industry links between D&T and encourage the modernisation of teaching and learning making more use of digital technologies and engineering no longer exist.

**Action**: Investment needs making to enable programmes similar in nature to those run in the past by the D&T Association, to ensure schools are staffed with teachers who are best able to provide STEM based career related activity.

*January 2017*