As you wait for the session to start...

Think about / write down (up to) 6 attributes you would use to describe yourself that you feel are essential to being successful in your role.

(Attributes can be thought of as employability skills)
Empowering future engineers through STEM role models

Carol Davenport, Northumbria University
Wendy Sadler, Science Made Simple/Cardiff University
Vienna McAndie, STEM Learning
Breakout session outline

- Role models and STEM attributes – intro and research
- Role models and science shows
  - Activity 1
- STEM Ambassadors
- Using attributes in other STEM engagement activities
  - Activity 2
- Question time
Role models

Save lives as an engineer

Meet Dilani

What's your job?
I'm a drone designer - I code drones to be able to fly!

I make a difference by...
I make drones that save people's lives! My drones find people who are lost or hurt, so that other people can find them and get them help.

What I love about my job is...
Experiencing and writing code to make my drones work properly. It's exciting when they take flight successfully!

Why did you want to be an engineer?
I love that every day is different. I wake up to new challenges, excitement, and new things to do.

Meet Leo

What's your job?
I'm a health scientist working for the NHS.

I make a difference by...
I design machines that help disabled people. Recently I helped a man use a tablet to talk, so he could speak to his wife again.

What I love about my job is...
When I'm helping people, I get to see how much my work helps their lives, affects their families and makes them smile.

Why did you want to be an engineer?
Engineering is about designing things, problem solving and getting things done! You get to be creative, and your work really matters in society.

Find out more about us: https://www.newcastle.ac.uk/neo
What makes an effective role model?

1. Portray role models as competent and successful (but not extreme success).
2. Portray role models as meaningfully similar to the students.
3. Prioritise exposing students to role models from groups that are traditionally under-represented in STEM.
4. Portray role models’ success as attainable.

What do we mean by ‘similar’?

- Outward appearance
- Family and social background
- Interests and hobbies
- Personal attributes
Attributes

- Non-technical employability skills often called ‘soft skills’ – even though they are not ‘soft’
- Systematic review by Sarfraz et al. (2018) identified 10 broad skills sets including:
  - Interpersonal and collaborative skills
  - Relationship management skills
  - Cognitive and problem-solving skills
  - Productive self-management skills
What attributes do STEM professionals have?

Previous research into
- what attributes employers want,
- attributes valued in different sectors
- what attributes undergraduate students need to get a job

- but very little about what STEM employees think.
Research

- Self-identified STEM professionals
- Participants recruited by email and social media and asked to complete a short online survey
- Survey consisted of free-response, likert scale and demographic questions.
- Asked “Can you identify up to 6 attributes you would describe yourself as having that you feel are essential to being successful in your role? Attributes can be thought of as employability skills.”
- Then asked how much they thought that the NUSTEM attributes described them as a STEM professional
Research

- Convenience sample of 218 self-identified STEM professionals
  - 107 women, 105 men, 5 other
  - from cross UK, but 52% from North East
  - mainly aged 35 – 64
  - range of different STEM sectors

- Asked “Can you identify up to 6 attributes you would describe yourself as having that you feel are essential to being successful in your role? Attributes can be thought of as employability skills.”

- Then asked how much they thought that the NUSTEM attributes described them as a STEM professional
# NUSTEM Attributes

<table>
<thead>
<tr>
<th>Collaborative</th>
<th>Curious</th>
<th>Observant</th>
<th>Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committed</td>
<td>Hard-working</td>
<td>Open-minded</td>
<td>Resilient</td>
</tr>
<tr>
<td>Communicator</td>
<td>Imaginative</td>
<td>Organised</td>
<td>Self-motivated</td>
</tr>
<tr>
<td>Creative</td>
<td>Logical</td>
<td>Passionate</td>
<td>Tenacious</td>
</tr>
</tbody>
</table>

![Northumbria University Newcastle Logo](Northumbria_University_Newcastle_Logo.png)
Identified attributes

- 1180 separate attributes identified by respondents
- Data sorting gave 269 unique terms for characteristics
- Thematic analysis gave 19 broad attribute themes
<table>
<thead>
<tr>
<th>Identified theme</th>
<th>Typical named attributes</th>
<th>Number of all respondents with this characteristic (n=215)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-minded</td>
<td>Adaptable, embraces change, growth mindset, healthy level of skepticism</td>
<td>103</td>
</tr>
<tr>
<td>Communicator</td>
<td>Teaching skills, diplomacy, good writer, delivering clear presentations</td>
<td>98</td>
</tr>
<tr>
<td>Logical</td>
<td>Critical thinker, accurate, analytical, able to improve processes</td>
<td>86</td>
</tr>
<tr>
<td>Domain Specific Knowledge</td>
<td>Numerate, data fluency, industry/subject knowledge, safety conscious</td>
<td>79</td>
</tr>
<tr>
<td>Curious</td>
<td>Asking questions of everything, interest in learning, likes to try out new things</td>
<td>76</td>
</tr>
<tr>
<td>Creative</td>
<td>Innovative, inventive, resourceful, experimental</td>
<td>70</td>
</tr>
<tr>
<td>Good colleague</td>
<td>Fair, friendly, interpersonal skills, humour, generous, helpful, honest, reliable</td>
<td>70</td>
</tr>
<tr>
<td>Resilient</td>
<td>Don’t give up, learn from mistakes, problem solver, unflappable</td>
<td>69</td>
</tr>
<tr>
<td>Collaborative</td>
<td>Team player, learn with and from others, supportive</td>
<td>65</td>
</tr>
<tr>
<td>Tenacious</td>
<td>Persistent, perseveres, determination, focussed, diligent</td>
<td>47</td>
</tr>
<tr>
<td>Hard-working</td>
<td>Determination, energetic, disciplined, thorough</td>
<td>42</td>
</tr>
<tr>
<td>Self-motivated</td>
<td>Ambitious, can-do attitude, independent learner, positive attitude</td>
<td>39</td>
</tr>
<tr>
<td>Professionalism</td>
<td>Accountability, integrity, leadership, vision,</td>
<td>33</td>
</tr>
<tr>
<td>Patient</td>
<td>Patient</td>
<td></td>
</tr>
<tr>
<td>Observant</td>
<td>Attention to detail</td>
<td>26</td>
</tr>
<tr>
<td>Passionate</td>
<td>Enthusiasm (about subject), love for STEM, passion</td>
<td>26</td>
</tr>
<tr>
<td>Organised</td>
<td>Ability to multitask, good time keeping, meticulous</td>
<td>19</td>
</tr>
<tr>
<td>Imaginative</td>
<td>Lateral thinking, making connections between subjects</td>
<td>18</td>
</tr>
<tr>
<td>Committed</td>
<td>Dedicated, output driven</td>
<td>9</td>
</tr>
</tbody>
</table>
## Top 5 characteristics by gender

<table>
<thead>
<tr>
<th></th>
<th>All (n=215)</th>
<th>female (n=107)</th>
<th>male (n=103)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open minded (48%)</td>
<td>Open-minded (55%)</td>
<td>Communicator (50%)</td>
<td></td>
</tr>
<tr>
<td>Communicator (46%)</td>
<td>Communicator (44%)</td>
<td>Domain specific knowledge (46%)</td>
<td></td>
</tr>
<tr>
<td>Logical (40%)</td>
<td>Logical (42%)</td>
<td>Open minded (41%)</td>
<td></td>
</tr>
<tr>
<td>Domain specific knowledge (37%)</td>
<td>Curious (39%)</td>
<td>Logical (38%)</td>
<td></td>
</tr>
<tr>
<td>Curious (35%)</td>
<td>Resilient (36%)</td>
<td>Good colleague (35%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Creative (35%)</td>
<td></td>
</tr>
</tbody>
</table>
NUSTEM attributes
Implications

- Domain specific knowledge is important to employees and employers – still need to ‘learn stuff’
- Using STEM attributes can help those who are thinking about careers identify characteristics that they share with others who work in STEM careers.
- However, the characteristics are broad enough that they don’t limit choices for those who ultimately don’t go into STEM
Activity

- Think about yourself (or a colleague) as a role model.
- What are your work attributes?
- How could you share them (in an active way) with children and young people?
Other examples of using attributes in STEM engagement
#1 Adapting workshops

The Materials Scientist

Observant, committed and organised

KS1 workshop: Testing materials

The Systems Engineer

collaborative
imaginative
resilient

Primary workshop: Designing a marble run
#2 Highlighting skills

- British science week packs
- Focus on ‘skills’ and careers linked to the activity
- Each activity includes three skills which children and young people can develop during the activity.
#3 STEM Person of the Week

Dr Alexandra Gibbs
Materials Scientist

Alex makes new materials in her laboratory and tests them to try and understand the interesting ways they behave. She is observant and logical, looking closely at crystal structures to understand their properties. Her resilience helps her overcome new challenges.

Ninad Pattalwar
Accelerator Technician

Ninad works as a technician in a laboratory. His job involves the design, assembly and testing of parts for particle accelerators and detectors. He has to be self-motivated to carry out tasks independently as he often works on projects that demand specialist knowledge and skills are more in short supply. Ninad has to be creative and open-minded to solve problems.

Dr Kate Winter
Polar Geologist

Kate investigates how ice flows in one of the most extreme environments in the world. She is imaginative and passionate about her work, travelling to Antarctica to see how ice dynamics and cold极性r冰雪形成学 works within the ice. She needs to be teakness when doing experiments in very cold temperatures.

Christopher Toth
Facility Scientist

Chris works in a research laboratory deep underground. He uses small detectors to search for rare particles belonging to the Standard Model of particle physics. The detectors can sometimes fail, so he needs to be both organised and patient to fix them.

Emma Hancock
Software Engineering Apprentice

Emma is learning new skills in lots of different areas of computing. She writes code, builds websites and faces a wide range of challenges. She is hard-working and curious, which allows her to solve computing challenges successfully. She’s collaborative, working in teams with others on different projects.
Erusa Adizie
Net Zero Manager

Erusa is **committed** to helping her company to make cement in a more environmentally sustainable way. She has to be **self-motivated** and keep track of many different activities as she **collaborates** with other people in the company to change how they make cement.

**Committed**
I can stick with an activity and try my hardest to make it happen.

**Self-motivated**
I like to do things for myself without being told how to do them.

**Collaborative**
I can work successfully with others to do things.
Reflection

What type of STEM engagement do you currently do?

How could you adapt your activity to include some of the attributes?

(5 minutes)

<table>
<thead>
<tr>
<th>Collaborative</th>
<th>Committed</th>
<th>Communicator</th>
<th>Creative</th>
<th>Curious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard-working</td>
<td>Imaginative</td>
<td>Logical</td>
<td>Observant</td>
<td>Open-minded</td>
</tr>
<tr>
<td>Organised</td>
<td>Passionate</td>
<td>Patient</td>
<td>Resilient</td>
<td>Self-motivated</td>
</tr>
</tbody>
</table>
Thank you

C. Davenport, M. Horan, B. Willis, A. Padwick, R. Strachan, “People like me”: identifying personal attributes of STEM professionals. FIE Conference 2022: In press