



Royal Academy  
of Engineering



Creating Inclusive Cultures

# Problem-solving

**Team workshop series – Facilitator guide**

# Problem-solving

### Getting ready to run your session

- Welcome to this inclusive team workshop and thank you for using this resource to help support teams to be more inclusive and therefore more productive.
- At the end of each part of the session, summarise what has been discussed (in a timely manner) so that you can move to the next section.
- This guide is designed to help you run this 60-minute session. All of the materials you will need can be found on the [Academy website](#).
- Take your group through the resources and use this step-by-step guide to lead you through the session.
- Your role is to facilitate and encourage conversation – you do not have to be an expert on diversity and inclusion to run a successful session.

### Advanced preparation

- ✓ Schedule time to prepare your session.
- ✓ Read the introduction and this guide and ensure that you are confident in how to run an inclusive session.
- ✓ Familiarise yourself with these facilitator notes and the slides so you know what to expect.
  - The notes provide both actions (indicated by a tick) and statements (indicated by a bullet).
- ✓ Make sure you download all of the content from the Academy website:
  - [facilitator notes and powerpoint](#)
  - the Academy [survey link](#) (and any organisational feedback forms).

- ✓ You will need paper, pens and/or a flip chart.
- ✓ Choose to run the quiz element with printed handouts or use the on-screen option to show the questions and answers on screen.
- ✓ You will be playing a video so ensure you have a suitable screen and speakers.
- ✓ Think about how you can make the content relevant to your audience.
- ✓ Think about the questions you're likely to be asked and what your answers will be.
- ✓ Think about the accessibility of the session and send out an email to all attendees to confirm if they have any specific requirements.

### On the day

- ✓ Set up the training space.
- ✓ Ensure screen and sound for video are working and all other equipment is in place.
- ✓ Encourage everyone to get involved, take part and ask questions.
- ✓ Recognise that there will be different learning styles – for example, some may need time to reflect on what is being discussed, and so may not immediately comment. Others may be very vocal and you may need to encourage them to let others in the group speak.

## The structure of the session

- **Welcome and introduction** (2 minutes)
- **Ashby's Law and the relevance to engineering** (8 minutes)
- **Quiz** (17 minutes)
- **Problem solving riddle** (20 minutes)
- **Developing an objective** (10 minutes)
- **Thank you and feedback** (three minutes)

## Introduction

- **Timings:** two minutes.
- **Purpose:** welcome participants, health and safety messages, outline objectives.
- **Prepare:** no additional resources required.

## Do

- ✓ Welcome everyone and give a short health and safety message.
- ✓ Explain the purpose of the session.
- ✓ Facilitate ground rules.
- ✓ Encourage participation.

## Say

Hello and welcome. My name and role is...

The purpose of this interactive workshop is to explore the relationship between problem solving, diversity and inclusion, and the outputs of engineering-based organisations.

We will be exploring the theory, research and real-life examples underpinning the link between diversity and inclusion and problem solving and undertaking some games and activities to help you understand the potential for new ways of working and new business opportunities.

## Ashby's Law and its relevance to engineering

- **Timings:** eight minutes.
- **Purpose:** to explain Ashby's Law, its relevance to diversity and how it can help in problem-solving.
- **Prepare:** no additional resources required.

## Do

- ✓ Explain *Ashby's Law of Requisite Variety*.
- ✓ Ask the group to consider how Ashby's Law could be relevant to diversity (variety) and how it can help in problem solving.
- ✓ Give examples of applying Ashby's Law in different contexts: nature, engineering, business.

## Say

W. Ross Ashby was an English psychiatrist and a pioneer in cybernetics, an approach to understanding complex systems. He proposed the idea in his 195 book *An Introduction to Cybernetics* and later expanded on it in his paper *Requisite variety and its implications for the control of complex systems*. Ashby's Law become one of the foundational concepts in the field of cybernetics. Ashby's Law is understood as follows:

- "If a system is to be able to deal successfully with the diversity of challenges that its environment produces, then it needs to have a repertoire of responses which is (at least) as nuanced as the problems thrown up by the environment. So a viable system is one that can handle the variability of its environment."
- Or, as Ashby put it: "only variety can absorb variety."

In the context of businesses and engineering organisations, Ashby's Law means that to address your diverse customer needs, diverse external changes or diverse competition from a globalised world, your company needs to be able to offer diverse solutions to engineering problems or diverse products to remain in business.



## Ask

Ask the group to consider how Ashby's Law could be relevant to diversity (variety) and problem-solving. For example:

- People from different backgrounds with different experiences, insights and thinking styles can bring new perspectives to the problem. They allow an organisation to innovate to meet diverse demands through diversity of thought.
- Interacting with individuals who share similar values, opinions, and interests can be perceived to be rewarding because doing so reinforces our own values, opinions and interests. However, this can lead to a lack of variety and diversity of thought, which can hamper innovation and problem-solving.

## Say

Give examples of applying Ashby's Law in different contexts:

### Nature:

The leopard is an example of an animal that has successfully dealt with the diversity of challenges thrown up by the environment it is in.

- The slide sets out the Leopard's response to the problems it faces in the environment.

### Engineering:

In the aerospace industry, Concorde is an example of an aircraft that failed to absorb the variability in its environment.

- Concorde addressed a problem (and market opportunity) for expensive but very high-speed flight across the Atlantic.
- There was variability in the environment with rising fuel prices and an increase in environmental and noise concerns. A change to quieter, fuel-efficient engines would have removed Concorde's only distinguishing feature, which was its speed.
- Concorde couldn't absorb the variability; they had no response to the problem and its service ended in 2003. More fuel efficient and quieter engines were expensive and difficult to integrate. It would have been a long, expensive process to adapt the design to match this new variation.
- Variation in the market outnumbered the responses the product could offer.

### Business:

In the tech world, the rise of Silicon Valley over Boston's Route 128 is an example of companies failing to take account of Ashby's Law.

- Boston's Route 128 is large, secure, has a long industrial history and proximity to high quality educational institutions (such as Harvard, Yale, Brown and MIT). It is made up of secrecy-focused, isolated conglomerates.
- Silicon Valley has clusters of small startups, promoting engagement, entrepreneurial experimentation and cross-fertilisation of ideas. It has deep roots in local networks and attracted non-traditional talent and immigrants.
- Shifts in the external environment left Boston unable to adapt:
  - Rise of personal computers and workstations, innovation in components and systems moving from hardware to application software and search engines.
  - Overseas competition.
- Each tech centre responded differently:
  - Boston – increased protection and secrecy.
  - Silicon Valley – promotion of openness and flexibility.
  - The variation in the sector had outnumbered the responses that isolated [Route 128 companies](#) could implement by themselves. Silicon Valley companies were more interconnected and thrived through the sharing of ideas and approaches.



## Quiz

- **Timings:** 17 minutes.
- **Purpose:** to look at the impact of diversity (or the lack of it) on engineering and technology.
- **Prepare:** the questions and answers on the slides or in a printed handout.

## Do

- ✓ Run the quiz in groups or pairs.
- ✓ Explain some of these questions are drawn from examples in Caroline Criado Perez's book *Invisible Women: Exposing Data Bias in a World Designed for Men*.
- ✓ Discuss the answers as a group and how to use the knowledge gained.

## Say

Let's look at how diversity (or the lack of it) has influenced the engineering, built environment and commercial sectors. There is no need for prior knowledge, this quiz is a light activity to see what people think the current situation is like.

**Note to facilitator:** The quiz can be run in groups, pairs or individually completed. The questions can be shown on screen and answers captured by a show of hands or issued as a printed handout (the digital pack you can download includes both options). Discussion can be undertaken as part of revealing the quiz answers. **Ask** as the answers are revealed – did this surprise you? Have you heard of any other real-life examples?



## Problem-solving riddle

- **Timings:** 20 minutes.
- **Purpose:** a lighthearted problem to solve, appealing to engineers' sense of overcoming barriers.
- **Prepare:** the video on the presentation. Have paper and/or a flip chart available if people wish to work through the problem.

## Do

- ✓ Split the group into pairs or small groups.
- ✓ Show the first part of the [video](#) with the problem (pause the video after 59 seconds, there is a moment in the video indicating when to pause with the problem set out).
- ✓ Discuss the solution in pairs or groups. Give up to 10 minutes.
- ✓ Facilitate a whole group discussion on solutions.
- ✓ Show the remainder of the video clip (four minutes).
- ✓ Discuss the relevance of the riddle to diversity and inclusion and problem-solving.

## Say

We have looked at theory relating to diversity and, through the quiz, begun to explore the world in which we operate, learning how it has not always been as inclusive as it should be. Potentially, these matters offer opportunities for us as a business. Let's explore a specific problem together.

In groups or pairs, let's look at this video clip, then try to solve the riddle. Come back and feedback.

## Ask

What is the relevance of this riddle? What do you think this riddle can tell us about diversity and inclusion in the workplace? Let people share what they think.

You might add... if your organisation is only making things for lions, then you are missing out on wildebeests (and crocodiles) as potential customers. Understanding the diverse needs of groups and individuals is important when considering how to solve problems – for example wildebeests are vulnerable to being eaten when outnumbered.

Did it help to have a mix of viewpoints and experiences when working to solve the riddle? Can you solve it more quickly if you all think the same or if you have a range of options and thoughts to draw from?

## Developing an objective

- **Timings:** 10 minutes.
- **Purpose:** to consider where increased diversity could support your business and develop an individual or team objective.
- **Prepare:** a flipchart or paper to note down objectives.

### Do

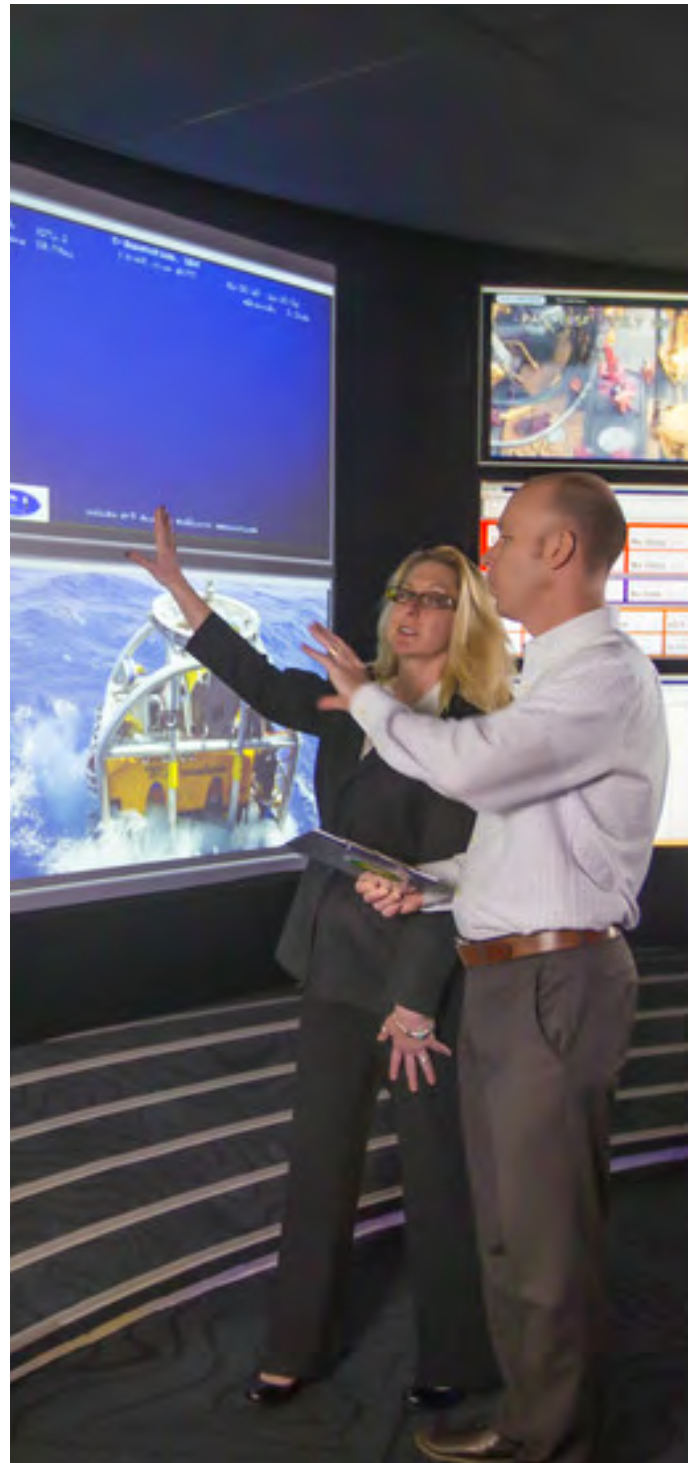
- ✓ Discuss where there might be an impact on different areas of your business/team due to insufficient diversity, for example, creativity and innovation, capability, products and outputs or customer relationships.
- ✓ Agree an individual or team objective to enhance an area of business through increased diversity and inclusion.
- ✓ Discuss how this/these objective/s might be achieved and what support might be required.

### Say

Let's discuss where there might be different parts of our business impacted by insufficient diversity (including people with different backgrounds, experiences and perspectives). For example, creativity and innovation, capability, products and outputs or customer relationships.

Let's agree an individual or team objective to enhance an area of business through increased diversity and inclusion.

How are we going to monitor the achievement of this objective? Who will be responsible/accountable? Who else or what other parts of the business will need to be engaged to achieve this? Are any resources (for example, people or finance) required?





## Thank you and feedback

- **Timings:** five minutes.
- **Purpose:** get feedback on the session.
- **Prepare:** feedback survey link.

### Do

- ✓ Require participants to complete the brief online feedback survey for the Academy.
- ✓ Hand out any other feedback form your company wishes to use to receive feedback.
- ✓ Thank them for their participation.
- ✓ Show them where the other workshops and further information can be found.
- ✓ Decide when to follow up with participants to see if the workshop has results in a change in behaviour for the participants, this could be three or six months after attending the workshop.

### Say

- ✓ Thank you all for attending this workshop and being active participants.
- ✓ Did you find it interesting? Thought provoking? I'm going to ask each of you what is your one take away from this session (go round the group).
- ✓ It is really important that you provide feedback to the Academy [and the company if the company requires this] so that we can continue to learn and improve the sessions we run. Please complete the feedback survey [and form] now.
- ✓ There are three other workshops available in this series by the Royal Academy of Engineering:
  - Why is diversity and inclusion important?
  - Ways of working
  - Problem-solving
- ✓ There is also a lot more information on the [Academy's website](#) explaining the research around this topic, such as the [Creating cultures where all engineers thrive](#) report.

**Note to facilitator.** It is very important that the Academy also receives your feedback, [available here](#). Thank you in advance for helping us to continue to improve the resources we provide by giving us your feedback.



### Contact the Royal Academy of Engineering Diversity and Inclusion team:

- ✉ [diversityteam@raeng.org.uk](mailto:diversityteam@raeng.org.uk)
- 📍 [www.raeng.org.uk/engdiversity](http://www.raeng.org.uk/engdiversity)



# Royal Academy of Engineering

**This workshop was designed and developed by Kevin Bowsher and Anna Calder in collaboration with other contributors. The Academy is very grateful for their work.**

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**The Royal Academy of Engineering** is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

## What we do

### Talent & diversity

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

### Innovation

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

### Policy & engagement

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.