

China Plate Theatre and One Tenth Human present

WE'RE STUCK! by Sarah Punshon

**commissioned by Shoreditch Town Hall and Z-arts
originally developed in collaboration with Maths on Toast**

PROJECT REPORT, MAY 2016

by Sarah Punshon (One Tenth Human), Alexandra Fitzsimmons (Maths on Toast) and
China Plate Theatre



“Best school trip ever” - Year 4 pupil

“Really great performers and ideas. Such a fantastic experience using a space so cleverly. The actors were fantastic and so committed to their roles. Really fabulous production.” Parent

“The problems were so cleverly introduced. It was incredibly fun and funny.” Parent

“Really hope there are more things planned for kids like this.” Parent

“It was like being in Doctor Who” Child

“Just thank you. We couldn't stop talking about how privileged we are to be able to enjoy such world-class theatre.” Parent

“It carried an important message about it being acceptable and beneficial to get things wrong, a concept which they often struggle with.” Parent

“Brilliant!!! Keep touring and tell me about your next tour in London so I can share with my friends!” Parent

“I didn't like it, I LOVED it” Year 4 pupil

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INTRODUCTION

Project Outline

We're Stuck! is an interactive theatrical adventure for children aged 8-11 and their accompanying adults. At 70 minutes long, it takes audiences through six different spaces as they explore "Volcano Industries", a top-secret Artificial Intelligence research facility that develops cutting-edge robots controlled by neuron-computer hybrid systems. The audience are cast as "Professors", who have to help "Dr Dikita Dey", "Dr Bernard Fenugreek" and "Dr Ernest Volcano" overcome the evil plans of the head of the institute, "Dr Astrid Volcano".

The show was developed by theatre-maker Sarah Punshon with a team of creative and scientific collaborators. After an initial development phase in 2014, we secured funding from the Wellcome Trust, Arts Council England, Shoreditch Town Hall, Z-arts and Manchester Science Festival to develop the full show via school and family workshops in London and Manchester during autumn 2015, and produce it at four different venues in London and the Northwest, 16 March – 16 April 2016. See Credits & Thanks, below, for full performance details and credits.

We secured additional funding to help create wrap-around educational resources to support the production. A 16 page, full-colour A5 "Volcano Industries Recruitment Pack" was developed via school and family workshops, and distributed to every child who attended the show, containing additional original games, maths activities and further reading on the real neuroscience behind our fiction. It included an invitation to cut out and complete a pre-printed postcard for "Dr Volcano". We also produced and tested teachers' classroom resources, available online.

Project Headline Figures

We ran four family workshops and four schools workshops, reaching 296 participants. Over 36 performances we reached exactly 1,000 audience members with the finished show. This was an average of 67% capacity across the tour. Through venue led activities and audience development projects we estimate to have reached a live secondary audience of approximately 900 young people. We also reached a secondary audience of approx. 7,000 people through the dissemination of various interviews and feature articles.

The project cost £88,514 in total. An additional £9,170 was raised by Maths On Toast from The Mercers' Company for an enhanced wrap-around educational package: "Recruitment Packs" were distributed to every child who attended. Around 5% of these children sent messages to Dr Volcano after the show.

EVALUATION & LEARNING

Scientific collaboration & communication

Initial objectives:

- To embed cutting edge research on maths learning, visuo-spatial cognition and neuroplasticity into the theatrical experience.

Process

Early on, Sarah met with all five of our scientific advisors in person, discussing their work and investigating its relevance to our objectives. Together with her designer and games designer, she also visited the Brain Embodiment Laboratory at University of Reading, meeting with Professor Slawomir Nasuto and his team of researchers to discuss their work with rat neurons.

During R&D weeks in the autumn, Professor Michael Thomas and Professor Matt Nolan joined the company for the family workshops in Manchester, followed by a Q&A with the performers; Professor Andy Tolmie and Dr Emily Farran observed schools workshops in London, and discussed their observations with the team afterwards.

Throughout December, January and February, Professor Thomas, Professor Nolan and Dr Farran were able to read and feed back on various drafts of the script, and in March Professor Thomas attended a dress rehearsal and gave notes afterwards.

During the run, Professor Thomas and Dr Farran each joined us for a post-show Q&A session with audience members, where they faced questions, which ranged from the brain and how we know how it works, to Artificial Intelligence and what will happen with robots in the future. These came both from children and their parents, suggesting the audience was well engaged with the ideas.

Challenges

Time, space, plot and our powers of assimilation and invention all placed limits on what made it into the show. Many fascinating ideas were explored, and not all of them could be squeezed into one show: constrained as we were by the length of a school day and the attention span of an eight year old. For instance, one particular game, Bernard-bot's Navigational Error, which was popular with our advisors and drew strongly on Dr Farran's research around mathematical language, was regrettably cut from the show at a late stage, after the first previews, when it became apparent that the show was ten minutes too long.

Physical proximity meant that our London advisors were more closely and consistently involved than Professor Nolan (Edinburgh) and Dr Cohen-Kadosh (Oxford). After our initial very useful research visit, Dr Cohen-Kadosh was unable to be more fully involved, due to heavy commitments elsewhere. However, Professor Nolan was able to attend a Manchester day, and subsequently was hugely helpful reading draft scripts and pointing Sarah towards useful research.

Successful Collaboration

The project was a genuine collaboration: the show would not, could not, have existed without the input of our scientific advisors. The team, particularly Sarah, learned a huge amount about the brain and maths learning. Many key plot points came from these discussions: the idea that Dr Dikita Dey should be a neuroscientist; the emphasis on how the characters learn and change their attitudes to learning during the show; the concept of robots controlled by cerebral organoids.

The games, as we had intended, were heavily inspired by our advisors' research: particularly the emphasis on rotation and spatial visualisation, use of positional language, and how important gesture became within the show. Dr Farran and Professor Tolmie provided detailed input on language use with children during activities, which was hugely reassuring (when they pointed out things we were doing well) and helpful (when they pointed out aspects we could improve).

"I was impressed with how your performers led the two-dimensional activities: they used all the right language, and their interactions with the kids were spot-on." *Professor Andrew Tolmie, Birkbeck College*

Often, we were amazed by what we learned. At the Q&A in Manchester, for instance, we were all astonished to discover how quickly our brains can grow new connections – a fact which made it into the finished script. Our advisors' rigorous questioning and detailed feedback also pushed Sarah into exploring the emotional landscape of the characters with more depth and nuance – a slightly unexpected benefit of involving senior scientists in a theatrical project.

"It was lovely, seeing the scientists' eagerness for creatively sharing their world with us. I learnt about neurons, and the endless re-sculptability of the brain." *Seiriol Davies, "Dr Ernest Volcano"*

"Had an absolute blast doing the Manchester week and enjoyed everything immensely (learned a lot, too)." *Robin Simpson, one of our R&D performer-devisors*

Our advisors enjoyed the process of collaborating with us, and felt the exchange had not just been one-way:

"It was a massively stimulating and enriching experience... Personally, many insightful questions from Sarah (and later on the members of the team) were helpful in making me reflect on my own research, its wider relevance, and how to communicate this." *Professor Matt Nolan, University of Edinburgh*

"The project has shown me the importance, if not necessity, of using multiple avenues to communicate key ideas about brain function and education to children. Theatre is a powerful medium to achieve this, especially the immersive, interactive experience provided by the We're Stuck production." *Professor Michael Thomas, Centre for Educational Neuroscience*

Success

We're proud of how well we integrated research into the performance.

"I thought it was excellent and so engaging. The kids absolutely loved it and so did I... the children lapped up the challenge, which is great."

Professor Emily Farran, Birkbeck College

"the show was remarkably successful at making abstract scientific ideas fun and entertaining for a young audience.... I was thrilled to see how engaged the children were... Working with Sarah felt like a very effective way to contribute to scientific communication to the wider public."

Professor Matt Nolan, University of Edinburgh

See "Audience Impact" (below) for more detailed evaluation of the impact on our audiences.

Artistic process, practice and quality

Initial objectives:

- To create a piece of theatre that is exciting, funny, accessible, and empowering.
- To tap into the swirling pools of strong emotion so many of us carry around maths, mistakes, and being clever.
- To develop a theatrical language which combines elements of game-play, clowning and dramatic story telling to playfully grapple with complex subjects.

We're Stuck! marks a new development in Sarah's artistic practice: for the first time, working as lead artist with a team of devisors, writing the script as well as directing. It was also the first time Sarah had worked directly with a producing company. As producers, China Plate supported the financial and project management of the project, creating the space for Sarah to realise this ambitious project, whilst also offering solutions and problem solving throughout the project's development.

"The experience was thrilling, if sometimes terrifying. It was wonderful to work with such a high calibre of collaborators. We're proud of the quality of what we created together." *Sarah Punshon, Director*

"It's brilliant! I loved it." *Michelle Walker, The Hat Fair*

"The whole setting, scenery, props and especially the actors were excellent. We totally didn't expect it to be so much fun. Genuinely laughed out loud a lot and left feeling really glad we'd been. The children in the audience got really stuck in and it was great to see them so enthused and unafraid to shout out. Elise loved it. An absolute triumph." *Elise's Guardians*

The show was referred to by many children and adults as "funny" (a fact frequently remarked on with some surprise, given that they'd come to a show involving maths).

The high quality of the performances was also frequently commented on, including by theatre professionals and critics:

“thanks to the warmth, energy and inventiveness of the performers, it's extremely exciting” *The Londonist*

“I thought your actors were all ace, particularly the woman playing Dikita – brilliant job as the moral heart of the story – and Dr Volcano was hilarious.”
Sam Howey Nunn, freelance theatre producer

“Clare Dunn... is an electric fizz of ornate gesticulation, rubbery as the human, clipped and stiff as the machine [...] Seiriol Davies... made me cry with laughter, [and brings] a quick-wittedness that means he can respond in a snip to everything the audience throw at him, as energetically at the end of the show as he does at the beginning.” *Maddie Costa, Exeunt Magazine*

We were pleased with the balance we struck between game-play and dramatic story telling. Many audience members commented positively on the interactive structure.

“I loved that you involved the children in a very real way. I thought the number of different rooms was a brilliant way to ensure wriggling bodies remained completely focused. The problems were so cleverly introduced. It was incredibly fun and funny.” *Parent comment*

“Treating the kids as proper people and getting them fully engaged.”
Parent comment in answer to “what did you value most about the show?”

It was clear that children felt a great responsibility to solve the problems and save the day, with excitement building as the plot progressed. Occasionally the show was even a little too exciting for one or two younger members of the audience, who had to be given time-out or leave the show entirely at particularly scary moments.

“It all becomes surprisingly high-stakes for the kids: my smallest, admittedly only seven, so younger than the recommended age range, had a meltdown at the potential dangers.” *Maddie Costa, Exeunt Magazine*

“I asked him how scared he actually was and he said: I thought 'am I going to get out of here alive' (!)”
Sam Howey Nunn, freelance theatre producer, of her 10 year old.

For most of our target 8-11 year old audience, however, we seemed to have pitched the level of excitement about right: we followed up a comment that the show was “scary” with one quieter child, asking “bad scary or good scary?”, and she said, “just a little bit scary”.

“My year 3 daughter seemed terrified. When I suggested she left she laughed, and said 'I'm just getting into the atmosphere of it mum' would love to see more shows like this.” *Parent comment*

Maths on Toast staff member (and ex-primary school teacher) Francesca Piacentini observed two performances in order to evaluate audience response:

Engagement:

From the outset all of the children were fully engaged with 'magnet eyes' to the stage, or wherever the action was unfolding, and this was maintained throughout (for 70 mins). When you bear in mind the average focused attention span of children under 12 and how they frequently require a change of activities, this is worth noting as an indication of the overall success of the show as being enjoyable and engaging.

Audience Participation:

The large majority of the children were keen to offer contributions. Although eager to be heard there was little in the way of children talking over one another or interrupting. They listened well and responded to the input of other children, who were in most cases unknown to them. Although adults accompanied the children and there was a structure to 'contain' their involvement, there was still room for them to get 'silly', but they didn't. This suggests that the children had really taken on the role of professors, had connected with the characters and felt that they were part of a team working together to solve the problem.

The audience participation elements in the show were excellently by the performers during the performance. Rules were subtly outlined from the beginning that encouraged sharing, listening and respect of the space.

The show was accessible to a broader age range than we originally thought, with many six and seven year olds and some twelve and thirteen year olds enjoying taking part. We were delighted that a broad demographic range of children saw the show – see Marketing and Demographic Reach below.

"The way the children were encouraged to participate, and the range of levels it could be accessed on. How thrilling and actively scary parts of it were. The adrenaline made it exciting for the kids, and that made maths exciting."

Parent

"Making my son laugh so much and seeing him enjoy something other than sports."

Parent, in answer to the question, "What did you value most about the show?"

"The show was just brilliant and so engaging – my girls who are very critical said it is their favourite show at Z-arts."

Zoe Pickering, Children's Theatre Programme Manager, Z-arts



Development Process Challenges & Successes

Though hugely rewarding and ultimately successful, the creative process was often challenging.

Initial objective:

- To treat young audiences with the respect they deserve as thinkers and theatregoers, daring to let them struggle with real problems that are genuinely difficult.

One of the biggest challenges was pitching the games at a level that required genuine effort for our target audience, whilst also retaining forward momentum. Our development process involved a lot of trial and error. We grappled with the huge difference between a family audience of highly varied ages and a class all of the same age, primed to do a show involving maths.

We succeeded in creating a show that gripped and challenged children aged 8-11, either in classes or family groups. Moreover, slightly younger and slightly older children also enjoyed the show. Older children up to 13 years old frequently engaged more at the end, in the most challenging sequence, rather than in the easier early stages.

Early on, we discussed the possibility of making an adaptable version of the show, with more challenging problems for older or more able groups. However, we ultimately decided this was too demanding an aim. All our games require specific props and items of set, and we didn't have the budget to create more than one of each. Instead we built in flexibility for the performers to challenge or support more or less, depending on the group.

Challenges for performers

We underestimated how difficult it would be to introduce a performer who hadn't been involved in the initial R&D workshops, which made the autumn development weeks more challenging than expected. The experience was in part a sobering reminder of how many people find maths stressful or downright frightening. We were asking our performers to do extremely difficult things: As a robot, to be accurate in moving around a coordinate grid (back to front, so the audience could view it the right way round). As a scientist, asking the right questions: to be an excellent teacher, not feeding the right answer but allowing children to discover it. All whilst staying in character and coping with varied audiences: from excitable schools to much quieter family groups.

Additionally, our performers not only had to overcome a fear of maths, but be prepared to cope with a great deal of uncertainty: the show's structure rests on audience responses, and they have to somehow respond to whatever the children throw at them. It takes a certain confidence and experience as a performer to enjoy this, rather than be terrified by it! After the initial R&D, we re-cast one role, a difficult but valuable decision.

"Figuring out the right questions to ask to get the responses we needed was challenging. Trying to keep the focus of audiences in different shaped and sized rooms was difficult at times. Trying to welcome suggestions but also continue with the script and plot was also sometimes tricky. Trying to get my brain to think logically and directionally was a personal challenge!"

Challenges with production design

The show was ambitious. The content inspired big ideas: the original design came in two times over budget. Utilising higher than anticipated project income and through careful planning and negotiation China Plate were able to increase the production budget to a level that allowed the majority of the design elements to be realised, which we believed was fundamental to the success of the project.

The effort was worthwhile: several theatre professionals who saw the show commented on the high quality of the design and physical production, expressing amazement at what had been achieved on tight schedules and budgets. This was also reflected in the responses we received:

"The labyrinthine tunnels have been transformed... into a detailed, futuristic lab, complete with zany characters, fun challenges and a rollicking good story. Fast-paced and immensely entertaining... The kids get totally wrapped up in the success or failure of the protagonists... Full of surprises, there is never a dull moment" *The Londonist*

"It was like being in Doctor Who" *Audience comment, Lancashire*

This initial run made us realise that the show needs more production support on the road, which will be introduced into any future touring plans.

Development process successes

Overall, the development process worked well. It was incredibly useful to try out games and characters with groups of children of the right age at every stage, to have individual feedback sessions with teachers and scientists, and to have time between each stage for thinking and writing. We were able to work the budget and add more time with the performers in December, which was hugely valuable in allowing everyone to hear an early full draft of the script. The final rehearsal period, though short, was adequate, and it was useful to have a few more days for reworking after the initial schools previews. We learned a great deal from our first few shows, and used this time to make cuts and tweaks to script and design.

We learned a huge amount from the process of making the show, as a company and as individual artists. Most of us were pushed out of our comfort zones in one way or another: Seiriol Davies, for instance, had never made anything for this age group before; Claire Dunn had been terrified of doing any maths; Daniel Bye usually only plays himself on stage, and found himself playing a dancing robot *and* a nervous scientist; China Plate have not previously produced a promenade family show. After a tricky first show, in which we discovered quite how exciting the show was for a class of 9 year olds, we adapted quickly to the challenges of navigating 30 children through the different spaces.

"It really broadened my experience of working with children; and took me well out of my comfort zone in that respect!" *Seiriol Davies, "Dr Ernest Volcano"*

The team were hard-working and pulled together brilliantly, adapting the show to the four different venues, still inventing and giving their best work after more than thirty performances.

“There were things I found difficult... [but] It was a real honour to be in a room with such great minds and to learn the process of theatre making, which I would love to do more of. I have learnt so much in the past fortnight. Thank you SO much for all of your support and understanding throughout the process.”

Nadia Emam, one of our R&D performer-devisors

“It’s been fantastic and I learn so much from you and your process. You have been not only so patient with me, but hugely supportive and always such a positive energy towards the things I find hard.” *Clare Dunn, “Dr Astrid Volcano”*

“I think this was a mammoth beast and was dealt with brilliantly. I always felt comfortable to explore and try things out in rehearsals.”

Avita Jay, “Dr Dikita Dey”

“It’s been a delight working with you!” *Seiriol Davies, “Dr Ernest Volcano”*

Sarah feels her confidence with and understanding of devising has grown in leaps and bounds over the past few months. She is already planning a new project with some of the same team, which will continue her relationship with China Plate.

Audience Impact

We had big ambitions for the audience experience which went well beyond the enjoyment, entertainment, energy and humour described above.

The aims for the show included:

- To create a show that provokes discussion, builds confidence and perhaps even changes beliefs around maths, learning and the brain.

Our post-show resources also aimed to:

- Increase children’s enthusiasm for hard problems
- Support parents/ teachers to praise struggle and strategy

We gathered information to assess whether we had met these outcomes in a number of ways. During the development phase, we carried out observations and asked audiences (in schools and in public places) for feedback. During the show, we assessed the audience’s experience through observation by educational and theatre professionals, as well as our team of advisors. We also spoke to groups attending the show, before and after. Finally, we sent out a questionnaire to audiences following the show, which attracted 28 responses, many in some depth.

Learning about the brain

“The production had stimulated a lot of thoughts on learning and the brain, as well as what computers and robots could do. There was enthusiasm both among the children and the parents. The children plucked up the courage to ask lots of questions of the 'scary neuroscientist'. It was clear to me that both the curiosity and the imagination of the children in the audience had been fired by their experience.” *Professor Michael Thomas, Centre for Educational Neuroscience*

In an activity before two of the Manchester development workshops, we asked audiences: “Lisa is struggling with a hard maths problem. What do you think is happening in her brain?”. Their response was to be written or drawn inside an outline of a head, with a brain outlined inside that. The 38 responses included images of mathematical symbols and problems (numbers, axes, + x etc.), question marks, ‘fireworks’, cogs, small people, images that we could not interpret and the occasional blank. Only one person gave a biological answer: a suggestion of inner and outer layers of the brain and the phrase ‘cerebellum becomes engaged’ from Joey, 9. Nobody mentioned neurons or brain cells, suggesting that the majority of this audience had no particular sense of the inside of the brain before the workshop.

In our follow-up survey after the finished show, 15 respondents (the majority) told us that they or their children had learned something about brains or brain cells:

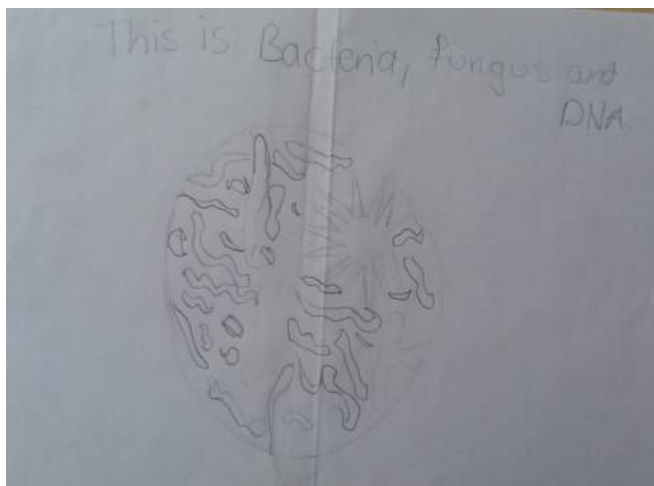
“They talked about brain cells all weekend!! The show really engaged them and piqued their interest in how the brain works.” *Parent, post-show survey*

“My children became fascinated by the fact that cells mean and do different things and by the idea that cells could be stored or replaced.”
Parent, post-show survey

Talking to children as they emerged from the show also supported the sense that people had learned about the brain:

“We have brain cells, more than a hundred of them in our heads, and it’s all squishy”.
Year 4 child, verbal comment

One child sent us in a picture of DNA in a petri dish, clearly inspired by the “cerebral organoids” in the show. Responses to the survey also suggested that this new knowledge about the brain was supporting beliefs about learning and ability – the idea that your brain can grow:



We're Stuck! by Sarah Punshon - Project Report



“Your brain adapts so that you can learn more and there is something beginning with 'n' that I can't remember”

Elise, aged 12, quoted by parents in post-show survey

“They talked about neurons a lot. And that new connections can be made.”

Parent, post-show survey

“Yes, the idea that they can be a living culture, that working your brain causes new connections and pathways to form, and that using your brain helps it improve.” *Parent, post-show survey*

Although four people told us they hadn't learned anything about brains, one of those said this was because he was already quite expert due to his son's enthusiasm for the topic.

Confidence and beliefs about learning, maths, mistakes and being stuck

“We really enjoyed the show - it was very ingenious to go into all those different spaces for unexpected challenges and happenings - and of course I loved the message about maths! Many congratulations to everyone involved.”

Anne Haworth, Chair of General Council, Association of Teachers of Mathematics

96% of our survey respondents (sample size: 28) identified that there was maths in the show. Although there was disagreement within the responses about exactly which elements were mathematical, this nonetheless indicates a very strong general sense that the show was about maths – and given that this same group also enjoyed the show, a connection forged or supported between maths and enjoyment.



Comments also supported that we were representing maths in a positive light.

'They were all really engaged, a lot of them don't really like maths, there are about 5 in the class that really love it but today I noticed how they were all engaged.' *Teacher, verbal comment*

"My children love maths anyway, but I think constantly re-enforcing the positive and incredibly important aspect of math in our everyday lives is crucial to the future problem-solvers we expect them to be." *Parent, post-show survey*

"... The adrenaline made it exciting for the kids, and that made maths exciting." *Parent, post-show survey*

"They had a great time and it helped consolidate their current understanding in a fun and practical way." *Parent, post-show survey*

We were particularly pleased to note a comment about maths as diverse, as well as useful:

"...Time will tell I suppose, but the kids loved the vitality of the show and seemed to engage well with the concept that Maths could be fun and useful to solve problems. And that it's diverse..." *Parent, post-show survey*

One comment shows we influenced aspirations. One girl was inspired to explore electronics – a field where maths is valuable, and not a field traditionally marketed to girls – by the show:

"Lola loved guessing the door code and using coordinates. But the most important thing was it opened her eyes to computers, robots and electronics. She now wants an electronic set!" *Parent, post-show survey*

In our survey, we also asked our audience: "In all honesty, do you think the show had any impact on yours or your children's confidence or enthusiasm when it comes to maths?". and we had 18 positive answers. Discussion ranged from straightforward enjoyment:

"Both my kids (aged 11 & 8) really enjoyed the show and were enthused to talk about the maths and problem solving on the way home." *Parent, post-show survey*

to the supportive nature of the interaction:

"Being at a stage where she is beginning to feel confident that she can do maths her confidence was greatly reinforced by the interactions in the show." *Parent, post-show survey*

"I'm not sure - they both love maths already. They were happy because they knew some of the things already like x and y axis and that this was recognised and praised by the actors." *Parent, post-show survey*

People carried on playing our games after the show:

"We played the guess the number game all the way home... loved it. We have sent the information to our maths teacher friends in Australia! Thanks for a great show." *Parent, post-show survey*

One child was so motivated by the show that her parents identified she had afterwards made significant progress in maths:

"Yes. Definitely. She spotted the problem solving, and thought that the people were 'cool' and 'fun' improving her perception of maths. She has voluntarily sought and completed a daily maths task since the visit, and passed her 'times machine' to enter the school 'super group' after being stuck on the same level for a few months" *Parent, post-show survey*

We saw particularly strong evidence that attitudes to making mistakes and to being stuck were influenced by the show. Parents and children emerging from the show consistently commented that they liked the show's messaging around making mistakes

"I liked the idea that you have to make mistakes to learn."
Parent, verbal comment

"Especially in maths I don't always succeed at first so often I have to try two or three times" *Child, verbal comment*

and this was supported by our survey:

"Hopefully - the message about having to keep trying/trial and error/not giving up the first time you get something wrong is important (my youngest - aged 7 - struggles with this at the moment as she doesn't like making mistakes)."
Parent, post-show survey

"It carried an important message about it being acceptable and beneficial to get things wrong, a concept which they often struggle with."
Parent, post-show survey

"Yes because you could shout out any answers you thought it was and you didn't have to care about getting the answers wrong' (Elise)"
Parent, post-show survey

One child, asked whether any part of the show would help with maths, described one of the problem-solving scenes, with appreciation of the level of challenge:

"The part when we had to figure out what was the right one to turn off the lasers.... if we are doing something in maths it's often easier"

We were also able to follow children's engagement with tricky problems through their feedback on the "Recruitment Pack" we provided after the show. Thirty-six children responded to our feedback mechanism. In this context, we asked children what activity they had found hardest in the booklet, how long they'd spent trying to do it, and what they find most useful to do when stuck on a problem. The time frames in the answers were especially interesting, with children declaring that they had spent as long as two weeks on a problem. Only seven children gave time spans less than an hour. This shows pride in spending a lot of time on a problem, indicating a value for perseverance. Suggestions for what to do when stuck showed that children were aware that persisting requires effort and may involve strong emotions. They included:

'Let my brain and heart tell me what to do'

'Try different methods'

'Calm down and do it later'

'Try and try again'

Children's responses from the Postcard to Dr Volcano activity

Name: **Professor** Ayza
Age: 7 Girl/Boy: Girl
Address (so we can reply): [Redacted]
Postcode: EN9 [Redacted]
I visited Volcano Industries on (date): 26/03/2016
In this pack, I most enjoyed having a go at: Dancing like volcanobot
The trickiest bit was: Having to look for the right + coordinate
and I spent 30 days/hours/minutes trying to figure it out.
When I get stuck on a hard problem, I find it most useful to: Try and figure out another way to do the activity.

Marketing and Demographic Reach

We were delighted with our diverse audiences, and that in London we succeeded in smashing our box office targets. Overall we reached 67% capacity across 36 performances in four different venues.

Our press team at Mobius managed to get extensive preview and review coverage for the show, we were particularly impressed with the results due to the short run and the challenge of promoting theatre for young people in the press. They secured show previews in high profile publications including The Guardian and Time Out, as well as reviews from The Times, Exeunt and Londonist. Please see press report attached for full details. Based on the circulation of the top publications the show was featured in we can estimate that our readership of this press coverage stands at over 800K people.

Shoreditch Town Hall school shows sold-out to a c.80% BAME audience, and family shows reached 86% capacity. Burnley Arts Centre achieved 93% audience capacity, however schools in the area proved difficult to engage due to the Easter holidays and the venue being without a marketing officer for a number of months. Burnley reduced ticket prices to encourage booking. The Boo, Waterfoot made particular effort to engage the participants of 'Different Moons', an artist led project that, through the Apna Centre, aims to record the stories of individuals from India, Pakistan and Bangladesh who settled in Rossendale after the war. Users of the Apna took advantage of a discounted ticket price and made up 30% of the family audience. Z-arts, on the other hand, struggled to hit audience targets. This was mainly due to the varied Easter holiday dates across Manchester; however, too much focus had possibly been placed on maths and science content in initial marketing. Z-arts felt the final show could have been more effectively marketed as a high-quality, funny, exciting adventure.

During the development of the show we worked closely with our venues to develop a comprehensive marketing plan that promoted the scientific and mathematical content as well as the dramatic experience. Mobius PR were committed to raising the profile of the production through the national press and secured a number of high quality preview features (Timeout Easter Tips, Mathematics Teaching Magazine, Lyn Gardner's Theatre tips) and reviewers to attend throughout the London run (Londonist, The Times, Exeunt, First News) – please see reviews and full press report attached. We ensured production images were taken at the earliest opportunity and created short video trailers for each venue to help promote the high production values and adventure side of the show.

Shoreditch Town Hall is in the early days of building up a family/school audience through its programming, particularly outside of the Christmas season. We worked closely with the marketing team to target local schools, youth centres, after school clubs and parenting forums to reach out to those audiences. It was a streamlined campaign that focussed on the local schools and residents living in very close proximity to the theatre. School shows sold out, including two classes from Jubilee Primary (who hosted development workshops in November), and four classes from Nelson Primary School in Newham. The public performances reached an average capacity of 86%, which far exceeded the 50% we had originally aimed for in our financial target.

28% of children at Jubilee Primary School and 14% of children at Nelson Primary School are eligible for Free School Meals (a poverty measure – data source: Edubase). This means that on average, the proportion of children at each school performance who

were eligible for free school meals is likely to be about 19%, above the national average of 16% (DfE, "Schools, pupils and their characteristics" 2015). The marketing department have commented that the primary school audiences were made up of approximately 80% BAME children, which is reflective of the demographic data available for the school postcodes showing their local populations being made up of nearly 70% Indian, Pakistani and Bangladeshi residents (ONS).

The audience demographic for the Shoreditch Town Hall family performances was more difficult to quantify as 40% of bookings did not provide a postcode and the remaining 60% was made up of 69 different postcodes, 97% of which were London postcodes, with 3% from Essex. However, 23.5% of bookings made use of the Hackney residents' discount, so we know we were reaching the local audience as well as the broader London market.

Z-arts ran an extensive and thorough marketing campaign involving a large number of themed activities, fun days and events run in partnership with local organisations. The development workshops held there in October were presented in partnership with Manchester Science Festival who continued to support and promote the final performances. The education team also ran a number of activities designed by both them and our partners Maths on Toast at the Manchester University Science and Engineering Fair that reached nearly 900 participants over three days. Z-arts were incredibly happy with the production overall and were disappointed that their audience figures did not reflect the quality of the work.

Z-arts are committed as a venue to increasing their cultural reach and ensuring that their audience reflects the diverse makeup of their surrounding area; after English the second most spoken language in Manchester is Somali, closely followed by Arabic (Manchester City Council). The venue has been engaging with local community groups, leaders and artists to diversify their activities and reach beyond their current audiences.

The booking patterns in Manchester show incredibly varied postcodes. The highest percentage of bookings came from two postcode areas: 11.5% from SK4, where the vast majority of residents are white (88%) and working class/non-working (46.7%); a further 11% came from M16 where over 60% of residents come from a non-white ethnic background, with equal numbers (approx. 28%) classing themselves as both upper middle class and working/non-working class in the same postal area (Z-arts sales reports and ONS). Whilst we do not have exact demographic data for the performances, the postcode data implies that the show appealed to an ethnically and socially diverse audience.

We monitored gender at early workshops at Z-arts, and in a sample of 55 children, 67% were female. This is not an uncommon balance for theatre, but for children's events on topics like maths and robots the balance tends to be the other way. This finding supports indications from our earlier development phase that theatre may bring girls to maths in a way other activities do not. In general, across the audiences, there was a good mix of girls and boys at performances – perhaps the 'robots' message was coming across strongly, and supporting bringing more boys into theatres! We have no data on gender at the final shows, but will look into ways to collect this information for future performances.

We asked the same group of families about when they had last been to the theatre and when they had last done maths for fun. Both questions showed huge variety. Children

reported having been to the theatre most recently “last year” and “last Christmas” as well as “yesterday” and “last week”. They reported having done maths for fun “never”, “?” and “ha ha” as well as “last week” and “at school”. Fiona, 39, reported that she had last been to the theatre “yesterday” but had “never” done maths for fun before, while Kate, over 18, reported doing maths for fun “yesterday” with her last theatre trip “last year”. This indicates that mixing theatre, maths, neuroscience and robots can bring audiences to experiences they’ve never had in the context of experiences that are comfortable and familiar.



Dissemination

Learning from the project is being shared with all the partners and collaborators.

During development, Sarah presented at the weekly public seminar at the Centre for Educational Neuroscience (Birkbeck). An interview with Sarah was published in the Journal of the Association of Teachers of Mathematics, which reaches an audience of 4,000.

Professor Andy Tolmie wrote a blog for the project, which has been on the China Plate *We're Stuck* web page since 14 March 2016 and has so far received over 800 hits.

We have written a 3,000 word in-depth piece about the project, which will be published in *Teaching Times* in June reaching an audience of 3,000. We have also been invited to speak at the annual conference of the Association of Teachers of Mathematics, at Easter 2017. Maths on Toast will also share this evaluation report with relevant partners, and include elements in their Annual Report which is sent to their funders and key partners and made available on their website.

Budget

Total income for the project increased from £78,707 to £88,514 as we raised more money from ACE than originally anticipated and both commissions and box office income were also higher than predicted.

This increased income was largely used to help realise a very ambitious design.

Realising the ambitious design increased the fees paid to all but one of the creative team. Alongside the Wellcome funds (spent in full), additional money was allocated from elsewhere in the budget to cover these increased costs:

Wellcome Spend Items	Budget	Actual
Director	5800	6773
Actors	17280	17400
Production Manager	3500	4500
Stage Manager	4050	4500
Games Designer	1920	1920
Scenic / Costume Designer	2500	3250
Lighting Designer	1750	2000
Sound Designer	1500	2000
Educational Resource Design	1500	2500
Total	39800	44843

The ambitious design also required a different transportation solution, including hiring a haulage company - these costs were covered from contingency and savings made elsewhere in the budget.

An additional script development phase was added to the project in December 2015 (see above) costing a total of £2210 – these costs were covered from contingency and savings made elsewhere in the budget.

Changes to casting meant adjustments to the travel, accommodation and per diems budget - these costs were covered from contingency and savings made elsewhere in the budget.

As with any large project, minor adjustments were made to a number of budget lines, however the final project was delivered on budget.

Our partners Maths On Toast raised additional funds totalling £9,170 to develop an enhanced wrap-around package for *We're Stuck* (see above). As these funds were managed by MOT they are not included in the figure above and not reported on here.

A full project budget is available upon request.

Relationship building and future plans

Initial objective:

- To use the initial performances as a launch pad for extensive future touring.

A good number of artistic directors and programmers attended performances in Manchester and London including:

Kate Cross (The Egg, Bath); Kevin Jameison (Home, Manchester); Peter Glanville (Polka Theatre, London); Rebecca Lees (Stratford Circus, London); Michelle Walker (The Hatfair Festival); Louise Flooks (Unity Theatre Liverpool); Jodie Lees (Corby Cube); Kerry Andrews (Artsdepot, London); Dani Parr (Almeida Theatre, London).

They expressed an overwhelmingly positive response and were blown away by the fact that a show for young people could have such high production values (outside of the West End) and explore important themes in an exciting and truly interactive way. Following a number of conversations with venues, including Stratford Circus, Unity Theatre and the Core at Corby Cube, we are now looking to tour the show again in spring 2017 for approximately 7 weeks.

To enable the show to tour again we will be approaching Wellcome for ongoing support via the Extension Award and coupling that an application to Arts Council England.

Touring the production a second time will give us the chance to extend our reach to new and more diverse audiences, widening the shows impact and extending it's message and learning significantly. The interactive nature of the show transported children into a theatrical world that encouraged participation in problem solving and getting stuck. Based on parent, teacher and children's feedback we believe the show has a positive influence on those who come to see it and we're committed to ensuring as many young people as possible get to experience that. The second tour will place a particular focus on areas of low arts engagement and young people at risk of social exclusion - young people for whom we believe seeing the show could have the biggest impact.

A further touring period would also extend engagement with the wrap-around materials that were developed alongside the show. The 'Recruitment Pack' offers further detail on the real scientists and scientific research that inspired the show and we know from our audience feedback that *We're Stuck!* sparked a great interest in a numbers of the areas explored, including brain cells and robotics. Future touring will ensure more children are able to interact with these resources, deepening the engagement with the science behind the show.

"Really enjoyed the show and the whole experience. What a cast!... We would be very interested in staying in touch about *We're Stuck!*"

Louise Flooks – Unity Theatre, Liverpool

"I thought it was brilliant!! It worked so well especially engaging that age group which is challenging, but they were so into it and I feel like it was loads of fun for the adults too – I had a great time!... it'd be great to know what your plans for it are for the future." *Rebecca Lees – Stratford Circus*

Summary

Overall the development and creation of *We're Stuck!* has been an exceptionally rewarding process. The collaboration between our scientific advisors and the creative team was highly successful and resulted in a theatrical production that was truly inspired by the science and research behind the story. Young audiences were transported into Volcano Industries and opened their minds to the challenges and tasks they encountered. They were willing to make mistakes, get stuck and risk total failure in the name of saving Bernard and the world from killer robots.

By creating a promenade, interactive adventure, audiences were invited to immerse themselves in the story and given a highly meaningful experience in return. *We're Stuck!* was a visual feast with high production values, which were consistently noted by our peers, partners and audiences.

The production appealed to family and school audiences in equal measure, which was incredibly important to our aims. Feedback from both our scientific advisors and audiences suggests that the show not only engaged the children with exciting scientific and mathematical concepts but also encouraged struggle and bravery in making mistakes.

We're Stuck! has the power to make a big impact on children from highly diverse backgrounds, and ought to be experienced by as wide a range of audiences as possible.

It's been a wonderful journey and we are excited about the potential for future touring that this initial run has opened up.



Credits and Thanks

We're Stuck!

Written and directed by Sarah Punshon

Performed by Daniel Bye, Seiriol Davies, Claire Dunn and Avita Jay

Devised by the company with Hannah Boyde, Nadia Emam, Abbi Greenland, Robin Simpson and Balvinder Sopal.

Designed by Joanna Scotcher

Lighting design by Joshua Pharo

Sound design by Elena Peña

Games design by Sophie Sampson

Produced by China Plate

Production manager: Chris Whitfield

Stage manager: Jennifer Hunting

Scientific Advisors:

Professor Matt Nolan, Professor of Neural Circuits and Computation, University of Edinburgh

Professor Michael Thomas, Professor of Cognitive Neuroscience at Birkbeck, University of London / Director of the University of London Centre for Educational Neuroscience

Professor Andrew Tolmie, Chair of Psychology and Human Development, UCL Institute of Education, University College London

Dr Emily Farran, Professor of Cognitive Development, Department of Education

Dr Roi Cohen Kadosh, Professor of Cognitive Neuroscience, Department of Experimental Psychology, University of Oxford

Funded by:

The Wellcome Trust, Arts Council England, The Mercers' Company, Manchester Science Festival

Performed at:

Shoreditch Town Hall, London, 16 March – 1 April 2016 (6 schools shows, 12 family)

Burnley Arts Centre, Lancashire, 5-6 April 2016 (2 schools shows, 2 family)

The Boo, Waterfoot, Lancashire, 8-9 April 2016 (4 family shows)

Z-arts, Manchester, 12-16 April 2016 (10 family shows)

With thanks to Professor Slawomir J Nasuto, Dr Yoshikatsu Hayashi and their colleagues at the Brain Embodiment Lab, University of Reading; Purni Morell, Unicorn Theatre; Rachel Briscoe, Ovalhouse Theatre; The Royal Exchange, Manchester; Contact, Manchester; Lia Commissar and David Cahill-Roots, Wellcome Trust; Dr Ellie Dommett, King's College London; Professor Andrew Davison and Dr Maxime Petit, Imperial College London; Science Grrl; Dr Hannah Fry, Dr Codina Cotar and Dr Luciano Rila, UCL Department of Mathematics; Maths on Toast volunteers; Helen Arney; Dr Ginevra Castellano and Dr Nick Hawes, University of Birmingham; Anthony Cotton, Association of Teachers of Mathematics; David McClure, Velcrobelly; staff and pupils at Jubilee, Ivydale, St James's and William Patten Primary Schools, and Queen's Park Community School; all the mathematicians and scientists who answered our "stuck" survey; the Ernest Cook Trust, who supported our initial R&D.

One Tenth Human and The Dukes Lancaster present

THE ASTONISHING VACUUM CLEANER ADVENTURE

Evaluation Report



In 2018, with support from Arts Council England, we remounted and toured our successful interactive theatrical adventure for children aged 6-10 years old, originally commissioned by Lancaster Arts & Hear Me Roar 2017.

In a co-production between The Dukes Lancaster and One Tenth Human, touring with the support of the Big Imaginations consortium, the show visited 6 venues and gave a total of 21 paid performances (13 family, 8 school shows) to 941 audience members.

The Dukes received support from the Ernest Cook Trust and the Duchy of Lancaster Benevolent Trust to fund the development and delivery of school workshops before and after the show. Freelance artists (trained by Artistic Director Sarah Punshon) delivered 20 sessions in primary schools across Lancashire: 585 children in years 2 to 6 were encouraged to creatively and practically explore Numatic hoovers, hypothesising, experimenting and taking them apart with screwdrivers to see how they work. Two schools also received follow-up workshops with Dr Irene Wise from Lancaster University Engineering Department: 108 students in years 5 and 4 took part in half-day sessions exploring further engineering challenges inspired by the show.

The Show: Audience & Industry Response

The show was well-received, with great feedback from audiences and industry:

“Absolutely loved it”

“Not only did the children thoroughly enjoy it but I did too!!”

“Pitched just right so that everyone could join in! full of fun and wonder. Thank you!”

(audience comments from The Citadel, St Helens)

“I stewarded the show and absolutely loved it. The audience were really engaged and really energetic, the actors were brilliant and interacted really well with everyone in the audience, and the show itself was clever, empowering, and very funny! It was a perfect opportunity for young people to explore theatre and science, to be empowered by theatre, to get involved, and to be inspired by science.”
(Emily Armstrong, Z-arts Marketing and Audience Development Manager)

“I LOVED it. It was a gorgeous show, the kids really bought in to the adventure and were really ready to participate. Great at involving the adults as well. Funny and fast-paced, and actors did really well at keeping a fully interactive story on track, and responding to our very excited audience members!”
(Staff comment from The Boo)



We had estimated 800 audience members, based on achieving 50% capacity. In fact, family shows generally exceeded this target, with several selling out their limited capacity; on the other hand, we had to cancel more than half our schools shows in Lancaster due to difficulties persuading schools to risk their very tight budgets on an unknown title. In Manchester, Z-arts were able to secure a small grant which supported several Hulme

schools to attend: without that support, at least some of those shows would also have gone un-sold. In total we beat our original target, reaching 914 audience members.

I just wanted to say Vacuum Cleaner Adventure was bloody brilliant!
Everyone at the Citadel is on the same page that it is the best thing we have programmed here in quite some time.
My family and friends that I brought along raved about it.
All good wishes
Fay Lamb, Chief Executive, Citadel





Schools audiences meet the cast at Z-arts, Manchester



Learning Points & Challenges



Schools shows at Lancaster were pitched at £400 per show, which for two classes per show, including a free pre and post show workshop, seemed reasonable. However it was only when we dropped the price to £200 per show that we were able to sell any shows at all. On the other hand, ticket prices for family shows (pitched at £7.50 in Lancaster) were clearly priced well, as shows sold out. Conversations with Big Imaginations venues indicates that schools budget cuts are having significant impact on theatre bookings, even since touring *We're Stuck* in 2017: potentially worrying implications for future planning.

Schools workshops were originally envisaged as happening only in schools who had booked to see the show: when bookings were hard to confirm, we offered the workshops to schools in St Helens and Rossendale via our tour venues The Citadel and Horse & Bamboo. These proved popular, and taking place before the shows in those venues, we believe helped sell family tickets.

Z-arts had originally planned that AVCA would be part of their partnership with Tameside Council, with Tameside schools attending: however a Z-arts oversight at booking stage meant that the show was booked during the Tameside half-term. Instead, Z-arts secured a grant to engage Hulme schools, including adding one extra schools show. These schools brought large and energetic groups, and we discovered that there was a breaking point: the show with 67 pupils was extremely difficult for the cast to manage.



Our kinds of show are very challenging to design and budget: having had four previews when we originally made the show, we knew we needed to make some tweaks to the original design. These were very successful: making the route much clearer between the flap at the top of the machine and the chamber where “Hetty” was trapped, meaning that the first interactive challenge (“the holey tube”) was reliably successful.

However, we hadn’t budgeted enough for repairing and making these amends, after a year in storage. We benefited enormously from the expertise and technical support of Dukes staff: many days of in-kind support were given, and free kit loaned for the tour, including a laptop, sound-card, cables and lighting kit. Without this free support, we would probably not have come in on budget. In future we should always allow more for set repairs / refresh on remounts.

The Ernest Cook Trust didn’t grant the Dukes the full amount requested, specifically noting that they wished to fund only the workshops and evaluation, not the production and distribution of printed workbooks. The Duchy of Lancaster were also able to give less than the full amount originally requested. Plans were therefore adapted – see detailed budgets below.

The Ernest Cook Trust have made us aware that they have recently reviewed their grant-giving activity, and in future intend to re-focus on “learning from the land”. Given that their support has been instrumental in the successful development of both our family shows, and that surprisingly few other Trusts support maths or engineering related work with schools and families, this could be a real challenge in future.

The project has enabled a long term partnership with Dr Irene Wise from Lancaster University Engineering Department to be developed. Both the Dukes and One Tenth Human

hope to build on this foundation to create specific STEM related art projects, building on the interest generated from participating schools.

Some of the schools used the experience of seeing the production to support with their delivery of Artsmark & Arts Awards, providing pupils with a nationally recognised accredited arts qualification from Trinity College, London. Bowerham Primary school for example had 25 pupils achieve 'Explore' level of Arts Awards.

We achieved a lot on a very tight marketing budget, coming in under-budget as we were able to re-use the original creative design with very little change, and make use of Dukes in-house expertise rather than pay freelancers. We also benefited considerably from the Dukes in-house Learning team expertise and relationships with local schools, including bringing in a school for a free dress rehearsal, and spending considerable time liaising with venues and freelancers to set up, deliver, and evaluate workshops.

Schools Workshops



Workshops took place in seven different schools, in very different parts of Lancashire.

		% pupils eligible for free school meals	% pupils BAMER
St Peter's, New Church, Pendle	Years 2, 3, 4 and 5 (pre-show)	8%	5%
St Anne's, Rossendale	Years 2, 3, 4 and 5 (pre-show)	27%	16%
Sandylands, Lancaster	Year 4 (pre and post show)	24%	10%
Bowerham, Lancaster	Year 5 (pre and post show)	10%	24%
Rolls Crescent, Manchester	Years 4 and 5 (post show)	37%	71%
St Philips, Manchester	Years 5 and 6 (post show)	21%	78%
Webster Primary, Manchester	Years 4 and 5 (post show)	32%	96%

Workshops were delivered by freelance artists who had received training from OTH Artistic Director, Sarah Punshon. The sessions were based on work done during development of the show – see Appendix 1 for session outlines.

Pupils were encouraged to ask questions, to experiment, and investigate, and to work collaboratively. A selection of Henry and Hetty Hoovers, plus the necessary screwdrivers to take them apart, were brought into school, and enthusiastically taken apart and investigated.



"The workshops were really interesting the schools and children loved them and they combined science and creativity really well. They fascinated the children and really sparked their imaginations."

(Staff comment, The Boo)

“Thoroughly enjoyed by staff and children, fantastic event for all who participated. Learning was very clear and done in a fun and engaging way.”

(Teacher comment, St Anne’s, Edgeside)

The key impacts for pupils listed on teacher feedback forms were:

- Developed scientific enquiry skills.
- Developed independent learning in science.
- Engaged children in science.
- Linked to curriculum objectives.

Two schools, in Lancaster, also received post-show workshops with Dr Irene Wise of Lancaster University Engineering Department. These sessions aimed to build on the excitement of the show to explore specific engineering challenges in a little more depth.

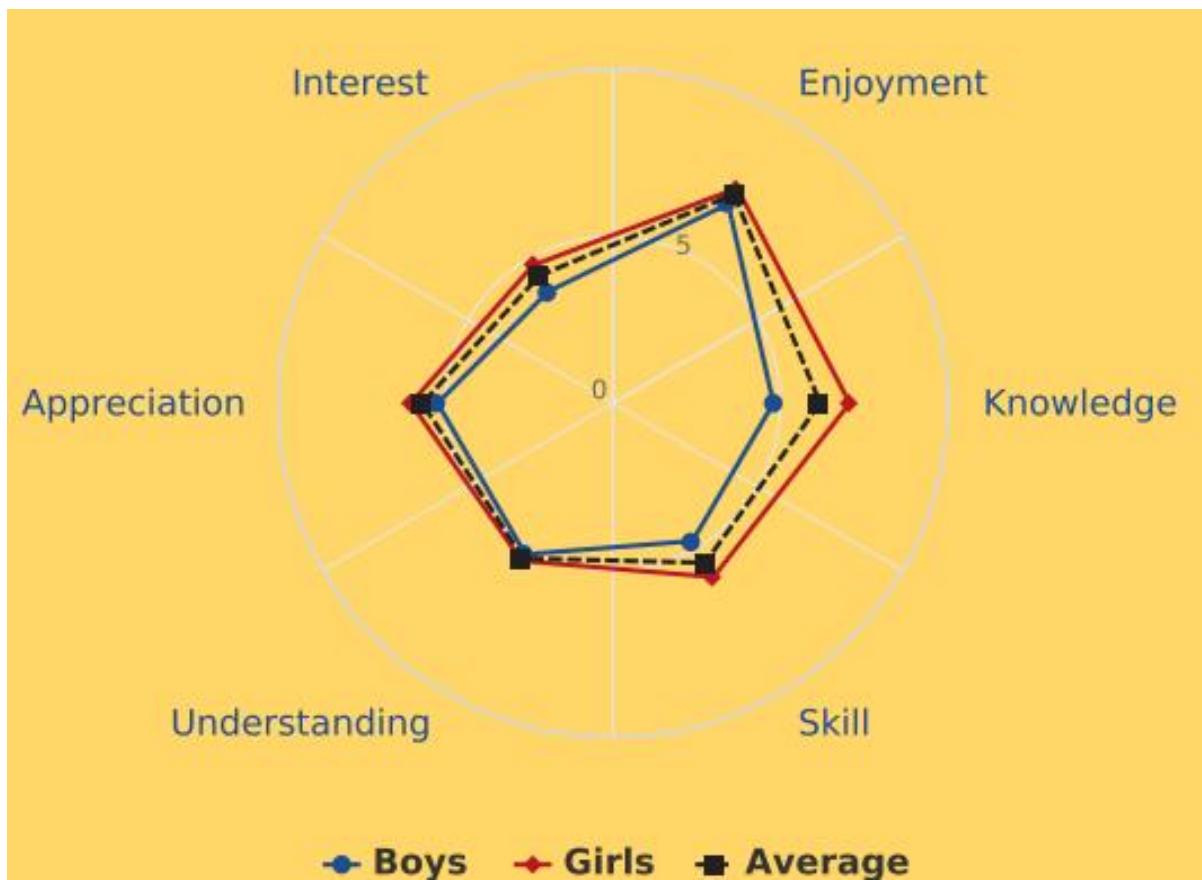
At the end of the show, the characters and audience discuss building a machine to travel anywhere in the universe – usually the children in the audience decided they wanted to go by rocket somewhere. Dr Wise’s sessions therefore asked children to solve the challenge of how to get material safely onto the surface of Mars: children used straws and plasticine, working in teams to create their own solutions to specific engineering challenges.

Dr Wise used the following questions to interrogate the success of the workshops.

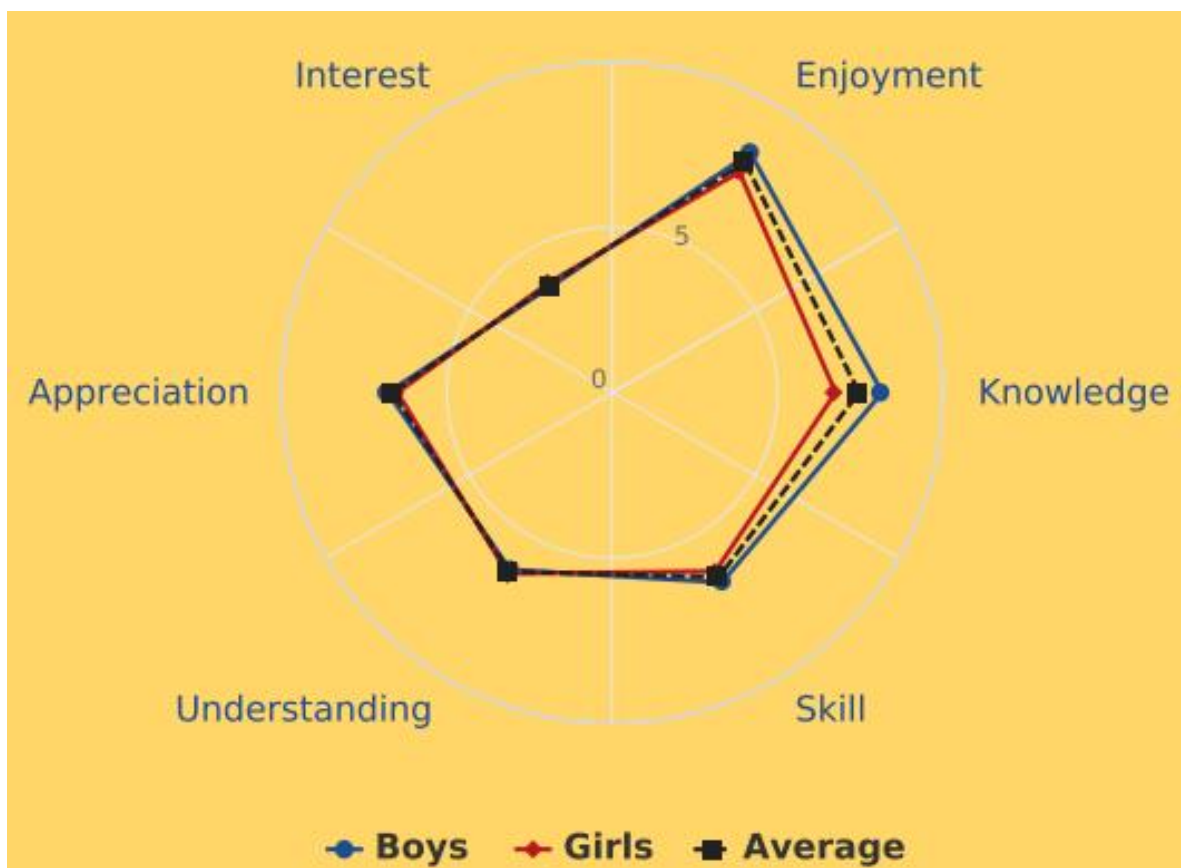
Category	Question asked
Enjoyment	How much fun did you have?
Knowledge	Did you learn anything new?
Skill	Did you discover and apply your new skills?
Understanding	How much did you understand about what you did today?
Appreciation	How much do you know about what engineers do now?
Interest	Would you like to be an engineer?

Responses indicated high levels of enjoyment and new knowledge gained from the sessions, including an increased appreciation of what it is engineers do.

Sandylands Year 4:



Bowerham, Year 5:



Interestingly, in both schools, by the end of the session, slightly more girls than boys indicated that they might like to be an engineer (ie answered “Lots” or “A bit” to the final question):

16/30 girls and only 9/21 boys at Sandylands; 14/25 girls but only 13/25 boys at Bowerham.

These are statistically insignificant differences, and may simply indicate that girls are more inclined to want to please the workshop leader. However, the show deliberately featured a likeable mixed-race female character as its lead: it’s a hopeful sign that more than half the girls in each school expressed interest in a future engineering career.



Budget Summary

Income	Original Budget	Actual
Box office	£6,060	£5,725
Arts Council England project grant	£14,908	£14,908
Ernest Cook Trust grant	£7,246	£4,500
Duchy of Lancaster grant	£957	£500
One Tenth Human funds	£7,000	£6,500
Support in kind (Lancaster University, Z-arts schools liaison, Dukes staff time, equipment and space hire)	£10,182	£10,182
TOTAL	£47,702	£42,315
Expenditure	Original Budget	Actual Spend
Creative team fees & expenses	£7,100	£7,398
Actors wages & expenses	£7,308	£8,112
Stage Management & Technical Team wages & expenses	£8,210	£7,232
Physical Production	£1,500	£2,650
Marketing	£1,350	£671
Education Workshops	£8,846	£6,070
Support in Kind	£10,182	£10,182
Contingency	£2,000	0
TOTAL	£47,702	£42,315

Schools Workshops Detail

Expenditure	Original Budget	Actual Spend
Dukes Learning Outreach Manager	£1,650	£1,650
Creative Lounge Consultation & room hire	£300	0
Travel	£300	£32
Printing	£36	£18
Hooovers, screwdrivers & other materials	£960	£645
Graphic Design, print & distribution	£1,900	0
Freelance session leaders	£1,500	£1,900
Photography	£350	0
Dukes Artistic Director	£1,600	£1,825
TOTAL	£8,846	£6,070

Appendix One: Pre Show Workshop Session Plan

1 lead facilitator

two options:

45-60 minute session

90 minute session involving more drama exercises NB extra material for this session is in ***bold italics*** within the main body of the shorter session

Equipment we'll bring with us

- 6 x Henry Hoovers, clean and empty, PAT-tested
- 6 bags of hoover attachments
- 6 small tupperware containers
- 4 Torx screwdrivers per table/hover
- two extension cables, PAT-tested
- Questions to Investigate sheets (12 per class)
- 4 laminated cards with "Additional Prompts" for adults.
- Post-it notes
- Flipchart paper & blu-tack (if required)
- A box of straws

What we need in the space (classroom or hall)

- 6 tables
- Pencils / pens
- Some scrap paper
- Electrical sockets
- At least two other adults ready to assist (eg teacher and teacher's assistant)

Before session begins:

- Check names of teacher & assistant(s) and that they understand their part in the workshop.
- Check where the most convenient power sockets are for tables, plus one for speaking to the whole class, and whether extension cables are necessary.
- Set up each table with kit.

Session outline

Lead facilitator to whole class: [5 mins *10 mins in longer session*]

- [Turns on hoover and demonstrates.] What's this?
- Yes! Excellent. You're clearly very observant investigators.
- ***Physical warm-up game: creating images/physical movement of hoovers – show me how a hoover works***
- Now, we've had some suspicious reports. We've had reports of *Talking Hoovers*. Have any of you ever heard a hoover talk? Me neither. But I don't think we should relax. We need to investigate this.
- What is investigating?
- What do you use to investigate?
- Interesting. My name is [xxxxx]. I'm from The Dukes / Z-arts. [if relevant: Did you know that [next week] you're going to take part in an interactive adventure at [The Dukes / Z-arts]? It's called *The Astonishing Vacuum Cleaner Adventure*.]
- I'm not quite sure what goes on in this so-called "show" but I'm suspicious. Look what these things are capable of! [Suck up piece of paper with hoover.] Where's it gone? [*inside!*]
- In your tables, you're going to take one of these beauties apart and find out what's going on. You're going to have about 30 minutes to do some experimenting and find out as much as you can.
- On your tables are some Questions to Investigate and a hoover. Off you go, investigators!
- [With help from teacher and assistants, assign a hoover to each table, but don't plug it in yet]

In small groups [15 minutes]:

Questions to Investigate [sheet for kids]

Adults, use the "Additional Prompts" questions as necessary.

Judge the moment to encourage / allow each table to plug in and turn on their hoover.

Additional Prompts – by no means necessary to ask/investigate all of them!

[if stuck on “invisible things”] What goes into the hoover down this wire?

What would happen if we were to block where air comes in? Or where it comes out?

What’s underneath the top black bit of the hoover? Take it off and see.

Take the hoover tube off the hoover: feel it. Why is it bendy?

Can you hear if you whisper to each other down the tube.

What could you pick up with the hoover?

How heavy an item can we pick up with the hoover? How do we “drop” the item?

What happens if you change the tool on the end? Is the suction stronger or weaker? How could you test that scientifically?

[if one tool is much weaker than another] why do you think they designed them like that?

Can you pick up a piece of paper using a straw? What if you use several straws together?

What happens if you open and close the hole in the connector? What do you think would happen if we cut lots of holes in the tube?

What kinds of things could you use the hoover for?

What if it was a giant hoover?

What could you use the outlet for?

What else would it be cool for the hoover to be able to do?

Who do you think designed and made the hoover? What kind of jobs are involved?

Bring whole group back together. Share discoveries and questions. (5 minutes)

- What invisible things go into the hoover?
- Where do things go in?
- What comes out of the hoover? Where?
- Which tools have the strongest suction?
- Did anyone hear any voices from the hoover?

Further investigation of the electrical parts of the Hoover, bringing up volunteers to use screwdrivers / feel elements, describe what they can feel, as necessary. (15-20 minutes)

- Open up the black part of the Hoover.
- Assign a “screw monitor” who must collect any loose screws.
- Loosen the first four screws, in a square (they don’t have to come all the way out)
- Remove top lid; discover copper connections, grease. What is this for, do you think?
- [copper conducts electricity; grease allows smooth movement of the parts]
- Look for three screws in a triangle. WARNING: when we remove these screws and reveal the engine housing, there is a slight risk the metal engine casing will be warm or even hot. Warn children not to touch it.
- Remove the three screws: reveal fan and engine housing.
- Remove rubber protective ring and check heat of engine housing.
- Feel inside the fan, make it move. What does it feel like? The electricity drives this fan, which moves air out, creating a vacuum into which air is sucked...
- Put the Hoover back together:
 - replace engine carefully (fits into two grooves)
 - replace rubber ring
 - replace black plastic without cabling in it (line up triangle and square of screws)
 - screw in triangle of screws
 - replace black plastic lid containing electrical cable
 - tighten square of screws
 - replace lid
 - check the Hoover works again!

Plenary [5-15 minutes]

So, now you know a lot more about Hoovers.

Let’s create Hoovers physically: show us what you’ve learned about how it works.

Did anyone hear any talking from inside the Hoover? What might it be, talking from inside the Hoover? Write down or draw one of your ideas on a post-it note.

Gather ideas on a big sheet.

Wow. You could write stories about one of these things happening.

You’ve been amazing investigators today. I want to keep track of the investigating skills you’ve used. I’m going to write them up here. Can you tell me some of the things you did in this session to find things out?

Eg Asking questions, looking, using tools, figuring things out, applying knowledge, using your imagination, listening, testing, experimenting

Amazing. Well done!