Making Science Outreach More Accessible

A guide for science communication

In partnership with:

Medtronic FOUNDATION

MIDLANDS SCIENCE Stay curious

Who are Midlands Science?

Established in 2001, Midlands Science is a not-for-profit organisation which develops and delivers innovative STEM (science, technology, engineering and maths) outreach programmes and events in the Midlands counties of Laois, Offaly, Longford and Westmeath.

We provide opportunities for people of all ages, backgrounds and abilities to explore and discuss issues of scientific interest, recognising that science is a unique and valuable part of our culture and society.

Who is this resource for?

This resource is aimed primarily at those who deliver STEM outreach activities to all sectors of the community. This could be informal activities in schools, youth clubs and public events such as those that take place during national Science Week.

This resource consists of a series of contributions from design and communications experts who share their wisdom and experience to help you present your information in a way that engages and connects with all learner profiles across a variety of media.

About The Medtronic Foundation

The Medtronic Foundation partners to improve lives for underserved and underrepresented populations worldwide, and support communities where Medtronic employees live and give.

We partner with leading equity-focused STEM organisations to address the root cause of persistent inequities by creating opportunity for economic advancement and improving lives through STEM education. We bring Medtronic employee volunteers, nonprofits, and communities together to remove barriers to achieving health, wellbeing and prosperity.

Everyone is welcome at the STEM party

How inviting will your party be?

By Dr Claire O'Connell

Imagine you are at a party. You had to knock on the door for ages to be let in. Then the food was terrible, and the other guests didn't dress or sound like you.

To make things worse, they were talking about things you didn't understand - although they assumed that you did. Most people would want to get out of there as quickly as possible.

Then you go to another party next door. The door is open, people welcome you in, they have put a lot of thought into the music, the food, the decor. Conversations are open, everyone wants to learn from each other, everyone is included. You have a brilliant time and you can't wait to tell your friends about it.

Planning your STEM (science, technology, engineering and maths) outreach activity is a little like planning a party. Every activity, such as a talk, an exhibition, a competition, an article or a workshop, offers people a doorway. We want everyone to feel they can enter through that doorway and join in.

We want everyone to feel intrigued or curious about a subject and to feel comfortable bringing their own ideas to it. This makes the party (or in this case the STEM and its impact) even better.

How inviting will your party be? This short guide shows you some ways to make your STEM activities more open, more inclusive, more successful. In short, it will help you to remove barriers and engage as wide an audience as possible.

Our contributors

Levina Reeves explains the concept of Universal Design for Learning, which uses the science of learning to help more people understand and make sense of what you present.

Maébh Coleman and **Jennifer Lombard** take us through how accessible graphics, fonts, and layout can help broader audiences to connect with your work.

Dr Spela Godec introduces the Equity Compass, a tool to help us navigate towards greater inclusivity.

Claire O'Riordan gives us a masterclass in plain language and the importance of clear writing to get the message across.

Dr Craig Slattery tells us about the power of storytelling in science communication.

Our thanks to all the contributors for sharing their insights and practical tips. I have learned a huge amount from them. I am sure you will too.

– Dr Claire O'Connell

Universal Design for Learning

Create your science communication for everyone

By Levina Reeves

People learn in different ways. By designing your science communication and outreach using Universal Design for Learning, everyone will get more from what you do… including you.

Do you like learning something new by reading about it? Or maybe you prefer to understand new ideas through pictures. Or maybe you learn by making things. Perhaps your brain happily soaks up information late at night. Or maybe you are the early bird that likes to concentrate on new things the moment you wake up.

We all learn in our own ways. So when it comes to science communication and outreach, it's important to design and present it with those various ways in mind.

Universal Design for Learning: What it is and how it can help your communication

Universal Design for Learning, or UDL, is a framework. It's a set of suggestions that help you to design with a variety of learners in mind.

UDL was itself designed by researchers at an organisation called CAST (Centre for Applied Special Technology) in the United States, because they wanted to give more people the opportunity to learn in positive and effective ways.

The UDL framework is a list of suggestions you can use when you are designing a lesson or trying to communicate something to students or an audience. It is based on research into the different ways that our brains learn, and its creators narrowed the UDL suggestions down to three main areas.

The three main areas are as follows:

- The first area is about giving people different ways to engage with information. This means thinking about where the learner will be when they are learning. Can they be flexible and learn at different times, or in different places? Can you break it into smaller chunks? What will make it interesting for them?

- The second area is about how you represent the science. Can learners access the information by reading it? Listening to it? Seeing images? Can you provide simple explanations for any words or ideas they might not immediately understand? This helps people to build their knowledge.

- And finally, can people take an active part and put forward their own ideas? Maybe there are objects or materials they can touch. Perhaps they can draw, write or speak their ideas about it. Can they show you what they have learned from it? This all helps people to understand and remember.

Universal Design for Learning: What it isn't

There are some myths and misunderstandings about UDL and it's worth taking a moment to consider them.

One myth is that UDL is something for specific learning situations. In fact, UDL is for every kind of learning; it is not just for special education or teaching students who are learning separately to others – it adds value to any learning environment.

Another myth is that UDL is just fun and games. Fun can be part of it, and games too if appropriate. But, at its core, UDL is simply good practice. It is something you do on purpose in design to help more learners get more out of what you are offering.

Putting Universal Design for Learning to work

If you use the UDL suggestions as you design and create your science communication or outreach, it can help to make your work more engaging. This is because UDL helps more people to find the material interesting. They want to work at figuring out new information and see how it fits – or doesn't – with what they already know and understand.

Some practical examples of applying UDL to, for example, a science lesson plan could include:

- breaking down points into more specific and achievable goals;
- allowing learners to receive the information in different ways, such as visual aids, spoken voice, hands-on activities and interactions; and
- building in enough time, such as pauses between sentences, for learners to process information.

Put the learner in the centre

So, when you are designing a piece of science communication or outreach, think about the learner – who they are, where they are, and how they might receive and react to what you're offering. Give them lots of choice in how they interact with the information, make it relevant to them and minimise distractions. Make any goals and objectives clear and repeat them so people see they are important.

Encourage learners to think and work with you or with other learners. Ask people to think about what they are learning and to give feedback about it. That way, you will learn too.

Dig deeper: Further resources

Scan the QR Code to see how UDL can help to make your outreach more engaging.

About the author

Levina Reeves

Levina Reeves is an educational and wellbeing consultant with more than 25 years' experience in adult and community education in Ireland and the UK.

She has a background in fine art and commercial arts, and first engaged with Universal Design for Learning in 2015. Levina obtained UDL Digital and Facilitators Badges in 2020, along with other accredited UDL learning outcomes.

Her poster presentation on UDL student leadership methods was published as part of an Atlantic Technological University (ATU) UDL Poster Portfolio in 2021.

Levina continues to facilitate internal and national UDL badge roll-outs in conjunction with AHEAD and UCDforALL for the enhancement of inclusive learning in further and higher education in Ireland.

Accessible Design in Science Communication

A little thoughtfulness goes a long way

By Maébh Coleman and Jennifer Lombard

Good design helps more audiences to connect with your science communication. Thinking about accessible language, colour and representation early on can pay dividends.

Have you ever felt frustrated when a website won't show up properly on your phone screen? Or have you ever narrowly missed being burned when a teapot lid fell off as you poured the tea? We often don't notice or think about design until it fails us.

It's the same for science communication. From the start, when you are planning and building a piece of science communication, you need to think about how its design can help people to access it easily, without it causing frustration or even harm.

There are also lots of benefits to taking this considered approach. When you embed universal design in your work, more people can understand and relate to your key messages. Clear, inclusive design helps wider audiences to engage with and learn from your communication. In turn, this offers more people access to areas such as science, technology, engineering, art and maths.

So how can design take all types of learners into account? How can it avoid creating unnecessary barriers for people? The first step is recognising that learners will be different from each other in a variety of ways, and that you're aiming to include everyone.

Then, by being considerate about language, visuals, and cultural assumptions in your work, you can make science communication or outreach more inclusive and effective for all.

Part of designing for accessibility is being thoughtful about the language that you use. Using plain, simple language helps people to access and understand the information. As well as explaining technical words and breaking down complicated ideas, your language can also help people to feel included.

Think, for example, about someone who is blind or vision impaired. If you use the common phrase 'as you can see' when you are presenting information, the person who cannot see it could feel left out. A more inclusive way of saying it would be to say something like 'in this slide', or 'in this picture', and then describe it. Similarly, some people you are communicating with may be Deaf or hard of hearing. Instead of inviting people to 'listen to the sound', you can be more inclusive by describing the sound in a way that people who cannot hear it can learn more about it.

This table lists some examples of common phrases that could exclude some of your audience. Alternatives are also listed which show how powerful a simple adjustment to your language can be.

What is the phrase?	What is the problem?	Who does it affect?	How do I fix it?
As you can see	Not everyone can see	Blind and vision impaired	On the screen there is…
See the picture	Not everyone can see	Blind and vision impaired	On the screen there is…
Notice the sound	Not everyone can hear	Deaf and hard of hearing	The sound of the…
He or she	Assuming there are only two genders	Gender diversity	They…
Men make more money than their wives	Generalisation	Gender equality	Mike makes more money than Susan

Assumptions and generalisations can be off-putting for your audience too. Be mindful of gender diversity and use pronouns (she, he, they) in an inclusive way.

It is also best to avoid blanket statements and generalisations such as:

'Men make more money than women'

Instead, be more specific where possible – for example:

'Mike makes more money than Susan'

Be aware of barriers

Language is important, and so too is the way people can access it. There may be barriers here that you need to consider.

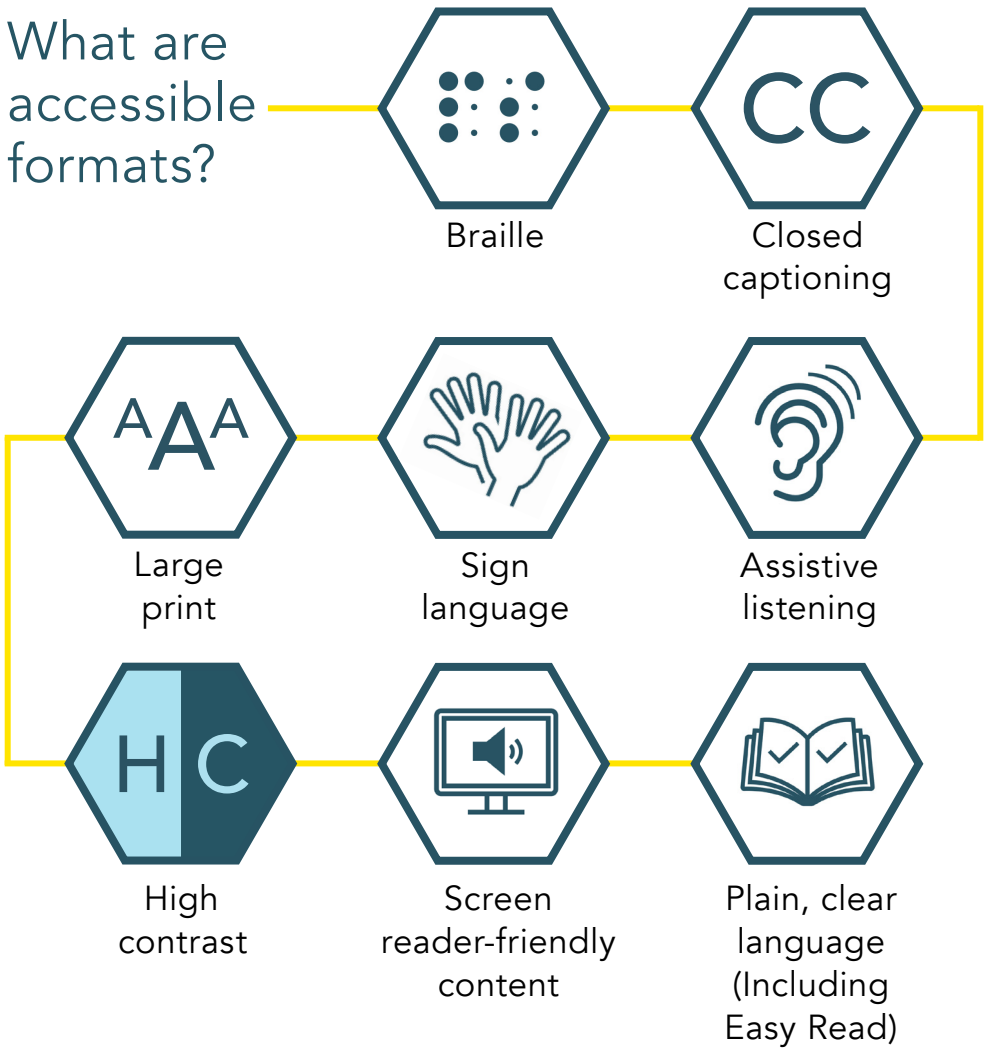
For example, you might design the text for a slide or a leaflet using a vibrant, colourful font. Your intention is to make it clear and impactful. But what if someone in your intended audience is colour blind and can't make out the text? For them, it's a design fail.

Or maybe you deliver your science communication through an app for smartphones. But some people don't have smartphones or access to the Internet, so they can't download and look at the app.

You can make your communication more accessible by being aware of barriers and coming up with creative ways to avoid or remove them.

Colour blindness, deafness, neurodiversity and dyslexia are some of the factors that you need to consider when you are designing to include specific audiences.

Accessible formats include Braille, sign language, closed captioning, using large print, assistive listening technology, screen reader-friendly content and high contrast formats. Many people in your audience won't need or even notice these aspects, but they could make all the difference to some people.



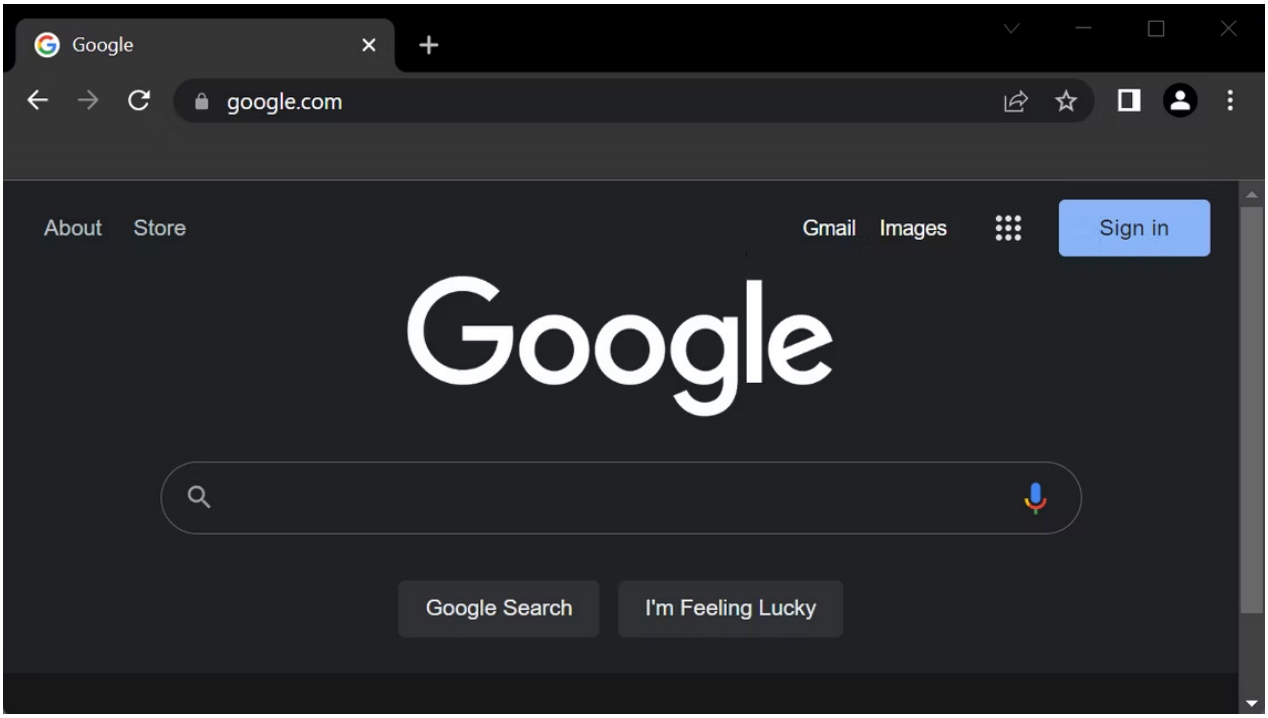
You also need to consider where people are when they are engaging with your science communication. This is important when it comes to their connection (if any) to the Internet.

People living in some areas, or perhaps people visiting from abroad, may have trouble accessing, downloading or streaming online content. This can mean they miss out on important information. It is advisable, therefore, to include different sizes and formats – perhaps even including offline options – to increase accessibility to your communication.

Colour, contrast and font selection

Taking colours into consideration can also make it easier for people to engage with your science communication.

For text, choose colours and backgrounds that work well in contrast to each other. For example, red text on a green background is very hard to read. Instead, you should consider black text on a white background, or white text on a black background so that it is much easier to read.



Thinking about how different learners relate to colour is also important. For example, some colours are over-stimulating – such as reds; and some are calming – such as blues. This can be important for neurodiverse participants – for example, those with dyslexia, ADHD, autism, and so on.

Contrast is important in images too. Graphics and images that have a strong contrast between different points within the image help people who have limited vision or who are colour blind to make out the different elements. Also, make sure that any text in a graphic is not obscured by parts of the image, as this overlap makes the text harder to read.

When choosing fonts for your communication, think about how the words will appear to the reader. Accessible fonts include Tahoma, Calibri, Helvetica, and Arial. You also want to make the font size large enough for the reader. Usually, this is size 12 or above.

Choose fonts that have wider spaces between the letters, and fonts that use easily distinguishable number and letter shapes. For example, with some fonts, the letter lower case 'l' can look very like the number 1; a capital O can look the same as the zero. Fonts where the letter and number sets are distinct are easier for everyone to read.

Negative spacing is bad for readability

A little spacing helps readability

T o o m u c h i m p a c t s r e a d a b i l i t y

Consider culture

It's hard to relate to a piece of communication that doesn't seem to fit with what you know or who you are. So, to make your science communication more accessible to a more diverse audience, put some thought into how you introduce, frame and present the information.

Make sure you give a background on the topic, so that everyone can start with the same basic information, no matter what their knowledge or understanding of the topic is. Think about any cultural references you may use – would everyone in your audience understand them and relate to them?

Images are powerful when we communicate, so when you use pictures and images in your science communication, include a variety of genders, races, ages and roles where possible.

Images are powerful when we communicate, so when you use pictures and images in your science communication, include a variety of genders, races, ages and roles where possible.

If you're using images on a website, you can program in a description for the image to be read out by screen-reading technology. This is called Alt text (short for alternative text) which makes images more meaningful for those with visual impairments or those viewing on very small screens or screens with low resolution.

Top tips for accessible design in science communication

- Use plain language, it makes things easier for your audience to understand
- Use words and phrases that make your audience feel included
- Use approaches and technologies that help people with visual or hearing impairments
- Choose colour schemes that make words and images easier to interpret
- If you use cultural references, use ones that people in your audience can relate to
- In images and videos, show a broad diversity of people and situations
- Avoid using large multimedia formats that need strong and fast connections to the Internet to download or stream
- Run your website or document through an accessibility checker (Find out more below)

Dig deeper: Further resources

Scan the QR Code to see more information on accessible design in science communication

About the authors

Maébh Coleman

Maébh Coleman is the founder and director of DóCent Training & Consulting, which uses empathic design to help keep the focus on people's needs in technology-based media. She holds multiple degrees in communication at Masters level.

She has worked with national organisations such as Science Foundation Ireland, Rethink Ireland and The Heritage Council to help hundreds of socially minded organisations move their services online. Maébh's work includes several large-scale projects relating to science impact in Ireland.

Jennifer Lombard

Jennifer Lombard is a creative e-learning specialist with a Masters in E-learning Design and Development and a Certificate in Digital Media Design. Her skills include professional photography, creative entrepreneurship and social media development for small businesses. Jennifer also created and recorded hundreds of accessible training videos using Universal Design for Learning (UDL) principles.

The Equity Compass

Find your way to more inclusive science communication

By Dr Spela Godec

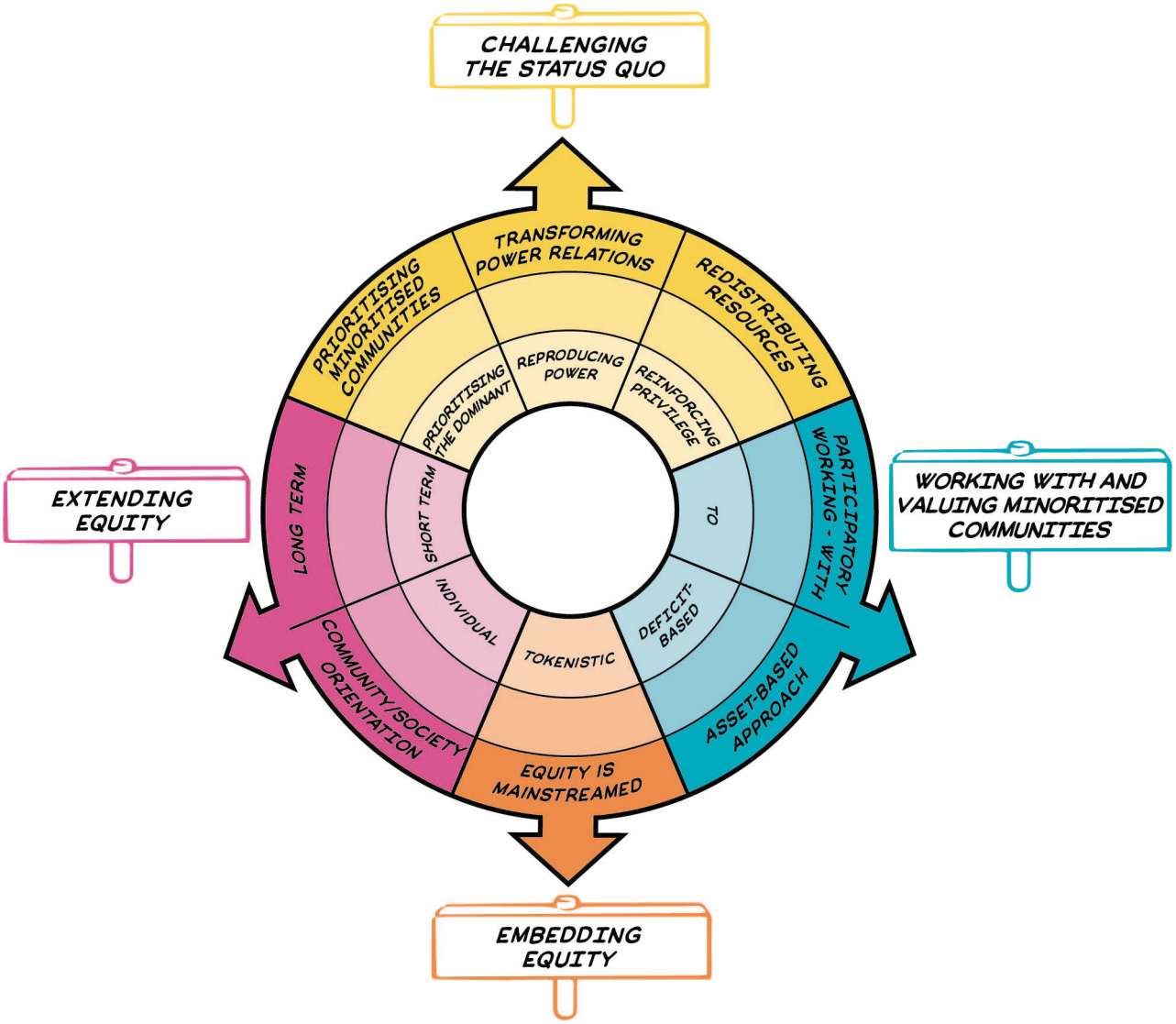
Using a tool called the Equity Compass can help you make science communication more accessible, interesting and engaging for a wider audience, and make it more likely to be guided by the audience's needs.

When you want to find your way on a journey, a compass can keep you on course. In science communication, the Equity Compass can help to ensure that people can access science, meaning you can show them a clear path and keep them on track.

When you are planning science communication, it is important to think about who the typical audience is, who might be missing from that audience, and how the communication can serve lots of different people with different backgrounds and interests.

This often means thinking about how science communication engages people from minoritised and disadvantaged groups, who might find it harder and less welcoming to take part in these activities. We know from research that just getting people through the door of a science centre, or to a science talk or a festival is, in itself, not enough. In fact, if the centre, talk or festival is not designed with equity in mind, it might even put people off altogether. They might not feel that science is for them.

It's important, therefore, to think about many different things when it comes to equity, making sure that everyone has a fair chance. If you consider equity when you start your planning, then you can develop activities where more people can engage with science.



Plan with the Equity Compass

How does it work? When you use the Equity Compass, it makes you think about how a particular approach engages your target audience. Importantly, the Equity Compass also points to how your design or delivery of the science communication could exclude people in ways you might not have even thought about.

The Equity Compass is divided into four main parts. Each part sets out themes and topics that help to focus your thinking about how equitable your approach is now, and how you could make it even more equitable:

1. Challenging the 'status quo' focuses on re-examining and thinking afresh about the time-worn perceptions and generalisations of science that are the accepted norms – the status quo. It makes you think about power and stereotypes, including about who and what 'counts' within a particular domain or activity.

For example, what skills, knowledge and experience count as science? How are people working in science, technology, engineering or maths (STEM) usually perceived and portrayed? It helps you make sure that science communication activities do not mainly benefit people who already have access to science information and are already engaged. It also helps you to make sure that the activities you design meet the needs of the audience.

2. Working with and valuing minoritised communities includes working people who are sometimes left out of science communication. This might involve working with communities to design science communication together with them, and recognising people for what they bring to the process rather than focusing on the gap in knowledge, interest or skills that the science communication should address.

3. Embedding equity is about ensuring that equitable practice is built into all aspects of science communication, whether it's one person designing and delivering it in their own time or a science professional or company for whom science communication is their business. Equity should not be just part of a single project. It needs to be embedded into the design of all projects. It also needs to be everybody's responsibility in an organisation, not just left to a few people.

4. Extending equity helps you think about how equitable practice can be longer-term and can have wide benefits in society as well as benefits for individual people – such as providing clear and accessible scientific information around important issues such as climate change and health matters.

Over the past few years, many people and organisations engaged in science communication have used the Equity Compass. They include the British Science Association, the Oxford University Public Engagement team and Cartas com Ciência, an organisation that supports young people and scientists in Portuguese-speaking countries to write letters to each other.

By helping you to challenge the usual ways of doing things in science communication and to think about wider audiences, the Equity Compass encourages you to consider important questions. These questions cover who we would like to engage, how the activities reflect the needs and interests of diverse people, what tends to get valued and recognised, and how equitable, more inclusive approaches can be embedded in long-term practice of science communication.

Top tips for using the Equity Compass

Focus on people and how science might best help them to address problems they face in their lives.

Involve your participants. What do people want to know? Can your science content link to what they care about?

Value your audience as experts. While you might be the science content expert, people often have valuable lived and other experience. Recognising and valuing what people bring can not only enrich the way you communicate science, but it will also help participants to see themselves as a valued and respected part of the conversation.

Be open and adaptable. It can be hard to get people to interact in a short session, so explore how you might be able to respond to any conversations with the participants. Being able to respond to their needs and interests takes time and practice, but it will help to engage an audience more fully.

Learn from discomfort and difficult reflections. If you are from a more privileged background, it can feel uncomfortable to use a tool that makes you think about power and privilege and that challenges the typical ways of communicating science. But you can learn a lot from thinking about this.

Don't try to address all the parts of the Equity Compass at once. Using the Equity Compass can feel overwhelming if you are new to it. Start with elements that might be the easiest to put in place, or might be particularly meaningful for your work. Small steps can make a difference – but they should be embedded for the long-term; not just something to do this one time.

Don't use the Equity Compass as a checklist

Instead, see it as a way to keep developing your communication with new and different audiences.

Let the Equity Compass help you think about how and why you do science communication.

Thinking about how and why you communicate your knowledge rather than just thinking about what you communicate will help you (and organisations) to grow a more equitable mindset. You will think more about the values underpinning what you do.

Learn from discomfort and difficult reflections. If you are from a more privileged background, using a tool that makes you think about power and privilege, and challenges the typical ways of communicating science can be uncomfortable. But you can learn a lot from thinking about this.

Dig deeper: Further resources

Scan the QR Code to find out more information on The Equity Compass.

About the author

Dr Spela Godec

Dr Spela Godec has spent over a decade at King's College London and University College London researching inequalities in science education and engagement. She has worked with educators, policymakers and funders to develop resources to improve equitable, inclusive practice that can support more diverse young people to engage with science, technology, engineering and mathematics (STEM). Most recently, Spela was a lead researcher on a prestigious five-year Youth Equity and STEM project, an international research-practice partnership between university researchers and informal STEM learning practitioners, where the team developed the Equity Compass tool.

Put it plainly

Plain English helps science communication and outreach

By Claire O'Riordan

If you want to help people find, understand and use knowledge about science, then writing and presenting information in plain English will help.

How we write things down matters. If we write and present information clearly, people are more likely to understand us. If we make things complicated for readers or present information that looks uninviting readers will lose interest. Poorly presented information means people will not understand what we mean and our efforts to communicate may possibly be even wasted.

Plain English can help

So what exactly is plain English? The International Federation of Plain Language says communication is in plain English if its wording, structure, and design are so clear that the intended readers can:

- easily find what they need.
- understand what they find.
- use that information.

This is important in any communication. You want to communicate something about science that gets your intended audience interested, thinking and interacting.

Plain English matters in science communication and outreach

When it comes to science communication and outreach, getting your message across clearly to an audience will have a big impact.

Plain English matters in science communication as it helps people find the information they want, understand it and use it. The public wants, needs and has a right to be informed, and to understand and take part in science-based issues and decisions.

This is why plain English is particularly important in specialist areas like climate, health, technology and general science. Because even if the ideas and research studies you are communicating about are complicated, using plain English can help people to understand them and make sense of them.

In practice, plain English helps science communication and outreach education to connect with your audience because it is more engaging, more transparent and can have a greater impact.

Using plain English means your audience will understand what you are saying the first time they read or hear it. This is partly because, when you use plain English, you don't use technical terms unless you explain them clearly, or unless your communication is for a specific audience who already understand those terms.

From the examples below you can see that plain English benefits all readers. In particular, it helps readers who find reading, writing and maths difficult.

Plain English in practice

To better understand what plain English is about, let's look at examples where it makes information clearer and more useful for readers.

Example 1:

Plain language makes medical procedures easier to understand.

In a research study published by Trudeau and Cawthorne in 2017 (see Dig Deeper for more details), the people taking part were asked:

> 'Which version would you prefer to read on a health form?'

They were given two versions to read.

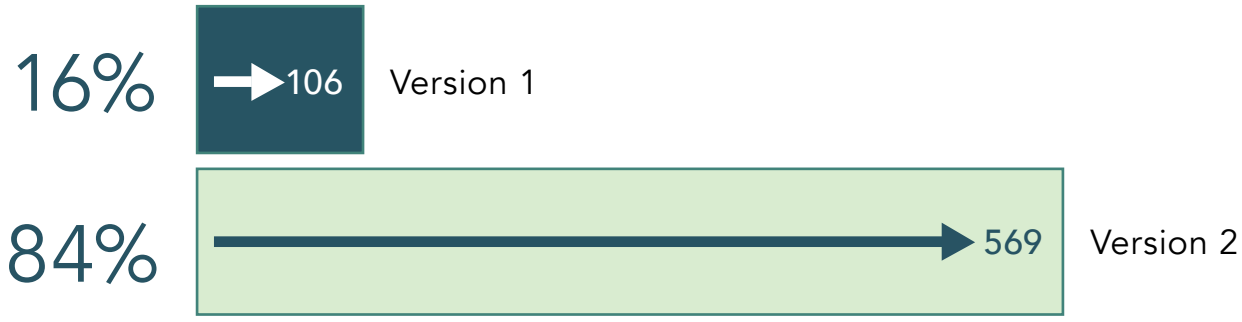
Version 1

A colonoscope will be inserted into your rectum and the inside lining of your colon will be carefully inspected. A biopsy may be removed for examination under a microscope. Polyps that may develop in the intestinal tract will be removed using forceps or electrocautery. Electrocautery may also be used to coagulate any bleeding lesions.

Version 2

Your medical provider will use a flexible, lighted tube, called a colonoscope, to look at the inside lining of your colon. This is done to see if there are any problems with your colon, such as cancers, growths that could turn into cancer, or other medical problems. During this process, your provider may use an instrument to remove any growths found or to remove small pieces of your colon for testing.

Which version do you think was easier to read and understand?



The results of the research showed that, of the 675 people surveyed, 569 (84%) preferred version 2.

Example 2: Before and after using plain English

Before	After
No consideration or surrender of Medical Cards will be required by pensioners at this retirement home in return for accommodation pursuant to their admission.	You do not have to hand in your medical card to get accommodation at this retirement home.
Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.	Lead in drinking water can make you sick. Here are some possible health effects of high lead levels in your drinking water: Children: • Delayed growth • Learning disabilities • Short attention span Adults: • Kidney problems • High blood pressure

Top tips for writing and presenting information in plain English

Tip 1: To better understand what plain English is about, let's look above again at the examples where plain English makes information clearer and more useful for readers.

Tip 2: Use numbers that tell a clear story and that are not confusing.

Tip 3: Use the active voice. For example, instead of 'The results will be sent to you shortly', write 'I will send you the results shortly'.

Tip 4: Keep sentences short (about 15-20 words). This might mean chopping one long sentence or paragraph into shorter sentences. Similarly, avoid using long paragraphs when you are writing, and avoid cramming lots of information onto one slide if you are giving a talk.

Tip 5: Use plenty of space and avoid squashing text – a font size of 11 or 12 in 100% black on white background is usually good.

Tip 6: Use bullet points for short lists.

By using a plain English approach in your science communication and outreach, you will help all readers, and it is more likely that they will understand and be able to use the information you offer.

Dig deeper: Further resources

Scan the QR Code to see more information on using plain English.

About the author

Claire O'Riordan

Claire O'Riordan is the Plain English Co-ordinator of the National Adult Literacy Agency's (NALA) Plain English Editing and Training Service. Claire and her team work with clients to make complicated text more accessible for a wider range of readers. They work on all kinds of texts such as the Climate Jargon Buster (www.climatejargonbuster.ie), edits of health information leaflets and reports, as well as information on the environment, climate and other areas.

Storytelling in Science

Spare me the lecture... tell me a story instead

By Dr Craig Slattery

Storytelling has become an essential tool in effective science communication. Used appropriately, it can allow scientists to communicate surprisingly complex concepts and important research findings in ways that are engaging, accessible, understandable, and memorable for a broad, non-expert audience.

Let me tell you a story about science communication. Years ago, scientists thought that just telling people interesting facts worked. They thought that audiences had gaps in their knowledge about science, and that if the scientists could just fill in those gaps with facts, then the job of science communication was done.

But there was a problem. This approach, which had the snappy title 'the deficit model of science communication', didn't work very well.

The facts didn't speak for themselves. People didn't engage in a meaningful way with, or remember, the facts about scientific developments or research. Lectures and other outreach events that just filled people's heads with more information didn't get the message across in the way that scientists thought it would.

Then along came a better idea. Rather than throwing out facts about science and research and hoping they will land well, how about telling people engaging stories? Stories rouse our emotions, they help us to remember key pieces of information, and they can inspire us to live our lives in new ways. And guess what? It works.

Storytelling has probably been a part of human culture for as long as human culture has been around. Over the last decade, leading science communicators around the world have been taking advantage of this ancient human activity to improve the way they communicate scientific ideas and discoveries to the wider public.

Structure	Benefits	Potential pitfalls
Hero's journey Bring the audience on their own epic journey from the safety of "home" (common knowledge) into new, unknown territories, and then back again with a different perspective.	Very useful to adapt "traditional" science communications (for example, a research paper) Very flexible	Avoid cliché Can get "predictable"
Trust me, I know what I'm doing. You want your audience to follow you to a "better world". Share your own journey to new knowledge to build your reputation and inspire confidence.	Very useful in bringing "order to chaos" where there is confusion in the public consciousness	Trust cannot be presumed
The Sales Pitch Selling anything, including ideas, requires trust. Use your talk to demonstrate your trustworthiness, Show why the audience can believe you will deliver on your "promises". Empathising with the audience perspectives can help win them over.	A very effective tactic for promoting public buy-in with important initiatives (for example, public health)	Balance can be tricky Avoid "hard-selling"
The Autobiography / Day-in-the-Life You may not realise it, but your own life story can be very compelling. Map out our own life journey to date and talk authentically about key decisions that shaped it.	Excellent tactic for promoting careers in STEM (for example, role-modelling)	Be careful it's not too self-promoting

Why stories matter in science communication

Some people have a very positive view of science, appreciating its value and contributions to society; others are highly skeptical and may mistrust certain scientific advancements. And some are indifferent to science and they simply don't want to engage. Stories can help to connect scientists and members of the public, whatever their thoughts on science. This connection then forms a basis for important conversations about science and its impact in society.

Well-developed stories can inspire. They can encourage us, as individuals, to achieve our goals, to overcome obstacles, and to imagine new possibilities. They also provide inspiration to the next generation of scientists.

Effective scientific storytelling can be used to highlight behaviours and characteristics that contribute to successful science, such as curiosity, courage, and clever thinking. In turn, this can encourage young, future scientists to embrace and develop their own talents.

Your brain on stories

What's so great about stories as a way to communicate complex ideas? Through stories we can share ideas and connect with one another emotionally. This helps us remember the ideas in those stories and apply them in our own lives and experience.

We know this from experience, but we also have evidence from studies of the brain. When we read or hear a compelling story, several things happen in our brains. There is a spike in activity in an area at the front of the brain, just behind our foreheads. This is the prefrontal cortex – a part of our brain that helps us to understand information.

A burst in activity in this part of the brain during a story shows that we are absorbing and processing information. Then, as we follow the story, activity increases in another brain region – the amygdala. This area is involved in emotions and long-term memory storage.

Neuroscientists who have researched this believe that when the prefrontal cortex (the bit of brain behind your forehead) receives new information, your amygdala works to "earmark" certain bits of information based on the emotions you feel at that time.

In turn, this can highlight to the brain exactly which pieces of information are important to keep in long-term memory.

The bottom line is that if we feel emotional about new information, we can remember it better for longer. So if you want to communicate scientific information well to a new audience, tell a good story. Wrap your important idea or message in a relatable yarn that gets people feeling emotional. That story is probably already there in your research – you just need to find it.

Build your science-communicating story

Good stories do not materialise fully formed. They need hard work to develop and polish. The starting point is to carefully define exactly what story you want to tell. As I often say during training workshops, if you do not know what story you're trying to tell, how is the audience supposed to figure it out.

At a minimum, a good story generally has relatable characters, a story arc (beginning, middle and end), some kind of emotional involvement, and then a conclusion.

Let's think for a moment about relatable characters. Stories about people will always be more memorable than a series of facts or figures alone. If your audience can feel for the human characters in your story, it builds trust and makes your message far more memorable. Those humans could be the researcher themselves, a customer/service user, a patient (or group of patients), or a particular community. These characters can make the real-world impact of your scientific research far more relatable.

Now to the arc, or the structure of the story. Every good story has a beginning, middle and end. This simple structure is one of the most effective tools in storytelling and for good reason.

Begin your story with something the audience can recognise. Meet them where they are. If you begin with something too unfamiliar or unrecognisable, people won't want to come on this journey with you. So, from the opening sentence to the last word, you need to make bring the audience with you.

The "Hero's Journey" is a common plot structure where the main character has a 'call to action' and embarks a journey that changes them, and maybe the world. That call to action could be the problem you are trying to solve in your research, and the journey is how you are tackling it.

Emotion is that all-important element of the story that helps us connect and remember. Try including a joke or funny moment in your story, building suspense, describing some easily recognised "pain point" and speculating on how your innovation or discovery could make the lives of the audience better.

Emotional buy-in will make your audience more invested in the research and they will appreciate its impact. Without that kind of meaningful connection, even the most significant scientific discovery might not hit home.

And what about the end? A good story will finish strong, solving a problem or at least pointing towards a solution. So when you are building your story, make sure that the destination is worth the journey. Of course, since science and research is a never-ending, human endeavour, this can be challenging.

But look for any conclusions you can draw, even if you need to remind people there is plenty of work still to be done.

Top tips for telling stories in science communication

Tip 1: Focus on discovery

Sometimes the most effective way to tell a science story is to focus on the discovery journey itself. Naturally, it doesn't hurt if that journey happens to be a months-long expedition to the Arctic Circle to study climate change and its impact. (See the Dig Deeper section to read that particular story by Shannon Hall in the scientific journal Nature, with its breathtaking pictures.)

Tip 2: Keep it honest and real

Wherever possible, use real, authentic materials from your own work and experiences. Do not be tempted to exaggerate or invent results or findings to enhance the story. Storytelling may be a creative exercise, but what we are creating is a familiar narrative structure to engage the audience. Fictional scientific results or findings are off-limits.

Always be realistic around timelines and about challenges facing the research you are communicating. False dawns have a significant undermining effect on public trust in science.

Tip 3: Remember, your audience are people too

Some topics can be important and are academically interesting to you. For example, how many people survive a particular illness, how much medicines cost or the lack of treatment options for some diseases.

But always remember, you may be speaking with patients or relatives of patients for whom your academic interest is a stark reality of daily life. Be sure to choose your words with due care and respect.

Tip 4: Window-shop, experiment and learn

Spend some time looking at the work of leading science communicators and don't be afraid to try out ideas that you like. Not every story you develop will be successful. Some will work really well; some will fall flat and not connect with the audience. Learn from every opportunity and never stop developing your stories.

Tip 5: Just do it

Many scientists want to improve their science communication skills but never take the leap and put themselves out there. The prospect of speaking in public about your research could be just the kick you need to begin a long and successful career in public science communication.

So use outreach events to motivate you to develop your science communications skills.

Dig deeper: Further resources

Scan the QR Code to see more information on storytelling in science communication.

About the author

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Dr Craig Slattery is a biomedical scientist, lecturer and passionate science communicator. He is committed to making science and scientific research easy for everyone to engage with and understand.

He has been involved in hundreds of public science events and has developed a range of training programmes aimed at helping scientists who want to develop their own public science communication skills. Craig is Assistant Professor of Regulatory Affairs & Toxicology at University College Dublin.

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