

Student Pre-survey: What is the impact of science shows?¹

ID Code (The initials of your name, and the day of the month you were born on – ie. SA04): _____

Age: _____ Year Level: _____ I am a: MALE/ FEMALE/Prefer not to say

Do you get to choose your courses next year? YES/NO/I DON'T KNOW

If yes, which STEM (science, technology, engineering, maths) subjects do you plan to take?

Please TICK the box that best describes what you think about science:

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
I'm really interested in science					
I'd be willing to learn more about science in my spare time					
I would like to study science at university					
I think science is boring					
I want to learn more about science					
I think scientists have a great job					
Science can be a lot of fun					
I would like to find out more about science careers					
I find science really inspiring					
I'm motivated to work hard in my science subjects					
I think science would be an exciting career					
I will choose science when I get to make subject choices					
Science is not something I'd consider doing as a job					
I get good marks in science at school					
I am confident when it comes to learning science					

Thank you for your contribution

¹ Student surveys adapted from: Walker, G. (2012). *Motivational features of science shows*. (Doctor of Philosophy), Australian National University, Canberra.

Student Post-survey: What is the impact of science shows?²

ID Code (The initials of your name, and the day of the month you were born on – ie. SA04): _____

Overall, what score would give this show out of 10? Please circle: 1 2 3 4 5 6 7 8 9 10

Please TICK the box that describes what you think about the show:

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
The show was funny					
I could see how the show related to things in the outside world					
I had fun for the entire show					
The show was relevant to my life					
The show was interesting					
The show had ideas that I can use myself					
I enjoyed the show					
The show made me curious					
The information in the show was important to me					
I was surprised by some of the experiments					
Parts of the show reminded me of things I've seen or done					
There were things in the show I have a personal interest in					
The show helped me understand things in everyday life					

Which part/s of the show made you feel most interested and why?

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Which part/s of the show did you enjoy the most and why?

Which part/s of the show did you enjoy the least and why?

Did the show change what you think about science? If so, how?

Please TICK which answer describes how you feel now you've seen the show:

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
I'm really interested in science					
I'd be willing to learn more about science in my spare time					
I would like to study science at university					
I think science is boring					
I want to learn more about science					
I think scientists have a great job					
Science can be a lot of fun					
I would like to find out more about science careers					
I find science really inspiring					
I'm motivated to work hard in my science subjects					
I think science would be an exciting career					
I will choose science when I get to make subject choices					
Science is not something I'd consider doing as a job					
I get good marks in science at school					
I am confident when it comes to learning science					

Thank you for your contribution

Reliability of Likert scales – Cronbach’s alpha

Scale	Items	
Attitudes	<ul style="list-style-type: none"> • I’m really interested in science • I think science is boring • I find science really inspiring • Science can be a lot of fun 	
Career/study intentions	<ul style="list-style-type: none"> • I’d be willing to learn more about science in my spare time • I would like to study science at university • I think scientists have a great job • I want to learn more about science • I would like to find out more about science careers • I’m motivated to work hard in my science subjects • I think science would be an exciting career • I will choose science when I get to make subject choices • Science is not something I’d consider doing as a job 	
Confidence	<ul style="list-style-type: none"> • I get good marks in science at school • I am confident when it comes to learning science 	
Show enjoyment	<ul style="list-style-type: none"> • The show was funny • I had fun for the entire show • The show was interesting • I enjoyed the show • There were things in the show I have a personal interest in 	
Show relevance	<ul style="list-style-type: none"> • I could see how the show related to things in the outside world • The show was relevant to my life • The show had ideas that I can use myself • The information in the show was important to me • Parts of the show reminded me of things I’ve seen or done • The show helped me understand things in everyday life 	
Show curiosity	<ul style="list-style-type: none"> • The show made me curious • I was surprised by some of the experiments 	
	Pre-show scale reliability	Post-show scale reliability
Attitudes	0.803	0.842
Career/study intentions	0.879	0.895
Confidence	0.764	0.806
Show enjoyment	N/A	0.840
Show relevance	N/A	0.848
Show curiosity	N/A	0.459

Scitech Presenters Interviewed – Work experience and expertise

Presenter ID	Department	Experience (years)	Experience developing scripts	Gender
1T	Theatre	6	Yes	M
2S	Statewide	1.3	No	M
3S	Statewide	3	Yes	F
4S	Statewide	10	Yes	F
5T	Theatre	1.5	No	M
6T	Theatre	8	Yes	M
7T	Theatre	2	No	F
8T	Theatre	6	Yes	F
9T	Theatre	3	Yes	F
10S	Statewide	1	No	F
11S	Statewide	2.5	No	F

Interview Protocol³

Do you think science shows are good for communicating science? If yes/no, why?

What do you hope your audience learns or takes away from one of your science shows?

Do you think science shows should be a one-way method of communication or a two-way dialogue? Does it always work out this way in practice?

Do you think different demonstrations fit into certain categories or types? For instance, ones that focus on teaching rather than entertaining the audience, or something like that? If so, what categories would you use for your demonstrations?

Do you think different categories/demonstrations are suitable for all audiences?

How much experience do you have presenting to high school students? (ie. only on a few occasions etc)

Is there anything you typically change or adapt in your shows when performing for a high school audience?

Any further comments?

Focus Group Plans³

What did you enjoy most about [the show]?

Questionnaires showed [demonstrations as noted from survey analysis] were rated as ‘most interesting’. Why do you think people might find these demonstrations interesting?

Was there anything you didn’t enjoy about [the show]?

There was an experiment that loads of people thought was the least interesting was [demonstrations as noted from survey analysis]. Why do you think this was the case?

Did you discuss [the show] with anyone after you left Scitech, or investigate/Google the topics covered?

If you were going to design a science demonstration, what would you like to include?

Is anyone planning to study science in Year 11 and 12? Which subjects?

Why are you choosing those subjects? (ie. For fun? For uni? Because parents say you have to?)

³ Interview and focus group questions adapted from: Sadler, W. J. (2004). *Evaluating the short and long-term impact of an interactive science show*. (Masters of Science), The Open University, UK.

Presenter Interviews Codebook

Code	Description	Example
Human presence	Discussing having a live person giving the presentation, and the different aspects of how human presence can be useful	got a live- a person who's actually there, ah, delivering content
Audience interaction	Discussing interaction with the audience	people can ask questions
A - Questioning and conversation	People asking questions and talking with the presenter	that two-way dialogue is necessary for that
B - Volunteers	People coming up on stage and doing stuff	having volunteers where you wouldn't normally have a volunteer
C - Non-verbal	Non-verbal cues from the audience	two-way communication doesn't necessarily mean that it's verbal, you can get the non-verbal cues, and you get that regardless if a person is sitting there
D - Other	Discussing interaction but it doesn't fit into A, B or C	I think the more interactive the better.
Gauging your audience	Taking information from your audience (through questions/reading their reactions) and adapting the show to suit	you might be going with adults and you start a bit higher but you realise that they might not know what a pie chart is
Audience needs	Acknowledging different audiences come with different needs and challenges, including different prior knowledge	say if it is a ball rolling down a ramp to demonstrate gravity, for 6 or 7 year olds, that would be really difficult
A – PEPK (Prior experience, prior knowledge)	Different ages have different knowledge levels	it still has to be age or level appropriate, so as not to be over anyone's head, 'cause the last thing you want to do is to alienate your audience.
B - Gauging	Gauging how your audience will respond to a certain style/delivery	you can play a lot on emotion to convey story in science shows to high-schoolers more than you can to primary
D - Listening	Listening to the wants and desires and requests of your audience/s, considering what THEY want to get out of it	I think they wanna be, they deserve to be, heard and it should be a conversation
E - Context	Understanding audiences of different sizes/in different locations/contexts have different needs	you could have the same group of kids, ah, in a classroom setting and then see the same audience, or the majority of the same audience, in a general public setting and they'd be a difference audience, um, because they're not in their school setting
Audience comfort	Putting audience at ease	I start off chatting to them, um, and putting <i>them</i> at ease

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Audience behaviour	Audiences will react and behave in particular ways, depending on a variety of factors.	because people are going to, um, maybe be a bit silly or they are going to misunderstand something
Audience respect	Respecting intelligence and age of your audience (for high school shows)	kind of need to treat them like they're the young adults that they are
Relevance	Making science relevant to the audience/making science feel relevant to your audience	science is relevant to them, ah, so they understand that, um, ah, it-it's not, um, just theoretical abstract stuff that doesn't affect them
Demonstration types	Acknowledging that demonstrations come in many shapes and forms and acknowledging the different uses of different demonstrations	A demonstration might be really flashy but it might not have much to do with what you're teaching, but it might be just useful for the presentation to-to start off the presentation or add on a high-a peak, a highpoint or maybe have-have a big finish
Making science fun!	Putting in the effort to consciously try and use dems to make science fun/engaging/exciting!	'I'm going to present these scientific concepts as best I can in an interesting way as well.
Encouraging science behaviour	Consciously encouraging curious/inquiry skills/investigation/go home and do some science yourself in the audience/helping the audience realise that they do science naturally	I suppose that it's ok to ask questions and that's the whole thing that that's how we get these answers
A - Inspiring/curiosity	Discussing inspiration/curiosity during show/about science/encouraging questions	I think ideally every show is engaging and inspiring
B - Call to action (DIY!)	Go home and do science yourself!/encouraging people to go and do science	And then, a call to action, like, "I'm gonna participate in, or I'm gonna see myself as being more capable, like, I could do science."
C - Interest	Discussing being interested in science/wanting to do more science	even if it's 'oh hey, maybe I do like science.'
D - Everywhere	Recognising that science is everywhere and recognising science that we do all the time without thinking	where I think the shows are important because they show it's easy to do science and they do it without thinking
Theatrics	Using different aspects of performance techniques/highs and lows during a show	useful for the presentation to-to start off the presentation or add on a high-a peak, a highpoint or maybe have-have a big finish
Barriers to science	Potential barriers to understanding/enjoying/engaging in science	kids don't think they're "science kids" or they don't think that they can do science,

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Anecdote	Remembering a specific experience, or discussing a specific part of a show/demonstration	I met this girl who did chemical engineering and she talked to me, she's in her Masters, she wanted to work in make-up
Infotainment	Making a demonstration/segment educational as well as interesting	I'm doing a dem where it's kind of an entertaining dem more so than an educational – I-I don't feel like it's mutually exclusive, I feel like it's probably a sliding scale.
Science confidence	Audiences becoming confident to understand, discuss and do science	"I'm gonna participate in, or I'm gonna see myself as being more capable, like, <i>I could do science.</i> "
Specific STEM	Talking about specific type of science/technology	like this aspect of physics or that aspect of chemistry
Out of school	Presenting science out of a classroom/formal learning setting	take them out of the books and into real presentations so outside of the classroom
Passion	Presenters share their own passion and enthusiasm for science with their audiences	I said about performing to them is being genuine, not only in your mannerisms but in your passion for it, because I think that's something that really reaches kids
Learning	Learning new things/facts/new behaviours by watching a science show	one of the things that they should hopefully take away is just they've learned something new.
IDK	I don't know - demonstrators hadn't considered this idea before	Yeah. I dunno. Haven't really thought about it
Reflection	Thinking about qualities of a good presenter/reflecting on own learning curve as presenter	I think if you're a skilled performer, you can make any type of demonstration work for any audience.
Other media	Talking about other ways/media where people learn science	we have to admit there's enough quality stuff on Youtube and Youtube has a completely different angle that we can't compete with.
Novelty	The novelty factor of science shows being so unique	they're good for that because it's things that people <i>don't</i> normally get to see.

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Student Focus Groups Codebook

Category	Code	Explanation	Example
Reasons for enjoying show	Learn	Discussing learning some new	I've always thought that it was, um, <i>certain</i> materials always shifted at a <i>certain</i> amount, ah, from ultraviolet to violet. I didn't realise that it could also go to red or orange on the other end of the spectrum.
	Novelty	Discussing how a demonstration is enjoyable because of it's unusual nature or novelty value	probably because unnatural fire is pretty much something that people enjoy.
	Excitement	Participant enjoyed a demonstration because it was exciting/big/visually spectacular	It was loud and big.
	Highlight	Participant enjoyed a demonstration because it was the most exciting one, compared to the others in the show	It was the loudest.
	Humour	Participant enjoyed demonstration/show because it was funny	Kind of funny
	Good/Bad jokes	Participants describing cringey jokes used in the show, and how it added to the experience in a positive way	It was little bit cringey but they were really good, [distorted] come together
	Cognitive	Participants describing part of the show they found particularly interesting because it made them think/it worked not how they expected	I liked the bit where it was like, they talked about, um, they didn't really talk about it, but I thought it was cool how, like, pressure made the ball, like, hit the target, like, they didn't like, set up any electrical [sic] things, it was just like, a fun thing, I dunno.
	Visual	Participants describing part of the show they enjoyed because of it's visual spectacular nature	The dry ice and the liquid, yeah, to make it explode, it looked really cool.

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	Well performed	Participants describing the skills of the demonstrator/overall polished performance	, I think it was also like a really cool how the slideshows and how he-they were perfectly on time, and especially when the explosion happened, as soon as it exploded, the, like, the music was perfect,
Reasons for not enjoying show	Normal	Discussing how a demonstration uses everyday materials in a way that isn't very exciting	The glowstick, because glowsticks are pretty much commonplace
	Weird	Participants discussing parts of the show they thought were strange or just a bit odd	Oh, and that space kitten at the end.
	Irrelevant	Participants confusing the science theatre with the planetarium/other component of their visit	You know in the planetarium?
	Maths	Participant discussing maths	The maths stuff!
	No jellybeans	Participants complaining about how they/other students didn't enjoy the jellybean section of the show because they couldn't eat them	He wouldn't let us eat them.
	Failed dem	Participant describing demonstration that didn't work	One of them didn't even work
	Talking vs dems	Participants describing how there was more talking vs demonstrations during the show or too much time spent talking about a demonstration vs actually performing one	Too much talking
After the show	No continuation	Participant didn't discuss the show with anyone/research anything they learned during the show	No, I did not-I did not leave Scitech with anyone, so I didn't get an opportunity for that.

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	Continuation	Participant did discuss the show after they left	
Why study science	Always enjoyed	Participant choosing STEM subject because they've always enjoyed it	Ah, 'cause I've just always loved maths.
	Uni	Participant choosing STEM subject because they plan to study it at uni/prerequisite for uni	Ah yes, definitely, in university.
	Career	Participant choosing STEM subject to help with career goals	And then I intend to become a maths professor so ... :)
	STEM Skills	Participants recognising the usefulness of STEM skills and the opportunities it may create in the future	it like opens up a lot more career options. It's like you can do more stuff.
	Interesting	Planning to study science in year 11/12 because they currently find it interesting/enjoyable	Yeah, it's fun and interesting.
	Parents	Pressure/encouragement from parents to study science in year 11/12	Yeah, just so my parents don't go beserk
	Suggestions for future demonstrations	From show	Participants describe a demonstration they would design based on demonstrations in the show
Similar to show		Participants describe a demonstration they would design similar to demonstrations using in the show	C4.

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	Improvement suggestions	Participants suggest ways they would have improved the show, or ways the show could have been better	Yeah, he should have done that. Put the jellybeans in the can and then launched it all.
	From elsewhere	Participants describe demonstration inspired from outside the show	Um, probably go really fast on the ramp and watch it, like, fly up and then fall into, like, a big hole or something
	Relevance	Participants describing a demonstration that they can more easily relate to	Something more, like, mainstream ... Because when are you gonna have, like, a helium balloon and set it on fire?
	Up the ante	Participants describing a demonstration they've seen previously, but want to make EVEN MORE exciting	You know when teachers do it, it comes out the top a little bit. I wanna see like one that goes 'BOOM!'
Audience	Audience - A (Disruptive)	Participants discussing members of the audience interrupting the show	It was coughing ... I think there was a random guy in the audience
	Audience - B (Understanding needs)	Participants recognising the context of the show (and the audience) and understanding why the presenter may have chosen certain strategies OR why audience members behaved a certain way	To be fair there were lots of little kids in the audience, so I can understand why you would make jokes about farts cause little kids find them really funny.
Other	Curiosity	Participants describing science philosophically/human curiosity	I think coz discovering more about our planet or our the universe and stuff. I mean for instance [mumbles] associating with something more. I mean since, um, first age of every human being has been to learn discovery like, that Eureka moment, like they even created a word called Eureka for that moment.
	IDK	Participant unsure/hesitating to answer	Um, the laser, I could have-I have no explanation for that

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Demonstration types (for future suggestions)	UV light	Participant describing demonstration about UV light	Um ... oh, probably include more on the ultraviolet light stuff and more about, um, like the actual, more about, um, the, ah, technical stuff
	More detail	Participant describing demonstration similar to one from show, where the science would be explained in greater detail	and more about, um, like the actual, more about, um, the, ah, technical stuff
	Dramatic	Participant describing a dramatic demonstration	I mean like, maybe like, you know, the coke in the bottle and mentos, that's a good one
	Dramatic - Explosion	Participant describing a dramatic demonstration, with specific mention of explosion or a type of explosion	Explosions. C4. If I were to make one, I'd make more explosions.
	Dramatic - Fire	Participant describing a dramatic demonstration involving fire	Chocolate, fire.
	Candy	Participant describing a demonstration involving lollies or chocolate	Chocolate, fire.
	Sensory	Participant describing a demonstration that highly stimulates one of their senses (ie. loud sounds, impressive visuals, can feel something from the demonstration)	Something big but like, as, I dunno, something big but then, like, you can actually feel it coming.
	Liquid nitrogen	Participant describing a demonstration involving liquid nitrogen	I would include dry ice or liquid nitrogen, coz I thought that was really cool.
	Reward	Participant describing a demonstration that involved some kind of audience reward	Prizes

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	Quiz/Knowledge	Participant describing a demonstration/show that then had a test of knowledge at the end	G2: A quiz at the end. SA: A quiz at the end? G1: [mumbles] paying attention. SA: So you like to have your knowledge test?
	Relevant	Participants describing a demonstration that they could replicate or something they're more likely to see in everyday life	Something we can relate to, like real-life
	Old-fashioned	Participant describing a demonstration of something old-fashioned, that you wouldn't normally see in modern science	Like, stuff that this generation didn't know ... so, like, really old stuff, you know, like, I dunno how safe would be but [laughs] I dunno! It would be cool!-

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