**Professor Fluffy Explores Engineering**

a fun and easy model for universities to introduce engineering at an early age to primary age children

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**Abstract**

The main purpose of this project was to establish a North West Primary Engineering Network which would enable higher education institutions (HEIs) across the North West to deliver a Key Stage 2 (KS2) engineering awareness programme within their local primary schools.

Building on the success of the tried-and-tested *Professor Fluffy Explores Engineering* module (funded by the London Engineering Project), the University of Liverpool provided a training and support programme for ten HEIs to enable the rollout of the Professor Fluffy module within their local primary schools.

The project provided participating HEIs with an “Engineering Starter Pack”, which included a series of interactive engineering resources linked to the KS2 national curriculum and enabled individual HEIs to work with up to 50 young people per year over a two-year period.

Working with primary age children is, by definition, taking a long-term approach, as the results of this work (in terms of young people being attracted to engineering careers) will not be seen for many years.

The project findings showed that the Professor Fluffy model clearly worked from the partners’ perspective. The long-term sustainability will, however, require institutional commitment to delivering primary activities, with either funding institutionally and/or support nationally. However, a well-established and proven delivery model obviously makes this easier and more cost-effective in the long run.

The development of the outreach activity included expertise from several sources within each institution (outreach teams and engineering departments) and was supported by external knowledge in the form of the Professor Fluffy models and on-going advice from University of Liverpool staff. This partnership approach offers a long-term vehicle for both raising aspirations and inspiring young people to pursue engineering careers.

**Keywords:** aspiration raising, primary, North West, delivery model, long-term, engineering careers

**Background**

For a number of years, the University of Liverpool (UoL) has been undertaking pioneering work on higher education access and has developed particular expertise in raising aspirations and understanding of university in younger age groups, most notably through its “Professor Fluffy” primary programme.

The recognition of the need for higher education institutions (HEIs) to work in primary schools was as a direct consequence of a European Objective 3-funded “White Coats” action research project (1999-2001). This work identified that young people of black and minority ethnic (BME) heritage in
post-16 or secondary schooling in inner-city Liverpool were extremely unlikely to be on a progression route to the University of Liverpool (and in particular to the Faculty of Medicine).

This emphasis on the need to start raising the aspirations of primary age children has been at the heart of UoL’s approach since that time. This resonates with the growing “science in society” movement across Europe, for example with the growth of Children’s University-type activities since 2000. This growing movement can be seen in other countries such as Poland, which had no Children’s Universities five years ago and now has over 150.

UoL delivers the Professor Fluffy programme in over 140 schools across Greater Merseyside with over 8,500 Year 5/6 pupils participating each year. The primary schools involved in the programme are all located in areas of multiple deprivation and are within wards of low participation in higher education. In Merseyside there are many communities in which there is no culture of progression to higher education and, for many people within these communities, higher education is an alien concept, not visible as a progression route for individuals or in the vocabulary of these young people and their families. The UoL approach is based on the need to give young people and their parents the knowledge that higher education could be an option for them.

UoL began the primary initiative in 2000 and, to date, has developed the following delivery models:

- The three-stage programme which includes sessions in school and a visit to an HEI/further education college (FEC) for Year 5 pupils
- A Professor Fluffy Roadshow (a half-day school-based session for Year 5 pupils)
- A second Roadshow session for Year 6 pupils which builds on the Year 5 programme and is linked to transition to secondary school and career options
- A series of curriculum modules (e.g. engineering, biology, chemistry, Egyptology, ICT, medicine and several languages) which further develops concepts of career progression and subject choices
- “Raising Aspirations” teachers’ pack.

For more information see [www.liv.ac.uk/educational-opportunities/primary/](http://www.liv.ac.uk/educational-opportunities/primary/)

The UoL approach to learning is through “active learning” and all of the Professor Fluffy models allow for a pupil-led approach, encouraging active participation through play and problem-based learning and employing hands-on activities with associated enhancement of communication skills. They are also fun! This is very important, as the message must be that “engineering is fun, an exciting thing to study, which can make your dream for the future come true!” If we get it wrong at this age and give them the message that “engineering is boring” we are just going to compound the problem!

The National Primary Network was established in 2005 to provide support and resources for HEIs/FECs and Aimhigher Partnerships wanting to deliver primary level widening participation programmes. The Professor Fluffy programme and resources have been rolled out nationally through the Network. The Network provides support to partners through a national dissemination programme. All partners have access to the Professor Fluffy resources, curriculum modules and website and also receive a two-day training programme and on-going staff development opportunities linked to Professor Fluffy curriculum resources.

In 2006, the Professor Fluffy engineering module was developed in partnership with the London Engineering Project. This module has since been delivered as part of the UoL delivery programme and has also been rolled out nationally through the National Primary Network.

All of the programmes are supported by a range of Professor Fluffy resources, including activity booklets, a website, Professor Fluffy comic books, certificates etc. for young people and a comprehensive training pack for WP practitioners and/or teachers.
The partners all had some experience of outreach activities, but this was variable and the embedding approach (which involved the outreach teams working closely with the engineering departments) was new to most, especially in terms of primary activities.

**Rationale**

The chosen approach also supports institutional development in terms of building capacity for sustainability by developing work with engineering departments and outreach teams. Sustainability must involve alignment with institutional missions and priorities, ease and cost-effectiveness of delivery and visible mutual benefits to all partners and players, including the children, students, schools and teams within the HEIs.

Working at primary level requires taking a long-term approach to the issues of increasing and targeting recruitment into engineering subject areas. We live in a society where many HEI and government priorities are short-term in terms of both funding and goal-setting. This makes development of a long-term sustained and consistent approach very difficult as a fundamental shift in deep-seated cultural attitudes and perceptions is required.

This project took a long-term approach to changing children’s perceptions of engineering as a career option by raising their awareness, understanding and aspirations in relation to engineering, including the specific encouragement of girls and young people from BME backgrounds to study engineering. The lack of attractiveness of engineering as a career for both young women and young people from BME backgrounds has long been documented (The Royal Academy of Engineering, 2009).

We aimed to explore the area of how to target children in primary schools. We did this by focusing equally on both girls and boys and by using female role models both in resources and as student ambassadors. We also specifically targeted primary schools with greater numbers of pupils from BME backgrounds.

Young people have dreams, but they actually make decisions which affect their career choices at a very young age. These are very closely related to the culture and expectations in which they, and their family, live. If cultural stereotypes are to be challenged, it is important to provide information, advice and guidance (IAG) at a very early age. For example, girls growing up in families where there is a family member or someone in their family circle who is an engineer are much more likely to choose engineering as a career.

Professor Fluffy asks young people to consider a range of different career options in a fun and engaging way. The activities also challenge stereotypes. Career aspirations of young children are hugely influenced by family and school and their expectations of them. For example, one young boy, when asked what he would like to be in the future, replied that he wanted to be ‘the best illegal cage fighter.’ He had high aspirations to succeed in a career that was part of his cultural landscape. If young people are to choose engineering as a career option when they are older, they need to know that it is an option (and, more specifically, a positive option) when they are much younger.

As an outcome, this programme sought to raise awareness of engineering as a career choice to pursue post-secondary school. In order to have that choice, young people need to make a series of choices at a much earlier age (for example, GCSE options, work placements, etc.) These choices build on top of each other and the crucial first step is the knowledge that engineering is a positive career option from as early an age as possible. This requires changing perceptions of “scientists”, “engineers” and science careers at an early age (for example, by Key Stage 2 (KS2)).

**The approach**

The UoL Educational Opportunities Team implemented three Professor Fluffy delivery models through this project:

- Engineering network model
- “Train the trainers” model
- Professor Fluffy model.

Engineering network model

This model involved eight HEIs in the North West of England working together and sharing a common approach to delivery of engineering outreach activities for primary age children. Although a common approach to training and resources was used, the activities were delivered within their institutional structures and procedures. The network enabled partners to share their learning, compare notes, and gain mutual support and expertise on an individual HEI basis.

The eight HEI partners were sourced after a detailed scoping exercise in consultation with The Royal Academy of Engineering. This was unexpectedly time-consuming and involved the identification of institutions which might potentially be interested and then drilling down through telephone conversations, etc. to identify individual contacts with the capacity, position and interest to get involved. This was a lengthy process and included the exploration of other engineering outreach activities. Through this process the contacts for “training of trainers” were then identified. These included both academics and outreach practitioners.

“Train the trainers” model

Ten delegates attended the “train the trainers” session. This included training for the Professor Fluffy delivery model and resources. Although the partners shared the UoL model, this was done in such a way as to enable them all to draw upon their own experiences and expertise.

The two-day programme for the “train the trainers” model was based on the successful National Primary Network training. It involved ensuring that all participants understood the background and purpose of the overall approach, as well as details of the Professor Fluffy Explores Engineering programme. It also included detailed exploration of the different delivery models, curriculum resources and primary evaluation techniques.

The programme also included demonstrations by engineering students as well as experience of an actual Professor Fluffy Explores Engineering primary visit. The UoL team knew from the National Primary Network training session that engagement with real children using the resources is a very important element in giving participants confidence in their own delivery in the future. Another example of good practice which came out of this approach was two partners sharing their ambassador training.

Programme for “train the trainers”:

Year 1 of project - Ambassador recruitment, a training session at each university and a minimum of one “Professor Fluffy Day” at the HEI (minimum of one per HEI, total of up to eight HEIs involved)

Year 2 of project - Ambassador recruitment, a training session at each university and a minimum of one “Professor Fluffy Day” at the HEI (minimum of one per HEI, total of up to eight HEIs involved).

The partners then used local knowledge of their region to identify schools in terms of areas of low participation in higher education, areas of high concentration of families with BME heritage and existing outreach relationships with their HEI.

Professor Fluffy model

The Professor Fluffy model used was the three-stage model involving a pre-visit to the school, a visit to the HEI and a post-visit for evaluation and consolidation. For details of the activities please see Appendices A and B. The programme provided everything that a “newcomer” HEI would require to deliver high quality activities for primary age children. This included training, resources, activity packs and their own Professor Fluffy!

Each partner then developed their own programme to fit into their existing outreach delivery. This was extremely important for the potential embedding of the programme, as each HEI operates differently in terms of its own timescales, staffing and outreach programmes. This flexibility was welcomed by the partners.

All partners used the Professor Fluffy Explores Engineering resources and evaluation techniques. This uses the thoughts and feelings of the children to establish a baseline which can then be compared with the children’s post-intervention evaluation.
The model involves participation from the school, but the resources enable the HEI to deliver all activities successfully without the school having to undertake any additional preparation.

From an HEI perspective, the programme gave the partners a relatively straightforward and cost-effective vehicle to deliver a proven primary level activity with a view to long-term implementation within their institution.

The strength of this approach was that the resources were of high quality and readily available for use, enabling HEIs to make links between outreach and engineering departments and build solid relationships with selected local primary schools.

During the lifetime of the project the role of students in the programme was seen as very beneficial both to them and to the delivery of the activities, with multiple benefits both to the undergraduate and the university. However on reflection, it was felt that this was probably not recognised sufficiently during the development of this project and that the value of two way benefit should be promoted in future developments.

For the students, these included work experience (in terms of transferable skills, enhancing future employability, etc.) and an overall enhancement of the student experience through an enjoyable and pleasurable activity.

Professor Fluffy Explores Engineering visit day

This case study provides an overview of the programme of activities for the Professor Fluffy Explores Engineering visit day (see Appendix C for a copy of the programme).

Welcome

In a lecture theatre, the children, teaching staff and parents/carers are welcomed by university staff and student advocates. The student advocates introduce themselves to the children and share one of their favourite things about studying engineering. The children are allocated to the following engineering-themed groups:

- Marvellous Mechanics
- Planet Protectors
- High Flyers
- Bright Sparks

The children are provided with a name badge and a Professor Fluffy Explores Engineering activity booklet to support them with the programme of activities.

Carousel of activities

A carousel of four activities is recommended, with each group spending approximately 20 minutes on each activity:
Professor Fluffy’s civil engineering challenge

In this activity the children learn about the factors that engineers need to consider when designing a building. Using the Professor Fluffy activity booklet, the student advocates discuss the structure and function of several famous buildings around the world. The children are then set the task of building Professor Fluffy a tower using newspaper and tape.

Professor Fluffy’s electrical engineering challenge

In this activity the student advocates introduce two different types of engineers: electrical and electronics. The children explore the basic principles of electricity and electronics by building their own series and parallel circuits using electronic kits.

Professor Fluffy’s aerospace engineering challenge

In this activity the children learn about design and the rules that are used to build aeroplanes and rockets. Student advocates demonstrate the science and engineering principles using paper planes and help the children to build and fly two different paper planes.

Professor Fluffy’s environmental engineering challenge

In this activity the children make simple paper windmills to examine how engineers can create structures that can be used to harness the power of the wind. Student advocates highlight the importance of green energy sources, along with some of the objections to wind turbines.

Professor Fluffy’s marine engineering challenge

In this activity the children learn about how objects float and relate this to how boats are designed. The student advocates guide the children through the process of making a boat out of kitchen foil.

Professor Fluffy’s automotive engineering challenge

In this activity the children learn about friction and the importance of tyres in the construction of cars. A car is used to demonstrate how friction is an important factor to consider when designing a car. The children are presented with two cars, one with tyres and one without, and are asked to test their performance and record the observations.

Campus tour

Led by the student advocates, the children explore the campus, including some of the science and engineering buildings and other facilities such as the library and sports centre. The children are encouraged to collect facts from each building to share with the class in the graduation ceremony.

Graduation ceremony

During this activity the children are asked to recall a fact that they have learnt during their visit. In return, the children are awarded a certificate and a Professor Fluffy reward for their participation in the day.
As specified in the original schedule, there was an agreed reporting period for partners to feed back issues and successes of the programme so far. The partners fulfilled this obligation, which enabled UoL to track progress.

Pupil evaluation forms, both quantitative and qualitative, enabled the collection of baseline data about the children’s attitudes and aspirations. Reflections were also collected, predominantly through participant observation during the initial delivery sessions and also during discussions with teachers. Data were captured using the Professor Fluffy “thought box” whereby the children were asked to note down their thoughts and feelings about university before and after participating in the programme.

There was no formal mechanism to obtain student ambassador feedback and this, in hindsight, was probably an oversight. However, it was apparent during training and delivery that the students’ contribution was not only enjoyable, but also gave them a useful set of skills, particularly communication.

**Evaluation**

Overall, the network of eight HEIs successfully reached 15 primary schools and engaged a total of 401 Year 5 and 6 children in the engineering programme. The targets set by The Royal Academy of Engineering were successfully achieved and the network reported that 50% of the participants were from BME backgrounds and 50% were females.

Evaluation of the quantitative and qualitative data collected via the network addresses the feedback from children, teaching staff and student ambassadors. In collating the data, several common themes were found and the findings will be discussed in more detail later in this report.

Regarding the Professor Fluffy model, teachers commented on the importance and usefulness of introducing the programme to children prior to the campus event through the pre-visits in school. Discussions with teachers revealed that there was little expectation that many children would progress to university. Many children in the target schools had relatively low aspirations and did not see university as a realistic option. Teachers felt that this could be due to pupils not knowing anything about university life, having minimal knowledge of further and higher education and not being aware of the progression routes and life choices available to them.

The University of Lancaster reported that the pre-visit sessions were well received, with one teacher commenting that ‘It was excellent. The content and pace suited the age group perfectly. It was very beneficial for the pupils to hear about university from university staff, especially as they start to think about their move to high school. It was also noted that the pre-visit set the day in context, providing information for all of the children and the staff who accompanied them. In addition, the University of Bolton found that teachers welcomed the pre-visit as it informed both staff and children about the subject theme and the aims and objectives of the programme.

Overall feedback from the HEI network was very positive. According to the participant evaluations, 95% of the children reported that they felt happy about the visit to the university (based on 267 responses from six HEIs) and qualitative responses show an increased understanding of engineering. Children were asked to recall engineering facts and vocabulary learnt during the programme and responses were very positive. At the University of Salford, one participant reported that ‘I learnt about building different things and that they need to be strong to be able to hold up things, also that when you make a plane you need to make the wings the same size, so that the plane goes further’.

Children were asked to rate how they felt about each the carousel of activities. Table 1 clearly shows that the most favoured activity was marine engineering, with a total of 85% of the children feeling happy. Another favoured activity, reported by four HEIs with a total of 181 responses, was aerospace engineering, with 81% of the children feeling happy about this activity.

As each HEI had the choice of delivering four activities out of six, the activities reported on varied. The lead institution found issues in collating evaluation responses (addressed later in this report).
The qualitative findings show that both children and teaching staff enjoyed the hands-on activities. One child commented that ‘I got the chance to do it myself instead of just watching. Also, at first I thought it was going to be hard, but in the end I felt confident about engineering’ (Salford).

Teaching staff responded positively to the engineering-themed activities as they provided children with opportunities to engage in problem-based learning. The hands-on learning allowed children to engage with student ambassadors, consider and apply engineering practices and develop their own communications skills. One teacher stated that ‘all practical activities were great for keeping the children’s attention. All children were involved and were able to learn something new from each activity’.

Table 1. Participant feedback on the carousel of activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>HEI response</th>
<th>Total participant response</th>
<th>Participant rating (%)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>197</td>
<td>Happy: 85</td>
</tr>
<tr>
<td>Marine</td>
<td>5</td>
<td></td>
<td>Ok: 12</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Sad: 3</td>
</tr>
<tr>
<td>Aerospace</td>
<td>4</td>
<td>181</td>
<td>Happy: 81</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ok: 15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sad: 4</td>
</tr>
<tr>
<td>Electrical</td>
<td>4</td>
<td>147</td>
<td>Happy: 74</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ok: 25</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Sad: 1</td>
</tr>
<tr>
<td>Environmental</td>
<td>3</td>
<td>110</td>
<td>Happy: 75</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ok: 23</td>
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<td></td>
<td></td>
<td></td>
<td>Sad: 2</td>
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<tr>
<td>Civil</td>
<td>3</td>
<td>104</td>
<td>Happy: 76</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Ok: 22</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Sad: 2</td>
</tr>
</tbody>
</table>

The baseline data collected by the Professor Fluffy “thought box” in the pre-visit indicated that the children had minimal knowledge of further/higher education and were not aware of the life choices available to them. The immediate and positive impact of the project was encapsulated in quotes and comments from participants in the post-evaluation session (the quotes below are from several partners):

- ‘I used to think university was boring but I found out it wasn’t’
- ‘At first engineering didn’t seem great to me. Now I’ve seen all the things it covers and how amazing it is’
- ‘I thought engineering was very technical but now it is so much more exciting having been to university’
- ‘First, I thought it was boring but the university changed it. Now that I know, I will most probably apply for it when I’m older’
‘I have learnt how fun engineering can be by doing all the activities and seeing how interesting it is’
‘The visit has changed the way I felt about engineering because I found out that engineering is not about one thing, it is about many things and that [sic] engineering can be really fun’.

The partners’ perspective

Liverpool John Moores University (LJMU), Paul Ireland, Account Manager, Student Recruitment and Widening Access:

‘In June 2011 we ran three days of Professor Fluffy Explores Engineering at Liverpool John Moores University. After attending an initial two-day training event at UoL, the PF [sic] model and the engineering activities were easy to explain to the student advocates and teachers who would be involved with the programme. All of the resources came in a handy kit-bag and lap bag and everything was clearly labelled and signposted throughout the guidance manual. The activity booklets and resources, such as pencils and mini-Professor Fluffys, had also been branded with the LJMU logo, which gave a nice institutional touch.

From an our point of view it was an excellent opportunity to strengthen the links with our local city centre primary schools, as well as some of those in the more deprived areas of Greater Merseyside. As an institution we do send out current students and staff into primary schools to take part in paired reading and mentoring, but this was the first time we’d been able to offer on-campus visits. The pre and post-visits to the schools complemented the on-campus activity and I think the three-staged approach is one which ensures both the university staff and school pupils enjoyed [sic]. Our student advocate team also welcomed the opportunity to work with younger aged pupils, something which they don’t usually get experience of. We have since been able to build on these links with the primary schools involved and have worked closely with one school particularly in terms of offering them our primary mentor scheme as well as involvement with a city-wide literacy event running at LJMU.

The feedback from the primary students, teaching staff and also our own advocate team means we would welcome the opportunity to run similar events in future, due to the positive experience we had last year, both in terms of support and training from UoL and also the professionalism and ease to use of the Professor Fluffy model.’

The role of student ambassadors

One of the common themes found in the teacher responses was the importance of the student ambassador role. Teachers valued the role highly and stated that the students were positive role models who brought expert subject knowledge to the carousel of activities and promoted engineering positively and enthusiastically. Teachers also highlighted the importance of female student ambassadors, as this challenges young peoples’ preconceptions of what an engineering undergraduate is.

At the University of Salford, the academics and other staff involved in the project were impressed by the range of activities offered on the day and by the level of the children’s understanding, due in part to the enthusiastic delivery of the student ambassadors. One teacher commented that ‘the practical activities were well planned and the children found them interesting because they involved a lot of practical activities and were well explained by the ambassadors’.
In support of this, the University of Lancaster reported that one teacher commented that the groups were fully engaged with their student ambassadors, who were also able to answer questions in an appropriate and interesting manner.

Overall, pupils commented on the helpfulness of the student ambassadors and reported that they had learned engineering facts from them student during the visit, for example:

- ‘Aerospace - planes have to be symmetrical’
- ‘Marine – different strong shapes’
- ‘I learned a boat has to have big sides’
- ‘Electronics – can use more than one battery’
- ‘I learnt about how sound travels around differently and more about electricity’.

Comments from the children further support the premise that participating in the programme raised their aspirations and expectations with regard to higher education and enhanced their knowledge and understanding of engineering.

**Student ambassador perspective**

Student ambassador, University of Liverpool:

‘This is an extremely rewarding programme to be a part of, inspiring young people as young as nine years old, to believe in themselves, and to show them that they are capable of going to university, through stimulating activities that revolve around different aspects within the engineering world.

I believe the Professor Fluffy scheme is an excellent opportunity for the engineering seed to be planted in their young, developing minds, giving them the opportunity to expand on their interest developed during the activities they take part in during their day at the university.

Also, being a female engineer enables me to relate to young girls who aspire to be involved in a career which involves being creative. I can help channel their thoughts and ideas, showing them the route that engineering can take them down, and reassuring them that females are just as capable of being fully respected members of such influential project teams.

I believe that inspiring a young person is key to ensuring that our future generations go on to further education, as they have something to aspire to, whether that be engineering or one of the other subjects covered by the Professor Fluffy scheme, and [that] getting students of the university involved provides them with more of a genuine experience of university life, which is essential.

In my case, this opportunity has set me apart from the crowd; it has enabled me to secure a three-month work placement with a large civil engineering firm. Work placements are often a difficult thing to gain, so when writing my CV I had to ensure that I included things that I believed would set me apart from the rest and I didn’t hesitate when deciding to include my time spent as a student advocate to do this.’

**Discussion, summary**

The evidence presented shows that, from the partners’ perspective, the Professor Fluffy engineering delivery model clearly works. Partners commented on the effectiveness of the model, ease of delivery using high quality materials and the positive impact the programme had on the pupils.
In the overall responses, there is also strong evidence of the importance of the student ambassador role and the feedback highlights the benefits both to pupils and to the ambassadors themselves.

The network enabled partners to deliver a high quality primary programme, share good practice and implement their own outreach practices based on previous experience. The effectiveness of the network can be recognised through the examples of shared good practice.

Manchester Metropolitan University (MMU), Salford University and the University of Manchester all agreed to work collaboratively and provided a joint training session at Salford University for student ambassadors working on Professor Fluffy. MMU reported that it was a successful event and highlighted how useful it is for ambassadors from different universities to meet and interact. Through the effectiveness of the network, the relationship of these universities has been enhanced and future outreach partnerships can build upon this.

The programme was embedded into the work of the outreach teams and engineering departments for the duration of the project. Outreach teams, academic staff and student ambassadors were all involved in the programme and it was clear that they valued its benefits. The impact on the pupils was recognised by academic staff at the University of Salford, who were impressed with the range of activities offered on the day and by the level of the children’s understanding.

With regard to sustainability of the project, partners stated that they would like to continue with the Professor Fluffy programme in the future. There were examples from several partners who reported that schools had also requested to take part in the project during the forthcoming year. However, if the project is to be sustained within the institutions, there is a need for funding for the delivery model and the consumable resources.

The project offered many benefits to schools, as highlighted by teachers’ responses. There was strong evidence to show how the Professor Fluffy model supported the KS2 national curriculum and teachers reported specific learning outcomes of the project, making references to “teaching” and “curriculum”.

The University of Salford provided evidence to support the multiple learning and curriculum benefits for the pupils. With reference to the marine engineering activity, one teacher commented that ‘it dispersed many misconceptions about weight’. However, the teacher felt that the electronic activity was not as successful, as pupils ‘did not have prior knowledge of the concepts of electricity or the equipment used’. During the development of the Professor Fluffy electrical engineering activity, the KS2 science curriculum was explored and the activity was designed to support the Sc4 physical processes curriculum topic (see www.education.gov.uk/schools/teachingandlearning/curriculum/primary/b00199179/science/ks2 )

At the University of Bolton, a teacher’s response supported the curriculum benefits of the electrical engineering activity, stating that ‘the children were able to complete circuit boards different to the ones in school which set a challenge. The pupils enjoyed the hands-on experience [and] it gave them an opportunity to look at engineering in more detail and in class we have been looking at circuits so they particularly enjoyed that’. The teacher’s suggestion to overcome the challenge of the different circuit boards was to explain future activities to the teachers in detail before the visit to ensure that they were familiar with the equipment they would use on the visit day. This highlights the importance of providing programme content to teachers, as they value teaching and learning and can see the added benefit of the programme supporting the national curriculum. This can be achieved in the pre-visit by discussing the Year 5 science topics that the pupils have covered and determining which activities would involve new subject content and which would help to reinforce prior knowledge.

There is also evidence to show how much the schools value the programme by the way in which pupils’ learning back in the classroom has been enhanced. For example, the University of Manchester reported that a teacher at one school followed the visit up with a writing exercise where all of the pupils sent letters of thanks to the widening participation team and student ambassadors. At Liverpool John Moore’s University, a participating school used the experience of the visit day to write an article for the school newsletter.
Another key benefit of the project was the collation of evidence to show that pupils’ perceptions had changed in relation to university and, in particular, to engineering. As found in the *Getting Girls into Engineering* report (2009) undertaken by The Royal Academy of Engineering, we are experiencing a worldwide shortage of engineers and scientists. We therefore need to equip the younger generation with the correct information, advice and guidance about what engineering is and the wide range of career options it provides. As a vehicle for promoting engineering and changing young people’s perceptions of what an engineer is, pupils involved in this programme are introduced to the Professor Fluffy character who is herself a female engineer. In the *Girls’ Career Aspiration Report* (Ofsted, 2011), a survey showed that girls held conventionally stereotypical views about jobs for men and women and, despite being taught about equality of opportunity and knowing their right to access any kind of future career, they often retained these views. The Professor Fluffy programme utilises supporting materials with the aim of challenging gender stereotypes that pupils may have about scientists and engineers. Manchester Metropolitan University reported that one female pupil commented that ‘I think it has changed my decision because I used to think engineering was just for men’.

The student ambassador role has played a key role within this project in promoting STEM and raising awareness of career choices. The key benefits to schools have been addressed in the evaluation; however, an unexpected benefit has been to the students themselves in that the project provided them with practical experience within an active learning environment and an opportunity to develop communication skills. At an institutional level, the network has recruited and trained a large pool of engineering ambassadors who can build on their experience of the primary outreach programme to volunteer for future programmes.

Overall, the approach was successful and the project received positive feedback from HEI partners, schools, pupils and student ambassadors.

The project leader and partners identified some issues which are addressed below.

For the lead institution, the issues faced early on in the project concerned identifying the most appropriate person for the training event. It is difficult to know how this could be improved, although with the implementation of Access Agreements there is possibly now an institutional contact. However, the joint approach of the outreach team and the engineering department was very successful, so the lesson learnt may well just be to ensure sufficient time and perseverance! Across the institutions, key players were eventually identified as a mixture of academics based in engineering departments and practitioners in outreach teams.

An unexpected benefit achieved through the “Train the trainers” session was the additional support that the partners offered each other as a consequence of spending time together on the training, working on a common delivery model and solving similar (although not identical) institutional issues.

Some partners found identifying target schools more problematic than others. As with the development of the overall network, building new relationships with schools within the timescales was not always easy. Written guidance from The Royal Academy of Engineering may have been useful to share with partners and schools and, again, Access Agreements may well contain these for an individual HEI.

The training programme was time-restricted and, although further advice and support was offered by UoL (and taken up), further consideration could perhaps have been given to tailoring programmes for individual partners. However, this would have been more expensive and dependent on time commitment and staging resources. On reflection, timescales set between training and delivery restricted partners (particularly those who may not have experienced working at primary level in the past) in obtaining schools.

The delivery of the programme would have been enhanced by the recruitment of more female and BME student advocates; this is the “catch 22” of these activities, as the numbers of these two groups of students are, by definition, lower within engineering departments! However, a targeted approach to the recruitment of student advocates could well have increased the numbers.
The programme has enhanced professional practice through a more systematic approach to networking across the North West. However, there are issues and, in order for long term sustainable development, funding would be required for dedicated resources.

**Further development**

School teaching staff, including head teachers, were very supportive of the primary project and warmly welcomed the opportunity to work with further and higher education institutions in raising aspirations within their schools.

All partners have identified that they would like to continue to use the Professor Fluffy model. However, for the model to be sustainable, future funding would be required by HEIs for both staff and Professor Fluffy resources. Individual HEIs have their own position on primary level delivery and where this fits within their Access Agreements.

There are now working Professor Fluffy models with an evidenced track record at both networking and delivery levels. This clearly has the potential to be rolled out on a much larger scale.

UoL now has the engineering model firmly embedded within the National Primary Network. At the moment, HEIs must find their own funding to become members of the Network; however, if funding (or part funding) was available for institutions with engineering departments to become members in order to support delivery of the Professor Fluffy model programme then the rollout of the programme could occur relatively easily and inexpensively.

Currently, UoL is seeking National Primary Network model support from the Royal Academy of Engineering to target and/or incentivise the recruitment of HEIs.

**References**


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