

Evaluation Report

I'm a (Biomedical) Engineer, Get me out of here!

The screenshot shows the 'I'm an Engineer' website interface. At the top, there's a navigation bar with 'Zone Home' and 'Engineers'. A search bar is present with 'global' and 'zone' filters. The main content area features a 'Meet the Engineers...' section with five profiles:

- Simon Willocks:** Head of a Function of 29 Engineering and SHE (Safety, Health & Environment) professionals – helping to ensure the availability of safe, compliant effective and reliable manufacturing facility for global supply of a flu vaccine.
- Rebecca Pullon:** I provide doctors with mobile phones and tablets to help them monitor patients in clinical trials.
- Laura O'Shea:** I aim to make sure our new fabrics and products can withstand the highest demands of performance so that athletes can rely upon them to train and play at their best.
- Krishnaa Mahubani:** I'm looking for a way to successfully freeze cells, tissues and organs so we can keep them longer and ensure they can be successfully transfused or transplanted.
- Julia Faerber:** I am a PhD student and involved in a project where we are developing a tiny pill that takes a live video of the human guts and beyond to uncover diseases such as cancer.

Each profile includes a 'Me and my Work' section, a 'Latest Question', and a 'Latest Comment'. The footer contains navigation links (FAQ, House Rules, Accessibility, Privacy, Partners, Contact), copyright information (Gallomanor, produced by Mangorolla CIC 2016), and the Wellcome Trust logo.

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1. Executive summary

Here is a summary of our main findings after evaluating the 8 zones of I'm an Engineer, Get me out of here, funded by the Wellcome Trust between June 2014 and June 2016:

1. The zones engaged over **3,100 students** across the UK with real people working in biomedical engineering (page 5).
2. **40 engineers** related to biomedical engineering themes were able to engage with school students (page 6). This included people designing prosthetic limbs, researchers developing regenerative tissue scaffolds, and hospital imaging system administrators.
3. The zones facilitated **many conversations and discussions around biomedical engineering themes** and what it was like to be a biomedical engineer: **Students asked the engineers 1,614 questions in ASK** (examples on page 9), and popular keywords in live chats included 'medical', 'food', 'research', 'career', 'technology', 'heart', 'people', 'design', 'bones', 'surgery', 'job', 'project' (page 10).
4. **After taking part, 84% of students said they thought engineers had an interesting job**, compared to 71% before (page 13). Students also said they knew more about **the types of people** who are engineers, more about **what engineers actually do**, and more about **the skills they would need to become engineers** (page 14).
5. Biomedical engineers enjoyed the challenge, **improved their communication skills**, said they wanted to do **more public engagement**, and became **more aware of what students thought about engineering** (page 12).
"It's been interesting getting to grips with school pupil levels of understanding about what engineering is and how it's applied. The questions have been quite testing at times, also in sheer scope." – **Dominic Eggbeer, Surgery Zone**
6. **£2,500 was awarded to 8 winning engineers to fund their own outreach activities** and extend the impact of the zones. To date, winners have reported on the use of £1,250 for activities including workshops in schools and laboratories, buying equipment for creating Youtube videos and producing copies of children's books about engineering (page 7).
7. Biomedical engineering zones were **popular with teachers and as busy as other engineering zones**, despite not fitting the stereotypical view of engineers and engineering.
8. Pages in biomedical engineering zones were viewed **140,000** times during the events and **55,000** times by members of the public since June 2014 (page 5).

2. Introduction and background

I'm an Engineer, Get me out of here! (IAE)

I'm an Engineer, Get me out of here! is an online event where students get to meet and interact with real engineers. It's an X-Factor style competition between the engineers, where students are the judges.



The event has 3 parts: ASK, CHAT and VOTE. Students ASK questions and have text-based live CHATs with the engineers. Students learn more about the engineers, and let engineers know their opinions. And finally, students VOTE for their favourite to win £500 prize to be spent on more science communication.

The event takes place over two weeks, online at imanengineer.org.uk, and it is split into “zones”. In each zone there are 5 engineers and around 350 school students in 20 classes. IAE is designed to bring real engineering to life for students, supported by carefully developed classroom resources.

In 2014 we were awarded a Wellcome Trust (WT) Peoples Award to run 8 Biomedical Engineer zones between June 2014 and March 2017.

Wellcome Trust

Wellcome is a global charitable foundation, politically and financially independent. They support scientists and researchers, take on big problems, fuel imaginations, and spark debate.

Wellcome funding supports over 14,000 people in more than 70 countries. They help to explore ideas in science, population health, medical innovation, the humanities and social sciences and public engagement.

Wellcome understands public engagement as conversations about science and health research in unexpected places and surprising ways. This is where *I'm a (Biomedical) Engineer, Get me out of here* comes into play.



3. Activity in the zones

We ran 8 zones, distributed across four events:

- 2 zones in I'm an Engineer June 2014: Food Zone, and Health Zone
- 2 zones in I'm an Engineer June 2015: Artificial Body Zone and Hospitals Zone
- 2 zone in I'm an Engineer March 2016: Food Zone, Surgery Zone
- 2 zones in I'm an Engineer June 2016: Health Zone, and Water Zone

Figures: Historic IAE average, average for all 8 Biomedical Zones, total figures for all 8 Biomed Zones.

	IAE Average to J16	Biomed Zone Average	Biomed Zones Total
Students	374	391	3,128
% of students active in ASK, CHAT or VOTE	85%	84%	-
Questions asked	533	521	4,165
Questions approved	199	202	1,614
Answers given	425	389	3,110
Comments	39	40	320
Votes	285	288	2,307
Lines of live chat	4,916	4,527	36,217
Live chats	17	16	127
Average lines per live chat	295	290	-
Schools	10	9	62
PAGE VIEWS DURING THE EVENT			
Total zone	19,051	17,510	140,082
ASK page	1,397	1,805	14,440
CHAT page	2,696	2,575	20,603
VOTE page	1,146	1,213	9,706

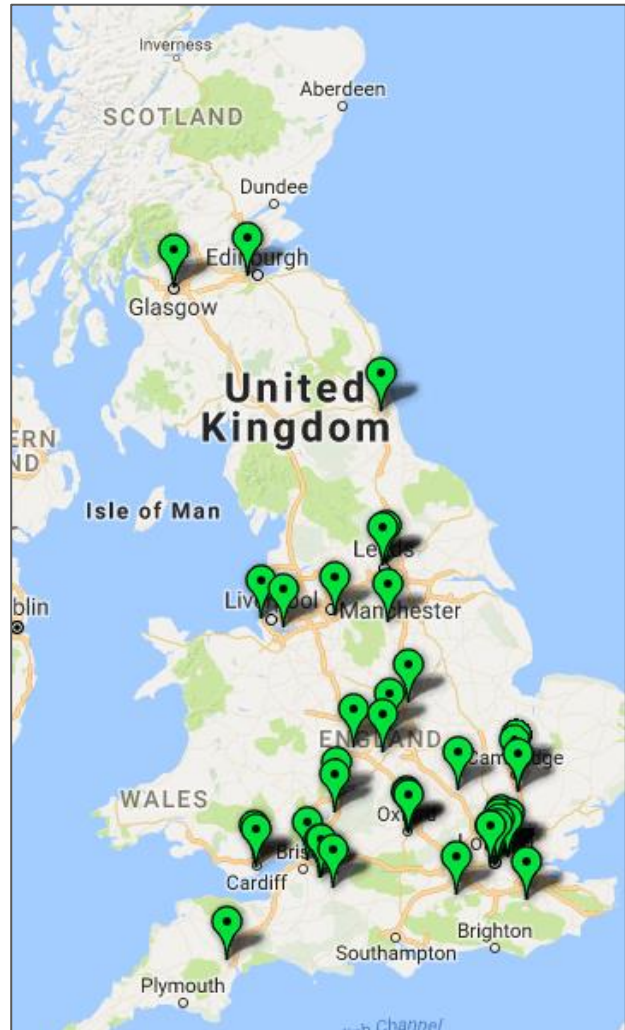
4. Participation

Engineers

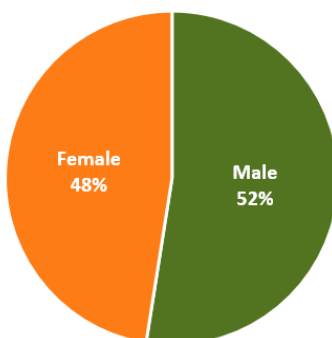
40 engineers took part in the 8 WT funded themed zones. When the engineers apply to take part in I'm an Engineer, they write a one-sentence summary of their work. This summary is sent to students and teachers, who rate the engineers based on their descriptions and how much they'd like to see them in the event. We also try to get a mix of research interests, academic levels (from Junior to Senior positions), places of work (public and private organisations), and a balance of female and male engineers, as well as engineers from minority ethnic backgrounds. This is important for helping every student find a relatable role model in their zone.

Of the 40 engineers who took part, 48% were female and 15% were from black or minority ethnics. The majority (60%) of the participants were academic engineers. Most of them were junior engineers, with up to 5 years of working experience. 13% of the engineers worked in both academia and industry.

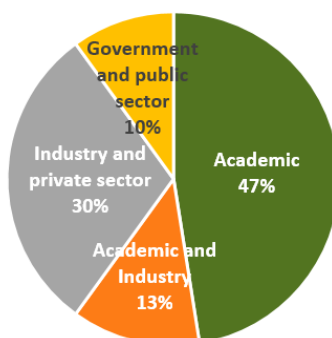
Engineers were widely spread in organisations across the UK, as shown in the map above.



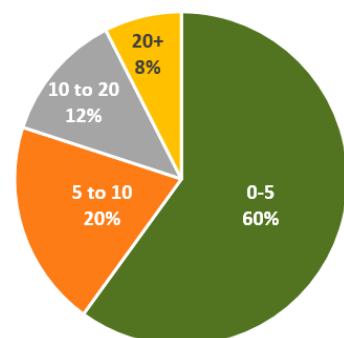
Gender of engineers



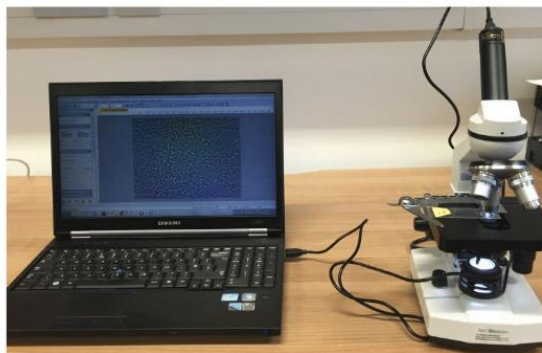
Sector



Years of experience



Prize money projects



[Zoe George](#) was voted the winner of the [Food Zone in June 2014](#). She used her money to facilitate workshops in the Chemical Engineering department at the University of Birmingham for 100 school students.

[Alex Lyness](#), winner of the [Health Zone in June 2014](#) has used the money to support taking his engineering workshop on a tour of secondary schools in both the UK and Ireland.

[Will Scott Jackson](#), winner of [Hospitals Zone in June of 2015](#), spent his prize money on different materials and resources for his outreach activities. He purchased a Raspberry Pi 3 to produce workshops on, two huge boxes of sensors, motors, microphones and other gadgets to use in his "Engineering for Health" workshops, and he spent the leftover money on camera equipment to start up a YouTube channel.

[Lizzie Kapasa](#), winner of [Artificial Body Zone in June 2015](#), used her prize money to expand the reach of her childrens' book project, 'Suzy and Ricky: Crash Landing. The money was used to build a website and print more copies of the book for distribution to schools around the country.

Read their reports at about.imanengineer.org.uk/category/prize-winner/wtwinner

The four winners from 2016 are currently in the middle of their projects (we give winners a year to get their plans underway), which include a workshop focused on the engineering of sports equipment and development of a tabletop model of a water treatment plant.

Schools

83 schools spread across the UK (shown on the map to the right) **were given a place in Biomedical Engineering zones**. 75% of these schools then took part in the event. We oversubscribe zones with 25 classes, when we expect around 20 classes to show up in each zone. The participation rate in these zones was slightly lower than the average participation rate for *I'm an Engineer* (80%).

Widening Participation

Being online we can reach those who are currently underserved by STEM outreach activities, and one of our main strategic aims since 2015 has been to increase the diversity of the schools taking part in *I'm an Engineer*. Since there is little data available for which are the most disengaged schools, we have created our own definition, considering distance to Higher Education Institutions, and Widening Participation indexes. We are targeting non-independent schools that fulfil at least one of these criteria:

- the % of students achieving 5 grades A*–C at KS4 is below 45%
- the % of students achieving level 4 in reading, writing, and maths at KS2 is below 45%
- the % of students eligible for free school meals is higher than 41%
- POLAR3 is in the first quintile
- A SEN School
- A school that is more than 25 miles away from their nearest Higher Education Institution

Read more on our Widening Participation strategy at about.imascientist.org.uk/widening-participation

In total, 162 students from 6 widening participation schools actively took part in the zones.



5. Popular Topics



Example ASK Questions in Wellcome funded zones (click for links)

Is it possible to repair people through engineering?

When you change the formula of food what kind of variables do you change?

If you can clip metal on to your brain and control a robot, could you control somebody else's robotic arm?

Why is designing a hospital harder than normal buildings?

How many ingredients go into one cracker?

What's the difference between the way you're trying to heal bones and the way doctors do it now?

My cousin is an engineer making Rolls Royce planes. How similar are those machines to the heart in terms of how they work?

Is there lots of maths involved in your work?

Will we be able to 3D print human organs?

What do you get out of engineering that you couldn't get from any other kind of work?

How many hours do you work?

How do you feel about making meat in a lab?

What would the world be without engineers?

What did your parents want you to do as a job?

There are not so many female engineers, so what inspired you to become one?

Will you try to improve the water in other countries where the water is limited and very unclean?



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Word clouds show popular terms in the live chats from each zone. They unveil some

consistently popular terms such as “research”, “people”, “technology”, “career”, “science”, “medical” “design”, “inspired”. From 2016 we included “work and “job in these clouds to show how much the students wanted to know about what engineering was like generally as a job.

Other words related directly to the work of the engineers stand out such as “heart”, “chocolate”, “bones” and “cola”. Ross Miller, winner of the March 2016 Food Zone, looks at how chocolate behaves as a solid and liquid to help make chocolate products.

Examples of good engagement

Most of the engineers in the WT funded zones were enthusiastic and engaging, here are just some examples of outstanding engagement to show how students and engineers interacted.

In the Surgery Zone, students brought up topical biomedical engineering subjects with the engineers, provoking interesting discussions:

Student: *“Do you think head transplants are going to work on humans?”*

Matthew: *“I’m not sure about head transplants as that would include the brain too. But it is possible to do face transplants and create artificial parts of the head already. There have even been ears growing on mice for use on humans. So bits of the head could be transplanted but not all of it, yet!”*

Student: *“Did any of you hear about the head transplant on the monkey? What did you think about it?”*

Matthew: *“I didn’t hear about that head transplant. Maybe it will be there for humans sooner than I thought! It sounds interesting but maybe with lots of ethical issues for humans too.” –*

Student: *“Apparently the monkey only lived for 20 hours or so”*

Matthew: *“That’s not much good for the monkey. I hope they learned something! But 20 hours is still a surprisingly long time.”*

Student: *“Thank you so much for your time! It was really interesting talking to you!”*

Students also used the live chats as a chance to ask the engineers about areas of STEM they were interested in, such as in this example from the Water Zone in which students ask Vinnie about coding:

Student: *“I am really interested in coding, I was wondering what coding language you think is the most important, and do you think coding is an important skill for STEM subjects?”*

Vinnie: *“Coding is definitely important for STEM subjects. A lot of my friends who did pure science degrees have either gone on to become programmers or they’ve had to learn programming while continuing science based careers.”*

Student: *“When did you start learning code?”*

Vinnie: *“I didn’t start learning code until university.”*

Student: *“Do you think it is important to start coding in school or is it too early and could confuse students?”*

Vinnie: *“I think coding should be an option to learn in school for those who want to. If it’s taught from basics it can be quite straight forward and I don’t think interested students should be underestimated. A lot of people start programming very young.”*

6. Impact

Engineers

All the engineers who filled in the surveys after each event said they enjoyed taking part, that they would recommend participating to colleagues and that they want to do more public engagement after taking part.

95% of the engineers also said they improved their communications skills and enjoyed talking to students and finding out what they think of engineering. They praised the online format, as it gave them the opportunity to be themselves and engage with the students in a different way they would have done face to face:

“It’s been interesting getting to grips with school pupil levels of understanding about what engineering is and how it’s applied. The questions have been quite testing at times, not just because of the fast pace which makes you think quickly, but also the sheer scope”
– Dominic Eggbeer, Surgery Zone, email

“It was great to hear all sorts of different questions, and be real with the students. In some ways being online allows you to do that in ways that you can’t face to face.” – Engineer, post event survey

Engineer interviews

We did telephone interviews with two engineers: [Elizabeth Kapasa](#), PhD Student in Tissue Engineering & Regenerative at the University of Leeds, from the Artificial Body Zone in June 2015, and [Matthew Round](#), system administrator at Royal Brompton Hospital who took part in the Surgery Zone in March 2016.

Elizabeth had done “quite a lot” of public engagement before taking part in I’m an Engineer and decided to apply after hearing about it from colleagues. Matthew, on the other side said he had had few opportunities, other than open days, but was keen to do more.

When applying, Matthew said he felt a bit anxious about being judged but he thought “it was clever to ask people to describe what they do, it gave you the chance to show some personality”. Elizabeth found the application process “very simple and easy to do”.

When we asked about their favourite part of I’m an Engineer, they both agreed on the live chats. According to Elizabeth “it was just a mixture of great curiosity, mayhem and hilarious moments.” Matthew enjoyed the spontaneity “How does a 12 year old think of these things?” We also asked them about suggestions for improvement. Matthew suggested ways to help engineers manage questions in the live chat. The new version of the live chat engine implements several similar ideas, such as being able to see questions directed just to you.

We asked if they felt they had gained anything personally from the experience, and both talked about appreciating the chance to improve their communication skills:

“it did help me to really think about the questions and with so much intense practice I think I got better at explaining things in a simple, concise and relatable way.” – Elizabeth

“It makes you think about how you’re explaining things and then you go on to think ‘how am I explaining things to other people?’ You tell a student you work with modalities, and they go ‘what’s a modality?’” – Matthew

Students and teachers

95% of teachers who responded to the online surveys sent after each I'm an Engineer event said they were satisfied with the experience.

Teachers and students both enjoyed taking part. Students loved talking to real engineers, they gained an increased awareness of what engineers actually do and how this affects the world around them and their daily lives. Some of the students said they were inspired to be engineers themselves:

"I found chatting with professionals unbelievable and I liked their thoughtful replies, especially Dominic's honest reply of running away if his experiments went wrong." – Student

"Taking part in this programme has definitely taught me more about what being an engineer consists of and what it is." – Student

"I have learnt a lot about engineers in the past few days and am now thinking what I want to be when I am older." – Student

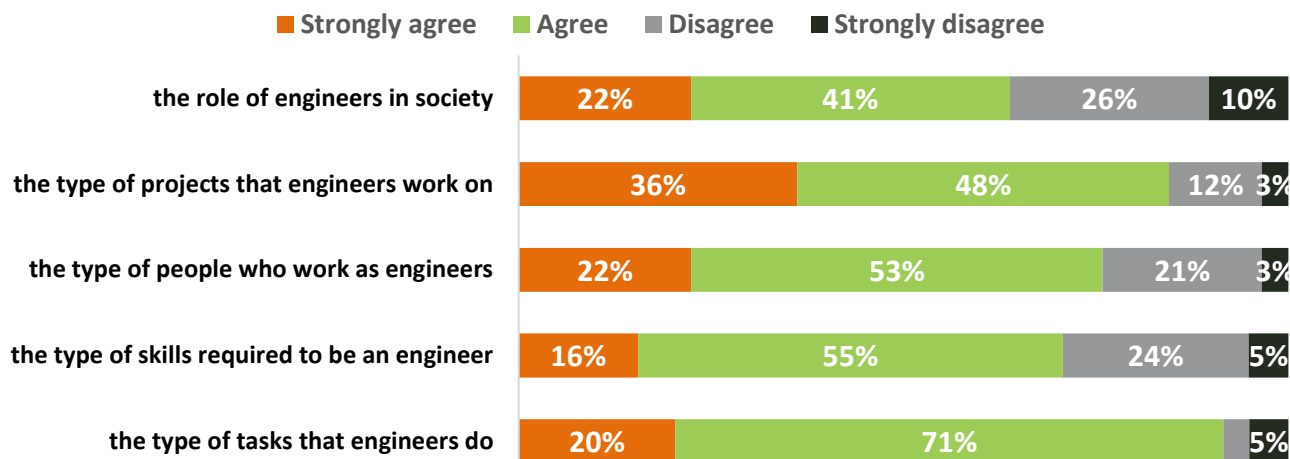
"We had a really good chat. I did it as a whole class as we had thought of the questions beforehand and I felt it would cut the silly questions. Thanks to Rebecca and Krish, it was really interesting and the children really enjoyed it"—Liz Gower, Teacher

"Students REALLY enjoyed the session - there was a lot of laughter throughout and they were thrilled when your answers to their individual questions came through." – Kate Williams, Teacher

We used a survey to ask students before and after taking part if they thought engineers had interesting jobs. The results show that students came into the event with a high regard for engineering jobs, with 71% saying they thought it was interesting. After the event this rose to 84% of the respondents.

We also wanted to evaluate how I'm an Engineer changes the students' perception of what engineers do. To this aim, we asked students for their degree of agreement on whether since taking part in *I'm an Engineer*, they know more about different aspects of being an engineer. Responses from 59 students in the four 2016 zones told us that taking part in I'm an Engineer helps them to improve their understanding of what engineering is and what engineers do.

Since taking part in I'm an Engineer, you know more about



NB: Figures rounded to nearest percentage

Almost all the students who filled in the survey said they knew more about the type of projects that engineers do, and the types of tasks that engineers do. 75% of students said they knew more about the types of people who are engineers, 63% said they now knew more about engineers' roles in society and 71% said they knew more about the type of skills needed to become an engineer.

7. Reflection and recommendations

Biomedical engineering is a popular area with teachers and students For many people, biomedical applications are unlikely to immediately spring to mind when they first think about engineering. For example, biomedical engineers don't fit popular stereotypes of engineers in hard hats, looking at plans. However, topics such as 'artificial body' and 'health' were consistently popular in surveys asking teachers which zones we should run.

This was carried forward into the numbers of teachers then applying to have classes take part in these zones. Furthermore, the number of students logging in per biomedical engineering zone was higher than the average for the I'm an Engineer event, indicating that students were interested and keen to engage with the engineers in biomedical related fields.

The relevance of biomedical engineering makes it engaging Most people are likely to either have had a personal healthcare experience of the applications of biomedical engineering, or one through a family member. Advocates for STEM careers should be aware that highlighting biomedical engineering could be a useful way to engage those who are turned off by the stereotypical 'hard hat and buildings' view of engineering.

8. Publicity

I'm an Engineer (@iaegmooh) regularly tweeted updates and popular questions. Some of the engineers were keen at engaging with other participants and teachers on Twitter. Here are just some examples, you can find more at [#IAEUK](#).

I'm an Engineer Team @IAEGMOOH Following

Next, the winner of @wellcometrust Diagnosis Zone is the conspicuous James Clarke of @CDTNeurotech @imperialcollege! Congrats James! #IAEUK

LIKE 1

3:10 pm - 18 Nov 2016

Louise France @LouiseFrance4 Follow

Medical Engineering...this is what it's all about [youtube.com/watch?v=oEx5lm...](https://www.youtube.com/watch?v=oEx5lm...) #CollectiveProject #IAEUK

The Collective Project: Robert Downey Jr. Delivers a Real Bi...
Robert Downey Jr. and Albert Manero, a #CollectiveProject student who founded Limbitless, surprised a very special child with a new bionic 3D printed arm at ...
youtube.com

RETWEETS 2

12:14 pm - 13 Mar 2015

FDF Taste Success @FDFtasteSuccess Follow

Ross Miller @MDLZ is an engineer who works with chocolate - ask him a question here: foodm16.imanengineer.org/profile/rossmi... #IAEUK #tastesuccess

LIKE 1

5:41 pm - 8 Mar 2016

I'm an Engineer Team @IAEGMOOH Following

More #WomenInStem: Artificial Body Zone winner @ElizabethKapasa of @UniversityLeeds! #IAEUK artificialj15.imanengineer.org.uk/profile/elizab...

Lizzie Kapasa
PhD Student
Artificial Body Zone Winner
#WomenInSTEM

RETWEETS 3 LIKE 1

1:25 pm - 11 Feb 2016

Elizabeth Kapasa @ElizabethKapasa Follow

First #IAEUK session with Nottingham High School this morning! It was GREAT! #ArtificialBodyZone #VoteLizzie @IAEGMOOH

RETWEETS 2

10:27 am - 15 Jun 2015