UNIVERSITY OF BIRMINGHAM

CENTRE FOR DOCTORAL TRAINING IN FORMULATION ENGINEERING

EngD Outreach Report

October 2015

EPSRC
Engineering and Physical Sciences Research Council

Introduction

This document captures the activities of the EngD Students during the last Academic Year (2014/15).

The intention of this record is not only just to disseminate information but to act as inspiration to the next generation of Research Engineers to encourage them to give something back to the public.

All of our REs are involved in some kind of outreach activity, whether they know it or not. This could simply be through the conversations they have with friends and family, or someone on the train, in the pub, on the street or in the supermarket whose awareness and understanding of a particular area is broadened or developed as a result. Our REs who have recorded their activities here demonstrate an enduring enthusiasm to be involved in the promotion of STEM subjects like Chemical Engineering and an ongoing willingness to be directly involved in mentoring students at multiple levels of their learning and education.

Specific examples from this year's report include:

- Promotion of Chemical Engineering/STEM To prospective students and to the wider public through:
    - taster days and workshops (Zoe George; Erik Hughes) and careers talks in schools (Toni-Bianca Di Paolo), UCAS/Open/Science Discovery days (Amir Asghari; Toni-Bianca Di Paolo; Cyrus Espinoza, Zoe George, Emily Summerton) and promotional videos (Emily Summerton).
    - participation in think tanks, entrepreneurial competitions (Charles Moore-Kelly), IChemE regional group activities (Dmytro Stratiychuck-Dear).

- Student mentoring of current undergraduates, for example through projects, tutorials (Amir Asghari), and lab demonstrations (Toni-Bianca Di Paolo; Cyrus Espinoza); and in their early engineering careers once graduated (Dmytro Stratiychuck-Dear).

- Pastoral support for prospective students, for example help with admissions essays (Zoe George), A2B scholarships (Toni-Bianca Di Paolo; Zoe George), additional help with maths (Toni-Bianca Di Paolo) and general advice on campus life.

Our female REs in this report, Zoe and Toni, are also keen to encourage girls to be interested in pursuing Chemical Engineering. To promote awareness and encourage students to have direct involvement with the subject, they have visited various schools and given talks and tasters where the students have to actively engage with concepts and applications of STEM subjects.

KRG October 2015

The EngDs have taken part in a variety of Events across the UK.

The following reports give the details of these Events and also include plans for Outreach Activities over the next year:

Amir Asghari
Toni Bianca Di-Paolo
Cyrus Espinosa
Zoe George
Erik Hughes
Charles Moore-Kelly
Dmytro Stratiychuk-Dear
Emily Summerton

Amir Asghari

Undergraduate open-days

I have been involved in 8 undergraduate open days, in which another post-graduate and I help out with the days proceedings; manage the attendance records of the prospective students, conduct tours around the department, campus and the city as well as conducting games designed to assess students creative thinking and team skills. Within the tours, the research currently being undertaken within the department (including detailed explanation of my own project) is explained and promoted. We also have the responsibility of trying to help with any queries the prospective students or their families may have.

Undergraduate Student Supervision

I contributed in the supervision of two MEng Chemical Engineering final year students during the winter term of 2015. Students worked either in a team or individually on a project related to my work. My role and responsibilities consisted of working initially with the students to introduce them to the topic, which entailed detailed training on specific techniques and equipment for their experimental work. I was committed to supervising their progress in the lab, organising frequent project meetings, advising and coping with problems and difficulties that arose throughout their projects. Through this experience I contributed to student learning and developed my own approach/'best practice' to supervising, according to the student's personality and capabilities.

I have also been helping out with second and third year tutorials on fundamental chemical engineering topics such as heat transfer and process enhancements. I currently contribute 3 hours a week to tutorials and a further 4-6 hours bi-weekly to the UCAS undergraduate days.

Future Plans

- Keep helping with undergraduate open-days
- Presenting my research at new events
- Finishing experiments and writing

Toni-Bianca Di Paolo

STEM Ambassador Induction Event: 29th October 2014, University of Birmingham.

A two-hour training session was completed in order to become a STEM ambassador. This training provided information on the skills required in order to work effectively with schools as a STEM ambassador. This included how to conduct a workshop, ideas for workshops and the types of activities that a STEM ambassador can get involved with including careers talks, mock interviews, science fairs etc. it allowed me to develop an idea for a workshop that I would like to carry out at schools in the future.

STEM Ambassador Event: Careers Talk - 28th November 2014, Smestow School, Wolverhampton, ~100 students.

As a STEM ambassador, I volunteered to give a careers talk to Sixth Formers at a high school in Wolverhampton. The purpose of this talk was to promote the opportunities available with a career in Science, Technology, Engineering and Maths (STEM). During the talk, I explained my career path so far including how and why I decided to do a degree in Chemical Engineering. In addition, I explained the alternative ways of being involved in STEM, such as apprenticeships, and I also gave a general overview of the variety of options and career paths that you have by doing a STEM related degree. From this talk, I got very positive feedback from students and teachers and many stated that they have gained a lot more knowledge about chemical engineering and its involvement.

STEM Ambassador Event: Maths Teaching Assistant- 28th November 2014, Smestow School, Wolverhampton.

Directly after the careers talk, I was involved in assisting pupils of various year groups, aged between 11 and 16 years old, in their maths lessons throughout the day. This involved assisting them with their class work and problems set by their teacher. The purpose of this was to provide extra support for the teachers and it also enabled me to interact with the students and explain the importance of maths in their daily life.

Applicant Visit Days (AVDs): November 2014 - March 2015, University of Birmingham.

Throughout the course of the academic year, I was involved in assisting the AVDs for prospective students of Chemical Engineering. This involved giving tours of the accommodation at the university as well as a tour of the chemical engineering department explaining the current research. In addition to this, I was involved in assisting the students with problem solving activities, some relating to engineering. During the AVDs, I am also involved in lab demonstrations. This involves giving a short talk and demonstration of either a model steam engine or the crystallisation of super-cooled water. During the demonstration, the fundamental engineering principles are explained and related to everyday life. Finally, AVDs provide a chance for me to promote chemical engineering and speak to prospective students about the degree and what to expect as well as the benefits and future prospects that chemical engineering can provide.

College of Engineering and Physical Sciences (EPS) Discovery Day: 23rd June 2015, University of Birmingham.

On 23rd June, the college of Engineering and Physical Sciences held a 'Discovery Day' for GCSE pupils, in order to make them aware of the STEM subjects available at the university as well as the research being undertaken. This day involved a number of school children visiting the university and attending interactive workshops in various schools across campus. Throughout the day, I was involved in welcoming the students and teachers to the university as well as accompanying groups of around 20 students to their workshops. I also helped out in the chemical engineering workshop attended and answered any questions from the students about STEM and chemical engineering. The overall aim of the day was to promote STEM in the university and to give the students an idea of the type of research involved in STEM subjects.

Open Days: 26th and 27th June 2015, University of Birmingham.

On 26th and 27th June, the university held two open days for students interested in attending the university. Throughout the two days, I was involved in greeting the students and their families on arrival as well as answering any questions related to chemical engineering as a degree or to university life as a whole. I was also involved in conducting two tours of the department throughout the day, each of which was given to around 40 people. Each open day welcomed around 200 students in total and the aim was to promote chemical engineering and the university.

Access to Birmingham (A2B) Scheme: 30th June- 30th July 2015, University of Birmingham.

During the summer, I was involved in mentoring a small number of students who had applied to the university to study engineering and were eligible for a scholarship via the Access to Birmingham (A2B) scheme. In order to obtain the scholarship, the students were required to write an assignment about their intended subject area, for example chemical engineering, and the advances being made in a certain industry (medicine, energy etc.). For this role, I was assigned eight students to mentor throughout the process. This involved assisting them with their essay, as well as organising an induction session for the total number of students (around 35) with three other tutors. In addition, as a mentor, I maintained regular contact online with the students answering any questions they may have regarding the essay as well as providing useful resource material online for the students. The role also involved marking a draft assignment from each student and providing feedback to them as well as marking and grading their final assignments. The overall aim was to make the students reflect on the advances that have occurred due to engineering and to get them used to writing an assignment which is of a university standard.

Girls in STEM Day: 16th September, University of Birmingham

This was a STEM event and the purpose was to promote women in engineering. Year 9 girls from various schools in the surrounding area attended the day which involved an introductory talk followed by two hour-long interactive workshops in different STEM subjects. Throughout the day, I was involved in guiding a certain school to their workshops, assisting the students and getting involved in the workshop. I also led a campus tour for a group of approximately 30 students as well as answered questions regarding STEM.

However, mostly importantly, the aim of the day was to promote women in STEM and try to encourage them to pursue a career within this field.

Future Plans

In the coming year, my aim is to become more involved in visiting schools in the surrounding area to raise awareness of STEM. In particular, I would like to develop an interactive workshop for students which I can then conduct when visiting the schools. Additionally, I will continue with the outreach and public engagement work carried out so far, including open days, AVDs and mentoring for the A2B scheme.

Cyrus Espinoza

I've been participating on AVD (applicant visit day) and UoB open days for the Chemical Engineering department. The purpose is to tour prospective students around the building and demonstrate some laboratory work involved in the course to show what Chemical Engineering is about and what role it plays in our everyday lives. Thus, it is an opportunity to share knowledge and ideas and to make Chemical Engineering more appealing to the younger generation.

In addition, I have also attended an induction as a STEM ambassador.

These events go on throughout the year and the numbers of audiences vary from 60 to 200 students.

Zoe George

Name of Event	Applicant visit days
Description of Event	UCAS applicants who have been offered a place on the chemical engineering undergraduate course were offered a chance to visit the department. This was a chance for the future undergraduates to connect with the lecturers and current students with various activities taking place on the day.
Date	November 2014- June 2015
Responsibilities	Giving tours of accommodation and the chemical engineering department. I was involved in the lab demonstrations one of which involved the topic of super cooling and crystallisation, applying engineering principles to real life problems. Problem solving activities relating to chemical engineering fundamentals were also ran on the days which I assisted with.
Location	Chemical Engineering, University of Birmingham
Audience	UCAS students
Purpose and benefits	The AVD days provided the students with a taster into the chemical engineering course and some labs which related to the course. The day allowed me to connect with undergraduate students and give them an insight into what they can expect on the course.

Name of Event	Chemical Engineering Open days
Description of Event	Chemical engineering open day
Date	12th September 2015
Responsibilities	Interacting with students who potentially would take the undergraduate course and providing them with information about the course and any questions they have related to it. I gave a talk on emulsion science in the labs and product applications. I also spoke about some of the research carried out within the microstructure group and the relevance to chemical engineering.
Location	Chemical Engineering, University of Birmingham
Audience	A level students and guests of students
Purpose and benefits	Open days provide students with an insight into to undergraduate programme and a chance to interact with researchers to provide some information of career paths they could go into. The day allowed me to connect with undergraduate students and give them an insight into what they can expect on the course and future career prospects.

Name of Event	Access to Birmingham (A2B) Scheme
Description of Event	Mentoring potential undergraduate chemical engineering students to write an essay for admission onto the course.
Date	June 2015- July 2015
Responsibilities	Teaching students how to structure a chemical engineering essay from a range of topics which were related to chemical engineering (e.g. fuel cells, medical and energy). The scheme involved an introductory session which

	included myself and three other tutors teaching students how to structure an essay and providing information on referencing to prepare them for university assignments. Regular contact was made online with the students and allowed them to ask any questions at any time.
Location	Chemical Engineering, University of Birmingham
Audience	Eight A level students from various schools across Birmingham
Purpose and benefits	Students had a draft essay which provided them with feedback to help them improve their essay writing skills. The online interaction allowed the students to develop confidence through asking questions. The draft essay allowed students to attempt writing an engineering style essay and the feedback would help them for their future course in chemical engineering.

Name of Event	**Engineering and Physical Sciences (EPS) Discovery day**
Description of Event	GCSE Students were brought into the University to have an insight into STEM careers and research
Date	23rd June 2015
Responsibilities	Assisting with a chemical engineering workshop and communicating with teachers and students throughout the day to promote chemical engineering
Session	I was helping out with schools and assisting with the chemical engineering workshop based on hydrogen fuel cells. The session enabled me to connect with the teachers and students and speak about my career progression in STEM
Location	Department of Physics, University of Birmingham
Audience	GCSE students
Purpose and benefits	Engaging students to learn more about the subject of chemical engineering and provide them with an understanding of various STEM applications and careers.

Name of Event	**Emulsion Workshop**
Description of Event	Delivering a session to year 11 girls based on emulsions and product design through a practical workshop and relating the session back to real life applications.
Date	9th July
Responsibilities	Preparation of a 45 minute session based on food engineering with a focus on the study of emulsion science and tribology.
Session	Students were given a chance to learn about the relevance of emulsion science applied to product design and the study of tribology.
Location	Lordswood girl school, Birmingham
Audience	~20 students
Purpose and benefits	Students built on their knowledge based on the curriculum and learnt about emulsion products and how to design new products based on engineering principles. The session also allowed girls to see the applications of chemical engineering research in industry and allowing them to connect and ask questions about STEM careers.

Name of Event	Girls in Stem day
Description of Event	Day organised for girls from various schools to learn about STEM subjects. The day involved schools being allocated two interactive workshops and having a tour of the University campus.
Date	16th September
Responsibilities	I was allocated a school for the day to assist and help with interactive workshops, one of which was based on chemical engineering.
Session	Two one hour STEM workshops
Location	University of Birmingham
Audience	Year 9 students from schools around Birmingham
Purpose and benefits	Engaging girls in interactive STEM activities and helping to encourage the girls to pursue stem careers. Throughout the day I was also able to talk to the girls and teachers to share my own experience about my career and research to give them an insight into how I chose my career path.

Erik Hughes

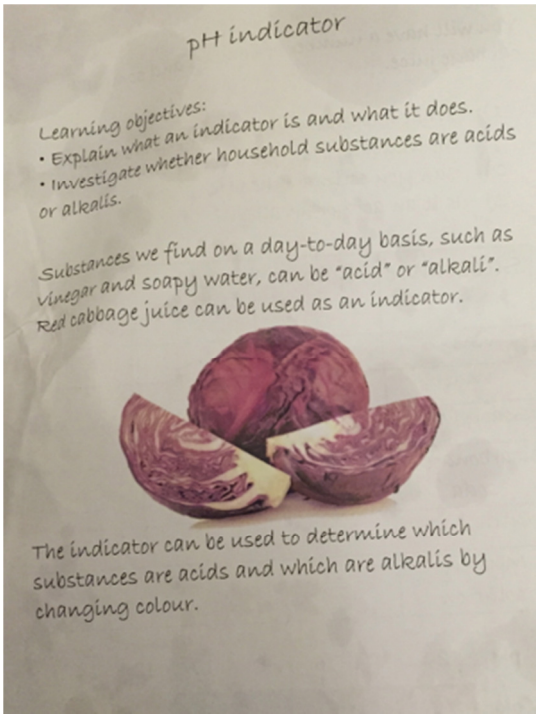
Activity 1
1 day, 27th November 2014
"Helping Hands" activity at Bursley Academy (Primary school), Staffordshire

I got involved with this activity through responding to the monthly call out for outreach ambassadors from the Staffordshire STEM base. My role was to assist with the activities as required. An experienced ambassador ran the activities. The day was split between two groups of mixed year 5-6's, with roughly 25 students in each group. Both groups carried out two activities in total. The first was making ice cream using salt ice water. The aim was to give the children an introduction into endothermic and exothermic reactions and energy transfer. Adding salt to ice water reduced the temperature of an ice bath allowing a mixture of milk, sugar and vanilla essence to freeze into ice cream, giving the children a tasty treat as a reward. The second activity involved designing and making a key holder for people suffering with arthritis. People with arthritis have stiff joints, thus it may be difficult for them to grip items like keys. The first task was to design the key holder. The children were asked to consider what might be important for the design, such as grip and shape. With designs to hand, the children were given a material called polymorph, which when added to hot water becomes workable and shapes can be made from it. Using the material the key holders were produced and tested with prizes given to the best holders. This activity gave the students an insight into the condition of arthritis as well as some materials science regarding the polymorph material they used.

Activity 2
2 days, 9th-10th July 2015
"Science day" activity at Pelsall Village School (Primary school), Pelsall

I got involved with this activity through my partner, a teaching assistant at the school. Having discussed the possibility of getting somebody in to do some science with the year 6 class with the teacher, my partner approached me to see if I'd be available. I put together some ideas for activities and produced some work sheets to go with the activities to give the children an insight into structuring scientific reports on a basic level (i.e. Introduction, results and conclusions). The same activities were carried out on both days with half of the year 6 class partaking per day, which was around 15 students per day. The first activity was making lava lamps. After a quick demo of one I had previously made, the kids got to work on making their own. Having brought in their own bottles, the kids were provided with oil, water and food colouring. The oil being less dense than the water formed a layer on top. Adding an alka seltzer tablet produced bubbles, completing the lava lamp. The activity got the children to think about why the water and oil didn't mix, the effects of adding more or less fizzy tablet and what the effects were of adding smaller or more crumbled up tablet were to create a better lava lamp and why. The second activity involved pH indicator from red cabbage juice. The pigment in red cabbage can be used as an indicator to detect acids and alkalis. Using red cabbage juice, the children tested different samples to determine if these were acids or alkalis. This gave them an introduction to what this means and associating it with household items such as soapy water (alkali), citric acid (found in lemons, acid) and vinegar (acid). The next activity involved the children becoming ink detectives. Having planted a ransom note in the classroom, the children had to uncover who had written the note from four suspect pens that were found nearby. Using chromatography paper, the children produced chromatography patterns for the four pens and for the note. Chromatography separates the colours present in the ink of the pens. The note sample could then be matched to the suspect pen. The children successfully uncovered who had written the note (turned out it was the teaching assistant!) as well as having time to play about with using

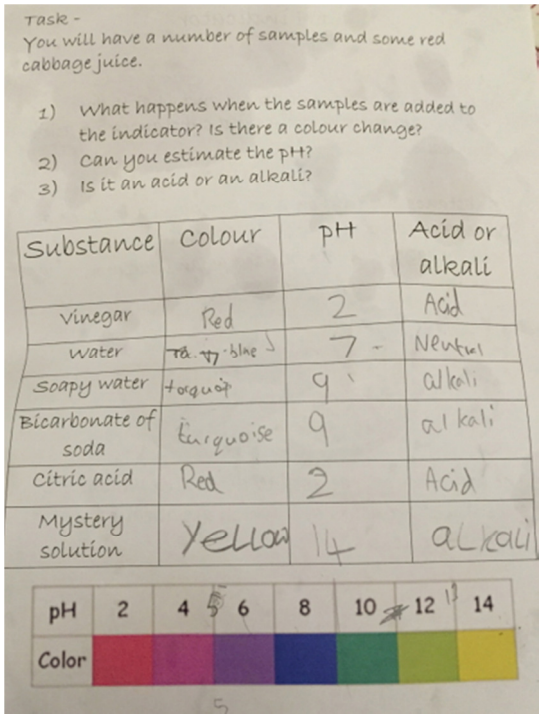
chromatography to separate the colours of felt tip pens. The penultimate activity was making rockets from film canisters, alka seltzer tablets and water. The tablets fizz within the sealed canister and the pressure build up that results pops the canister in the air. The activity focused on getting the best rockets by investigating what amount of water to use and tablet. The children realized that although having more water may seem obvious, this actually weighed down the rocket so it couldn't get as high. The last activity was to make slime from corn flour and water. This mixture acts really weirdly as it can feel like both a liquid and a solid depending if force is applied due to its shear thickening nature. The children got to make their own slime and also investigated the addition of magnetic powder to produce magnetic slime that could be manipulated with a magnet. At the end of each day the children were asked to see if they enjoyed the day and if they had found the science interesting and fun. It was really good to hear that the kids had had a great couple of days and hopefully will be inspired in the sciences for when they go to secondary school. I plan to return to this school around the same time next year for similar activities.


pH indicator

Learning objectives:
- Explain what an indicator is and what it does.
- Investigate whether household substances are acids or alkalis.

Substances we find on a day-to-day basis, such as vinegar and soapy water, can be "acid" or "alkali". Red cabbage juice can be used as an indicator.

The indicator can be used to determine which substances are acids and which are alkalis by changing colour.


Task -
You will have a number of samples and some red cabbage juice.

1) What happens when the samples are added to the indicator? Is there a colour change?
2) Can you estimate the pH?
3) Is it an acid or an alkali?

Substance	Colour	pH	Acid or alkali
Vinegar	Red	2	Acid
Water	~~Red~~ Blue	7	Neutral
Soapy water	Turquoise	9	alkali
Bicarbonate of soda	Turquoise	9	alkali
Citric acid	Red	2	Acid
Mystery solution	Yellow	14	alkali

pH	2	4	6	8	10	12	14
Color							

(Above) Work sheets from the red cabbage pH indicator experiments

Charles Moore-Kelly

Event Title: 'Clever Microbes'
Venue: Think Tank, Birmingham
Date: 20/02/2015

In February, I volunteered alongside four other members of the School of Chemical Engineering to host an exhibition called 'Clever Microbes' at the Think Tank Science Museum in Birmingham. The event sought to present and discuss the perception of microbes and their applications in every day life, with fun practical demonstrations held to engage younger museum attendees.

The public were encouraged to participate in experiments that included capturing carbon dioxide evolved from baker's yeast with balloons and examining cells using of a microscope. The application of separation techniques in bioprocessing and biotherapeutic purification were also presented, and visitors were invited to carry out thin layer chromatography to separate coloured dyes from M&Ms.

The event was a success and received praise from both visitors and museum volunteers. It was encouraging to find that parents enjoyed the exhibit as much as the children, and the age range of the audience allowed for a variety of discussions to be held about the exhibition topic.

E
vent Title: 'BBSRC Young Entrepreneur Scheme competition'
Venue: Unilever R&D, Colworth
Date: 30/09 – 02/10/2015

BBSRC Young Entrepreneur Scheme competition
(http://www.biotechnologyyes.co.uk/biotechnologyyes/index.aspx).
I was part of a team from the School of Biosciences entered the competition which took place from 30th September - 2nd October at Unilever R&D, Colworth. The competition involved 2 days of workshops and lectures about commercialising biotechnology and a final day during which we pitched our product ('smart fruit packaging' to reduce food waste and

give more control of fruit ripening to consumers), marketing and business plan to a panel of investors. Our team came joint winners alongside Cambridge University and we've been given a place in the London final in December.

From left to right - Charles Moore-Kelly, Sian Bailey, Julia Kraemer, Jim Crilly (Judge from Unilever), Matt Tridgett and Stephen Hall

Dmytro Stratiychuk-Dear

Sponsoring company: DuPont Teijin Films U.K. Ltd. (DTF), Redcar, TS10 4RF
Date started EngD program: 09/09/13
This report aims to outline the activities undertaken to promote Engineering Doctorate programme as well as Engineering career as a whole.
Activity: ECP Chair
Date: 09 June 2014 onwards
Organisation: IChemE (Teesside Regional Group)

Since commencing my EngD, I have been involved with the Teesside Regional Group for the Institution of Chemical Engineers. The group organises a number of events throughout the year catering for the engineers at varying stages of their careers. Technical and social events allow for the attendees to develop their knowledge and provide a networking opportunity.

Within the group I have the responsibility of the Early Careers Panel (ECP) Chair. The role involves organising social events for the regional group members in early stages of their career. Currently, I am organising an annual pub crawl to be held in at the end of October. Events planned for later in the year/next year include GoApe and Escape games.

I am also the email campaign coordinator for the group. This role involves contacting the members of the regional group to promote the various technical and social events throughout the year.

Emily Summerton

Since the start of the academic year I have held the role of one of the postgraduate ambassadors for the university. Through this role I have completed various activities aimed at promoting the university to potential postgraduate applicants. Such activities have involved working at the open day from both an organisational and interactive aspect. Tasks included ensuring parents and applicants were aware of the open day programme and providing information on various topics of interest such as the campus, accommodation and department specific issues. Campus tours have also been something I have been involved with, both on open days and also for those who pre-booked a tour for a specific day. On pre-booked tour days the groups are much smaller consisting of usually 1-2 applicants and their respective guests. As such it is more personal experience involving a campus tour followed by an informative chat where I provide information on my experience of postgraduate life at Birmingham to date and answer any questions they may have.

Also through my role as postgraduate ambassador, I have been involved in two media promotions, both through video recording. The first promotional video was aimed at promoting the university and encourages postgraduates to attend the open day, specifically for at those applying for Chemical Engineering. On the video I show and discuss the laboratory equipment available in the department as well as providing other information at various points round the campus and in the department. Post filming the video was uploaded onto the postgraduate open day platform. The second promotional video was an interview scenario that aimed at providing more in depth information about the EngD course here at Birmingham, where I specifically outlined the differences between studying an EngD and a PhD in the Chemical Engineering department. I was keen to be involved in promoting the EngD to future applicants because, for those with a desire for a long term industry career, this is the ideal postgraduate study route.

https://www.youtube.com/watch?v=r1d9AvJyzcI
https://www.youtube.com/watch?v=53WdEa9q1e0

My future plan is to apply to become a STEM ambassador and hence get involved in promoting science and chemical engineering outside of the university.