Tomorrow's Engineers ENTHUSE Partnership Case Study

Wirral STEM Partnership for Girls – led by Upton Hall School FCJ

In collaboration with:

Birkenhead High School Academy

Prenton High School for Girls

West Kirby Grammar School

Wirral Grammar School for Girls

Weatherhead High School

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GEOGRAPHICAL CONTEXT AND SCHOOLS

The Wirral STEM Partnership for Girls has enabled each of the single-sex girls school in Wirral, Merseyside to collaborate on a STEM-specific long-term professional development project for the first time.

The educational landscape in Wirral is unique in that it still retains a selective educational system, as well as having many state comprehensive schools. Of the twenty secondary schools (non-special), ten are single sex, including six all-girls. Wirral is socio-economically diverse; it is home to some of the most affluent areas in the England, and conversely, some of the poorest, which presents a wide range of challenges for schools.

All six of the single-sex girls' secondary schools in Wirral took part in this project.

Upton Hall School FCJ

Birkenhead High School Academy

Prenton High School for Girls

Weatherhead High School

West Kirby Grammar School

Wirral Grammar School for Girls

This project aimed to break down barriers between the schools, particularly the collaboration between grammar schools and non-grammar schools.

CHALLENGES

Girls are underrepresented in STEM fields across the world and one way of closing the gender gap is by improving teaching and learning across STEM subjects, in order to enthuse more girls into STEM fields and improve attainment.

The partnership aimed to improve teaching and learning in both Science and Design and Technology, particularly in the way maths concepts are applied in these subjects, due to an increased emphasis on maths skills at GCSE and A Level.

What local challenges did you face?

As a new partnership it was a challenge to set up the partnership in the first instance and gain buy-in from all stakeholders. All leaders at the respective schools were happy for teachers to be involved in the project, which promoted success.

Schools in Wirral used to collaborate often through the Local Authority, however since schools began to convert to academies in 2010, the Local Authority provision for CPD diminished, leading to less and less collaboration.

Teachers were very keen to collaborate and it is with their efforts that the partnership became a success.

What local issues did you want to address?

The attainment gap between disadvantaged and non-disadvantaged pupils is a national issue, however it is particularly prevalent in Wirral schools, therefore the partnership decided to focus their efforts on improving outcomes for disadvantaged pupils.

How familiar were teachers within the schools before you started?

Teachers were very familiar with their own contexts, however, throughout the duration of the project, they were able to explore some of the strengths and challenges that teachers face in other contexts and bring this learning to their own classroom.

Teachers have enjoyed working with each other and in many cases the collaborative work will continue long after the end of this project.

AIMS AND OBJECTIVES

The main aim of the partnership was to develop the knowledge of STEM teachers in the delivery of numeracy concepts in the new specifications across KS4 and beyond in Science and Design and Technology.

It was through collaboration that the aim was to raise attainment of Year 8 pupils in Science and Design and Technology by focusing on new numeracy content. Although all pupils would benefit from the partnership, the focus was to improve the attainment of Year 8 girls in receipt of the Pupil Premium Grant or Free School Meals. This was to be achieved through developing the subject knowledge of numeracy across all STEM subjects.

As the two-year project progressed, it became apparent that a key way of pupils improving a wide range of skills, including maths, was to introduce programming and intelligent systems in Design and Technology. This became a new aim of the Design and Technology arm of the partnership.

Throughout the partnership, the teaching of maths concepts within Science and Design and Technology remained an important issue that teachers at each school aimed to address.

PARTNERSHIP EVENTS

The focus of Year One was to enthuse pupils by providing a range of activities for them, as well as establishing subject groups and teacher CPD. Year Two was focused around developing networks further and sharing knowledge gained from CPD through collaborative planning and training.

Examples of pupil activities

- Hundreds of Year 8 pupils attended the Big Bang North West Fair in Liverpool. Without funding, the volume of pupils attending the event would not have been possible.
- Pupils from three of the schools attended a Women in STEM event held by Accenture.
- Students from four of the schools attended the Business in Science conference in Liverpool.
- Pupils from all six schools continued to take part in the Unilever Bright Futures Programme, coordinated by All About STEM.
- All About STEM were able to support all schools and promote a wide range of events. Our relationship with All About STEM has strengthened significantly as a result of the partnership.
- A cross-partnership STEM competition was held, supported by local manufacturer Evoke Creative and STEM ambassadors, some of which were ex-pupils of partnership schools.
- Schools were able to focus on STEM careers at their own careers fairs and events.
- Two of the schools were able to take part in the Make It Challenge coordinated by the Manufacturing Institute.

Examples of Teacher CPD

- Teachers from across the partnership attended ‘Maths in D&T’ courses held at the National STEM Learning Centre.
- Networks were established in D&T, which has now evolved into a borough-wide network which has not existed since the Local Authority demise.
- Teachers from across the partnership were able to collaborate at bespoke ‘Maths in Science’ and Science Curriculum Planning CPD held at Upton Hall.
- Teachers were able to attend further programmable components CPD held at Upton Hall and between the schools.

STEM INSIGHT PLACEMENT

A member of staff from Upton Hall completed a STEM Insight placement at local engineering consultancy, Curtins.

The teacher who completed the placement was a children's book illustrator for many years before becoming a teacher only two years ago. As an art specialist teaching KS3 Design and Technology, she felt it was important she takes any opportunity she can for D&T focused CPD.

Below is from a blog post on the Curtins website.

Our founder, Bill Curtin believed that young people were the future of Curtins and engineering. His belief still resonates with us today, at a time when the industry is struggling to find sufficient new talent to fill the STEM skills gap. To inspire the next generation to pursue careers in engineering, our Liverpool office has been delighted to welcome a teacher placement from Upton Girls School for the past 5 weeks. Art and Design teacher, Shelagh McNicholas has been spending time with our team to not only find out what career opportunities are available in the industry, but to also advise Curtins on how we can better support STEM activity in schools. In the following blog she summarises her experiences with us…

"Being relatively new to teaching and having a professional career in industry as a children's book illustrator, I have a wealth of subject knowledge in Art & Design, my specialist subject, but not so much in STEM subjects. I am now teaching Art and Product Design at Upton Hall School, an all-girls grammar school on the Wirral and as Product Design is a new subject for me, the opportunity to work at Curtins on a placement was simply perfect!

With excitement and some slight trepidation, I entered Curtins building and was greeted with such a warm and friendly welcome. I was introduced to Rebecca King, Learning and Development Manager, who immediately put me at ease and after handing me a freshly brewed coffee, she introduced me to the Curtins team. It wasn't long before I felt like one of the family, I need not have worried at all.

Firstly, Rebecca introduced me to Directors Andy Macfarlane and Tim Bingham. Tim shared with me his fascinating story of his educational path and the belief that if you work hard you can achieve your goal, and with their founder Bill Curtin's passion to teach and share knowledge, I

knew I was in the right place to build my knowledge and confidence in teaching STEM based topics in a creative and inspiring way to promote STEM subjects back in school.

But what did I hope to achieve and gain during my placement? To learn more about the industry of civil and structural engineering of course, but even more so, I wanted to further raise awareness and ignite interest in the diversity of engineering, encouraging and enticing our girls at Upton Hall School into the variety of career opportunities within the industry.

I had the privilege of working alongside Ciaran Allen who carefully demonstrated and explained to me in detail TEKLA, one of the many software programs used by Curtins structural engineers. Mark Webber enriched my knowledge of the city by detailing the fascinating historic finds whilst working on restoration projects in and around Liverpool. John Kelly and Alex Matthews invited me to join them for a meeting with local architects (Ryder), to discuss engineering solutions and oversee design solutions for one of their many multi projects based in Liverpool. The meeting gave me an insight into the importance of good, clear communication not only within the company departments but also with other external industries for the successful outcome of each, and every project.

With having a background in a creative industry, I was hugely impressed and interested in the many talents of the Create department. Kate Clegg highlighted how marketing the company takes account of the ability to understand customer's needs, how they [Curtins] value their product and the vision all Curtins employees share and work towards. Clare Hodgson described how she masterminds the visuals promoting Curtins' seven specialisms, keeping an exciting and engaging visual communication throughout the company's UK offices both internally and externally.

Being school based, Rebecca excitedly explained to me the growing Academy scheme for graduates, apprenticeships and work placement experience for school and college students, unlocking boundless possibilities for students to work on cutting edge projects, within dynamic teams and engaging with clients. Mentored by high callibre professionals providing a real insight into the working environment, helping to shape students understanding of the profession and start to identify a potential career path. I had the pleasure to chat to one apprentice Owen Smith. He explained to me the educational path he embarked on and his journey so far. Following the successful achievement of a BTEC Level 3 Advanced Apprenticeship, Owen has

now embarked on a Degree Apprenticeship at LJMU. Whilst studying, Owen is continually learning on the job and refining crucial workplace specific skills whilst being supported by a dedicated Curtins mentor. I believe this mentoring initiative continues beyond the apprenticeship scheme, as well as graduate development, Curtins offer support to teachers in areas that will stretch them as well as their students beyond their own specialism and that's exactly what I'm hoping to achieve.

There is a plethora of continued CPD sessions on offer within the company, all extremely well supported. I attended one such session hosted by Jeff Lawrenson, North West Membership Officer, from the Institute of Civil Engineers (ICE) who clearly outlined the various paths that can be taken to achieve Chartered status. Developing solutions, taking leadership and thinking outside the box. I very much like his perspective.

I have had the pleasure of gaining such an invaluable experience and knowledge, my only disappointment is that the five days over five weeks has come to an end all too soon. However, I am confident that this is certainly not the end but the just the very beginning of my relationship with Curtins and Upton Hall School. I cannot wait to relay to our girls all that I have learned, and further develop and strengthen this relationship with Curtins. I look forward to working with the wonderful team designing collaborative school and real-life projects, igniting student's interest in a future career in engineering."

As a result of the placement the school has developed a strong relationship with Curtins who have provided many more opportunities for our pupils:

- Careers in the construction industry event held at Liverpool John Moores University.
- Women in Leadership event held at Everton Football Club HQ.
- Provided a range of pupil/student placements.
- Curriculum consultation and collaborative planning of KS2/3 project.
- Joint venture to create an 'Ella the Engineer' brand aimed at enthusing girls into engineering from a young age.
- CEO/Operations staff visit to school and networking.

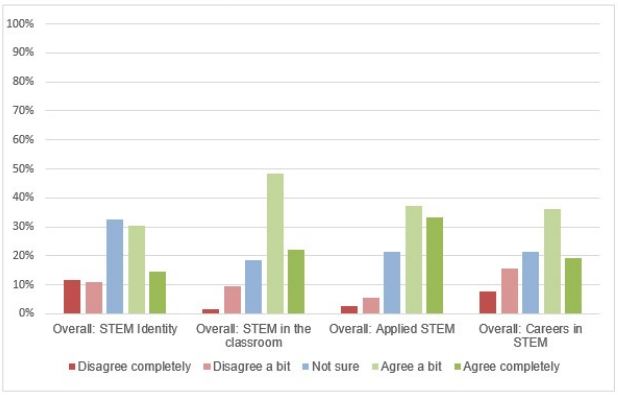
IMPACT

The partnership has had a positive impact on all involved, especially teachers. The principle of the project was to develop the effectiveness of teachers, as this will have a much greater, long-term impact, positively affecting many more pupils than could be possible with the focus cohort over a two-year period.

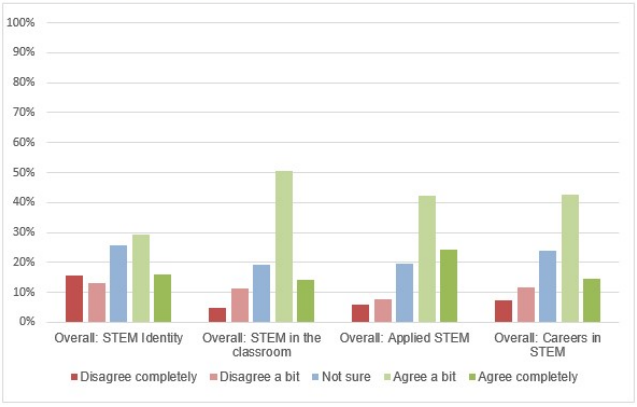
Pupils

Attitudes

1) Proportion of responses to all categories at the beginning of the partnership

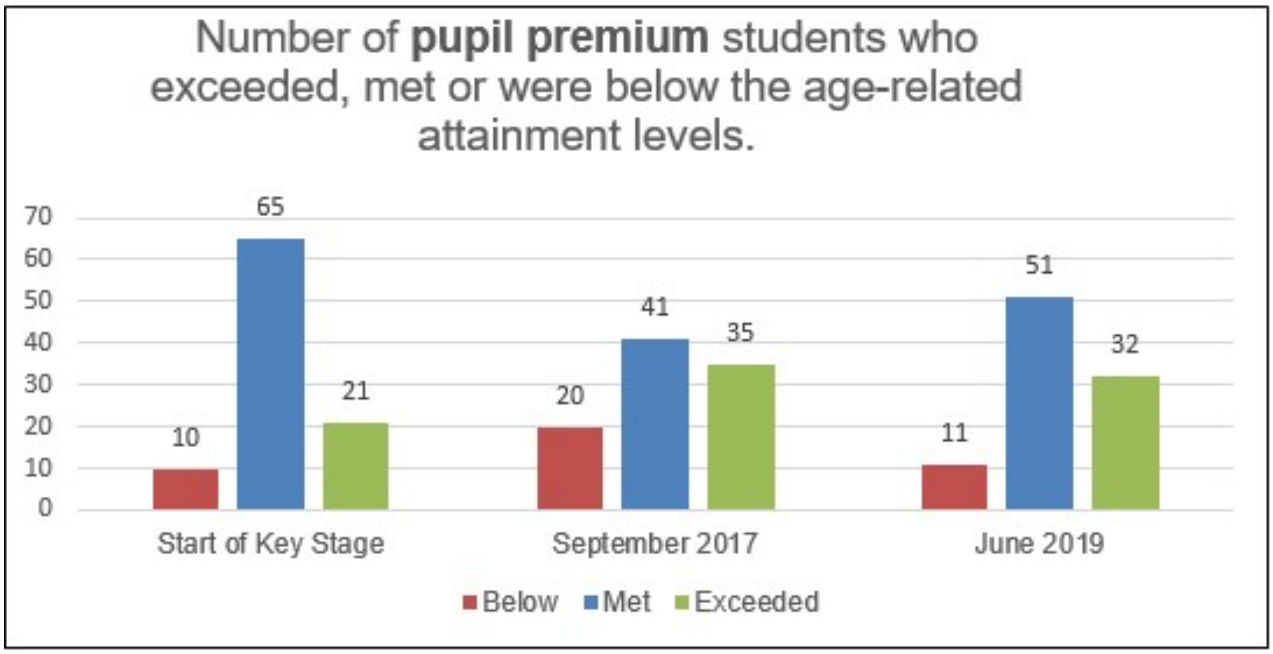


1) Proportion of responses to all categories at the end of the partnership



Disadvantaged pupil's attitudes towards STEM was mostly positive at the beginning of the partnership. Attitudes towards STEM identity has improved at the end of the partnership as well as attitudes towards applied STEM.

Attainment



Over the two-year partnership, disadvantaged pupil attainment has increased, with a significantly lower number of pupils performing below age-related expectations. Data from Year 7 is often inflated from primary school, this usually levels out in Year 7 which explains why so many pupils were 'meeting' age related expectations at the beginning of the key stage and a lot less were in September 2017.

Teachers

Teachers from each school were asked to rate a wide range of aspects of their pedagogy both before and after the partnership.

	Average Response		
	Before	**After**	**Diff.**
I am able to use a wide range of teaching and learning approaches in D&T	7.86	8.80	0.94
I am confident in my own subject knowledge	8.57	9.00	0.43
I am able to teach my subject using cross-curricular STEM activities	6.00	7.20	1.20
I am confident managing behaviour in lessons	9.00	9.20	0.20
I collaborate with my colleagues in and across STEM subjects to help support students' learning	5.00	8.20	3.20
I know where to find high quality teaching resources (including online)	7.14	8.60	1.46
I am confident managing risk or potential dangers in the classroom	8.57	9.60	1.03
I am comfortable demonstrating practical (hands-on) activities	9.00	9.80	0.80
I have a good understanding of differentiating the learning (DfL) approaches	7.43	7.60	0.17
I regularly use these approaches to plan, teach and assess my students	7.14	7.80	0.66
I regularly use formative assessment to support my planning	8.00	8.00	0.00
I can easily identify and challenge stereotypical thinking about STEM in my teaching	7.14	7.80	0.66
I am good at motivating my students to do extra-curricular activities related to STEM	5.57	8.20	2.63
I am confident leading or organising activities related to engineering in my school (e.g. school project, STEM club, competitions)	6.14	7.80	1.66
It's easy for me to use engineering contexts to enrich my subject teaching	5.57	6.40	0.83
I have good knowledge of enrichment opportunities offered by STEM employers	5.00	7.00	2.00
I know how to work effectively with employers to support STEM education in my school	4.14	7.00	2.86
I regularly use cutting-edge STEM knowledge and real-life context to support careers education in my school	4.86	6.00	1.14
I regularly use careers information to provide a context in my teaching	5.29	5.80	0.51
I am comfortable giving my students informal advice on STEM careers and progression routes into them	6.29	7.20	0.91

N.B. one teacher did not fill in the post-questionnaire, which could skew data.

After the project, teachers felt that their practice had improved significantly in:

- Collaborating with other STEM colleagues.
- Motivating pupils to attend STEM-related extra-curricular activities.
- Their knowledge of enrichment opportunities to support STEM education in their school.
- How to work effectively with employers to support STEM education in their school.

Partnership

Departments now have a large bank of collaboratively produced resources as well as a range of contacts and networks to draw upon in the future.

The Design and Technology network has enabled teachers to draw upon collective knowledge and expertise, allowing for close collaboration and a 'helping hand' when required.

BEST BITS

The partnership has enabled many excellent activities to be organised, for both pupils and teachers.

CHALLENGES

The main challenges have been in the collection of data. This required teachers to spend a lot of time doing additional administration tasks, which were gratefully received. Sustaining the partnership has also been a challenge.

TOP TIPS

The top tips from our partnership would be to keep on top of the data and to keep Senior Leaders informed of what is going on within the partnership. The more they know, the more likely they are to support time off for CPD, pupil activities and collaborative work.

WHAT DIFFERENCE DID THE FUNDING MAKE?

The funding allowed schools to invest the time in CPD and enable student activities to take place. It also allowed training using products that would not have been possible without the funding.

WHAT'S NEXT?

The schools in the partnership will continue to work together closely, particularly the Design and Technology departments, which have developed a close-knit network over the two years.