Volunteer Walkthrough

JUST TRANSITION

STEM Lessons for Primary Schools in the UK and Ireland

Future Skills

sse | For a better world of energy

CONTENTS

Volunteers should be aware of the following pieces of information before delivering these lessons:

All lessons in this suite are designed to be delivered in a normal classroom setting, although facilitators could adapt them for use in an assembly.

Each lesson plan contains information about how it can be adapted to suit pupils with SEND provision.

Each lesson plan builds one essential skill step from the Skills Builder Framework for essential skills. This Framework provides a common language for defining and developing eight essential skills. You can explore the Framework here.

Lesson slide decks, worksheets and knowledge organisers for each lesson can all be found in the appendix ready for download at SSE's STEM website.

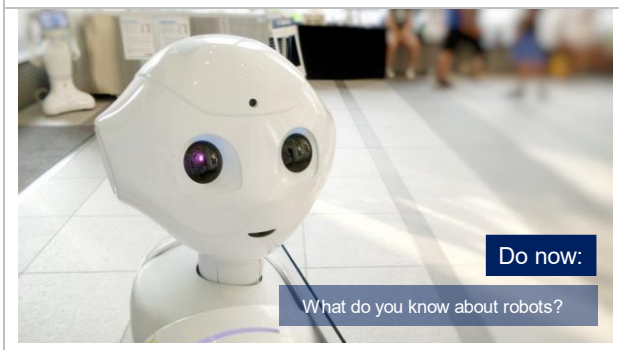
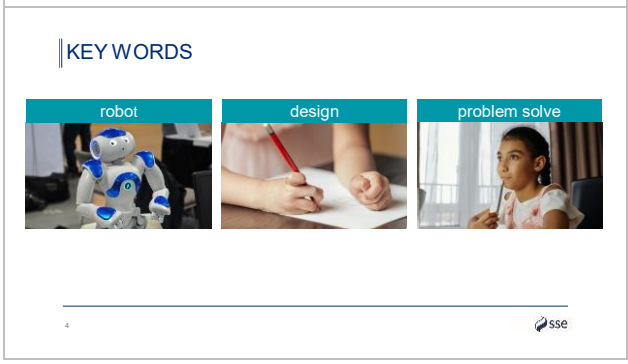
The lessons can be delivered by an in-class teacher or delivered by SSE volunteers. To contact SSE about this opportunity, please email stem@sse.com. It is suggested that if only one lesson is to be delivered, that this is the first lesson in the topic.

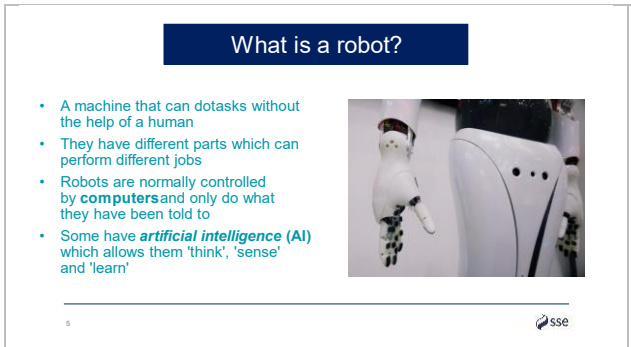
Please share your pupils' work on social media, tagging @SSE on Twitter or @SSEplc on Instagram and using the #STEMatSSE tag.

FUTURE SKILLS

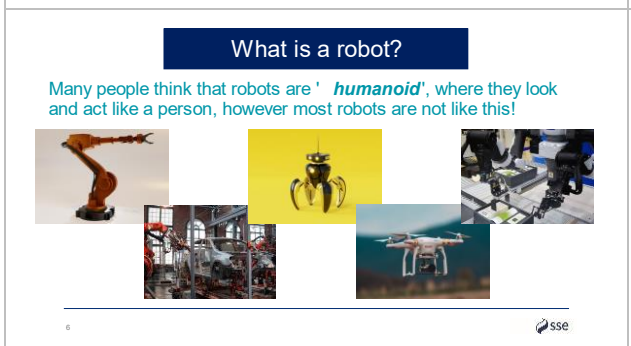
Lesson 1

RISE OF THE ROBOTS

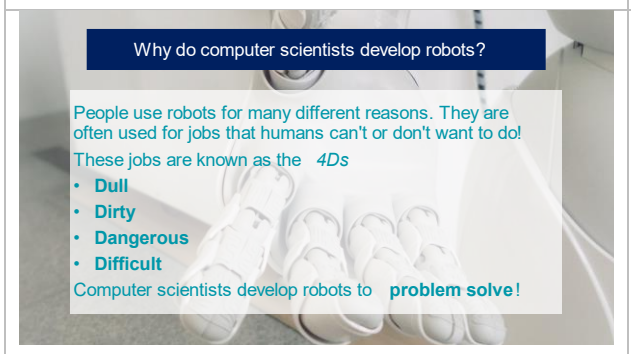
	Introduce yourself as the educator.
	Briefly introduce yourself and explain who SSE are and what they do.
	**Do Now (5 mins)** Leave the following question on the board for pupils to engage with: *'What do you know about robots?'* Ask pupils to discuss with their talk partners and share their ideas aloud – the facilitator may refer them to familiar popular culture including well-known literature, films and toys
	Explain key words used in the lesson



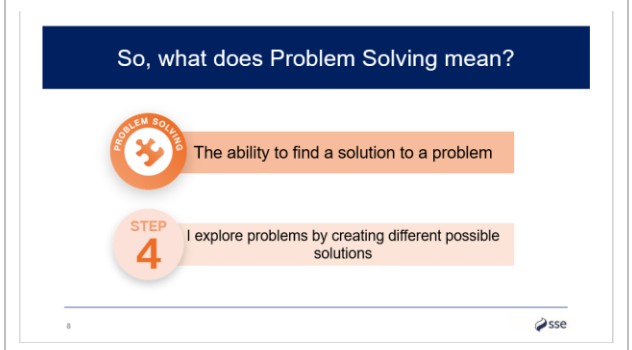
Introduce pupils to the concept of a robot and artificial intelligence



Clarify the idea that not *all* robots look humanoid like the cartoons we see on screen



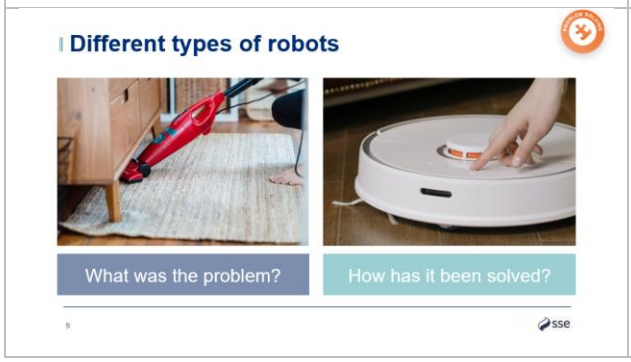
Explain how robots serve a range of purposes



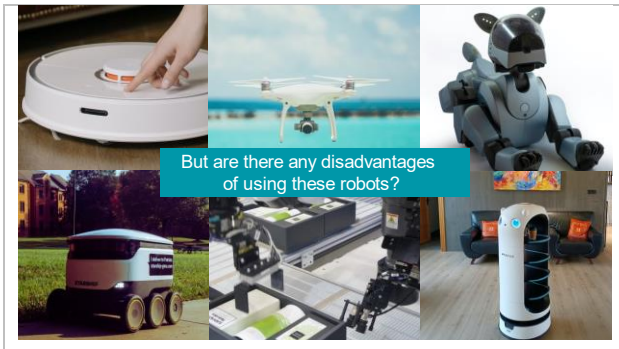
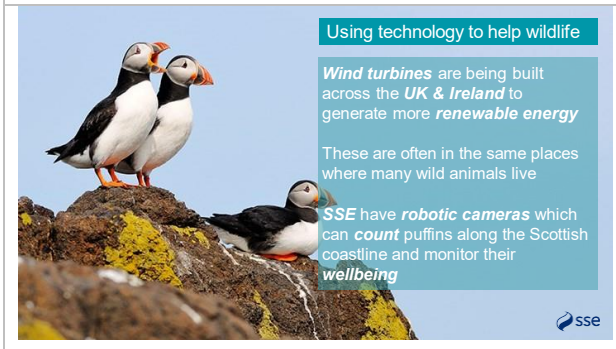
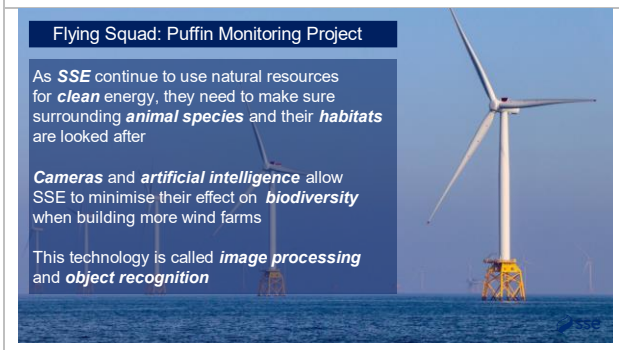
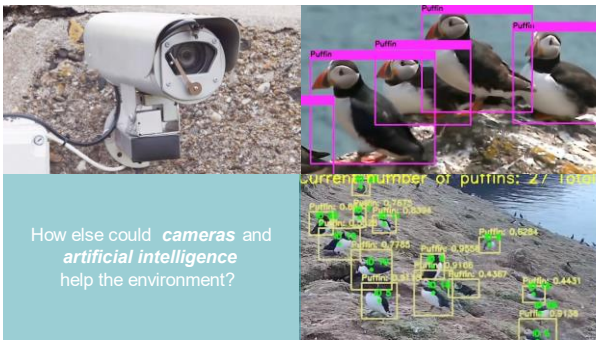
Explain that Problem Solving is the ability to find a solution to a problem.

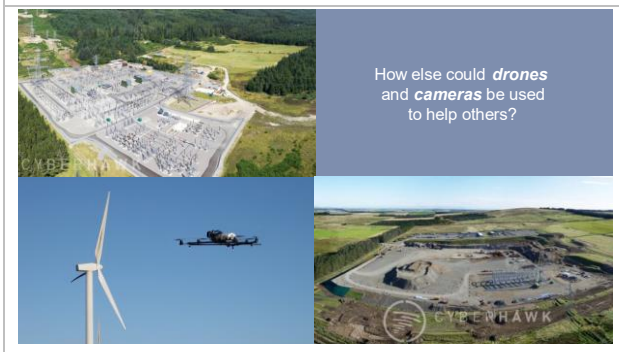
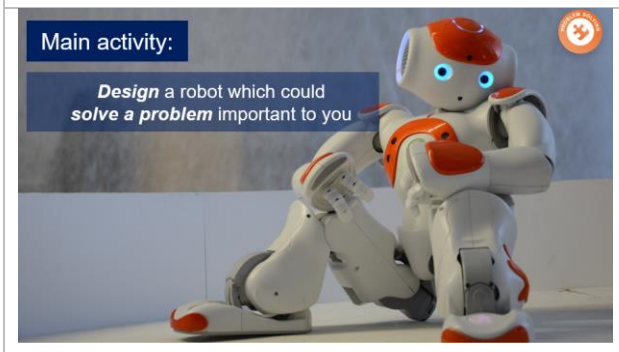
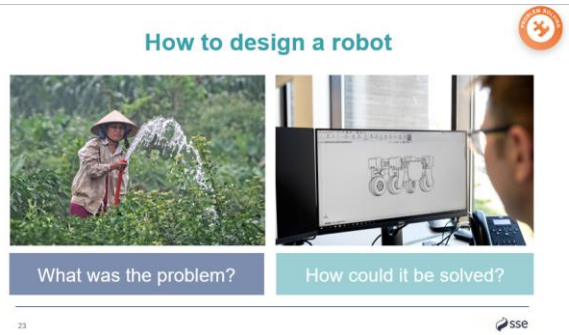
Explain that throughout the lesson, children will be working on Step 4 of Problem Solving: exploring problems by creating different possible solutions.

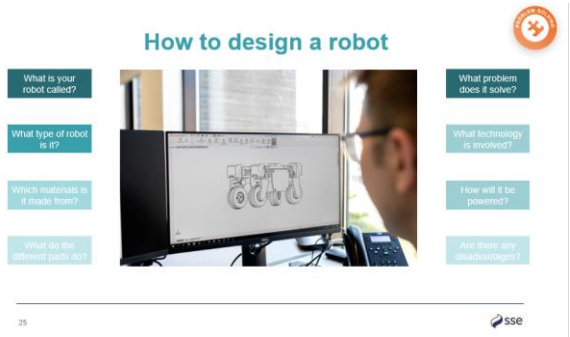
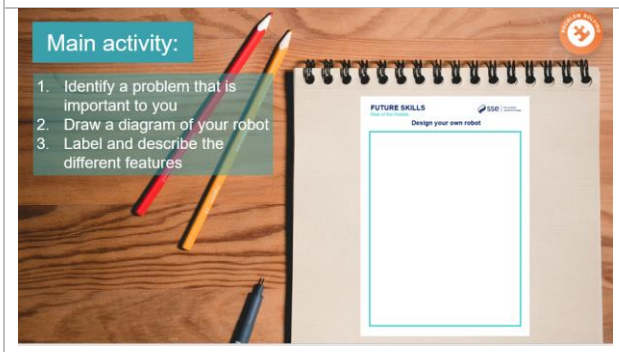
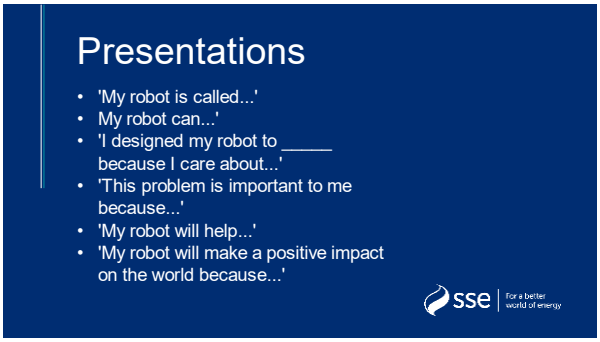
Optional: Describe when you have demonstrated this skill step in your own role

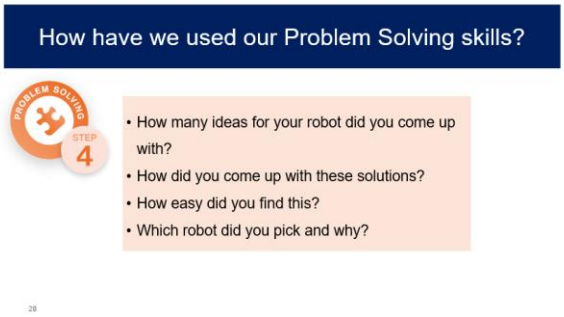


Use side-by-side pictures to compare the problems to the robotic solutions – pupils should discuss with a talk partner before sharing their ideas with the class

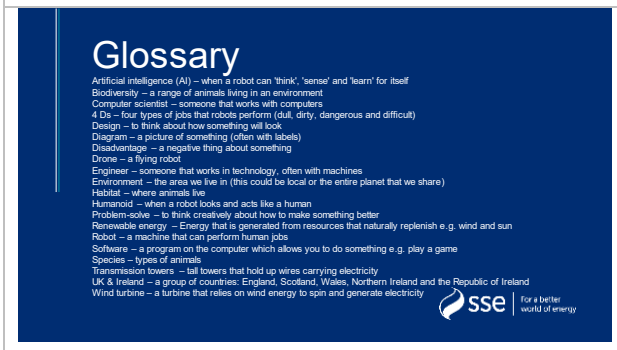
	Discuss whether there are any disadvantages of using these robots - pupils should discuss with a talk partner before sharing their ideas with the class
	Explain how SSE are addressing a problem important to them: protecting wildlife in the UK & Ireland
	Introduce the Flying Squad initiative where camera and artificial intelligence technology enable SSE to monitor animal species while installing new hydro power stations and windfarms
	Ask pupils if they can think of other ways that cameras and artificial intelligence could help the environment – e.g. monitoring any other endangered species Share how SSE intend to support dolphins, porpoises and other sea birds Pupils should discuss with their talk partner first before sharing ideas with the class
	Explain the automated drones project with Cyberhawk (iHawk software) to inspect transmission towers and wind turbines in Scotland, Northern Ireland and Republic of Ireland

	Introduce the Flying Squad initiative where camera and artificial intelligence technology enable SSE to monitor animal species while installing new hydro power stations and windfarms
	Ask pupils if they can think of other ways that drones and cameras could help the environment – the facilitator may use these aerial photos to further explain how SSE utilise drones (to take high quality images and videos of substations across Northern Scotland for inspection) Pupils should discuss with a talk partner before sharing their ideas with the class
	How to design a robot Explain that as responsible citizens, pupils will become roboticists themselves to solve a real-world problem
	Show example – compare the chosen problem to the robotic solution – someone needs to manually water the crops Pupils can guess what the robot might be solving with their talk partner before sharing with the class The robot being designed is a farming robot that can water plants itself
	Present some example problems which could be addressed via a new robot (these are optional and pupils should be encouraged to consider what matters to them personally)

	Discuss the different features of the robot design e.g. the name, type, materials, parts, function, technology involved, advantages and disadvantages Pupils can discuss the questions on the slide with their talk partner as they begin to imagine what problem they are going to solve and how they are going to design their robot All children should be encouraged to think about the questions on the left Higher attaining children should be encouraged to think about the questions on the right additionally and incorporate ideas from the lesson into their work e.g. Artificial intelligence for counting things or sensors to tell a robot when to move when it faces obstruction
	**Pupil Practise**: Designing your own robot (15 mins) Assign pupils the task of designing their own robot to problem solve following the three steps SEND pupils can focus on just drawing their robot Higher attaining pupils can label their design and write short descriptions to describe their design
	**Review of learning:** Presentations (10 mins) Ask pupils to present their design proposals to the class – promote a discussion on the appearance, purpose, functionality, impact and ethicality of their suggested technologies Explain the importance of being able to communicate your ideas with others, whether it is using a short simple stem sentence or explaining using your own words, as they will be required to speak in front of others in almost any STEM job they may choose, whether it is robotics or another area of technology Encourage pupils to ask questions about each other's designs: What do they like or dislike? Do they understand the design and agree on How would they improve it?



Ask the children how they used their problem-solving skills. Open a class discussion around the questions on screen. This will help children understand and communicate the skill they have built alongside their knowledge.



A glossary for facilitators to refer to if they need help defining technical vocabulary

Activity	Time Allocation Guide
Do Now	5 mins
Introduction to robots	15 mins
Provide Model: How to design a robot	15 mins
Pupil Practise: Designing your own robot	15 mins
Review of Learning: Presentations	10 mins

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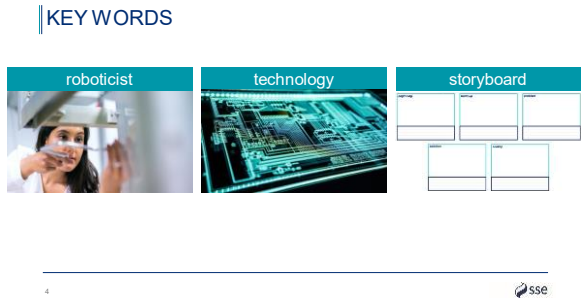
Use these timings as a guide – this can be adjusted for the session being led

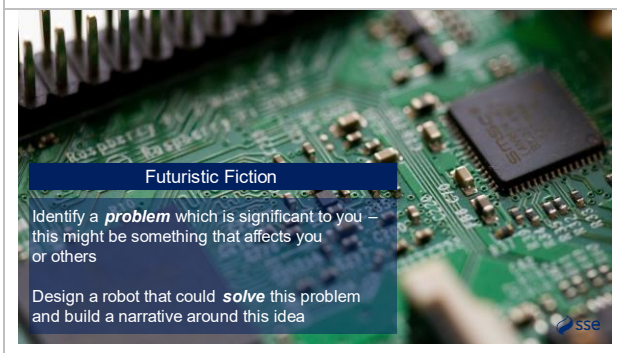
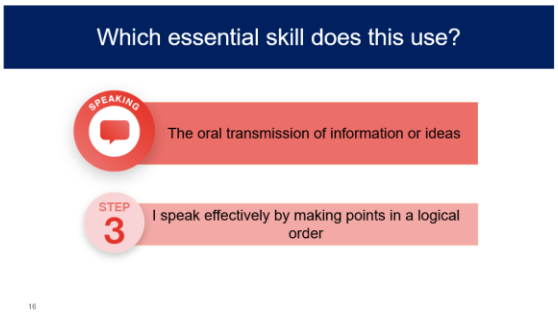
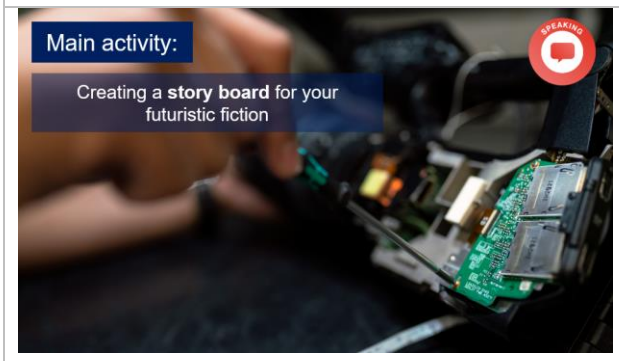
Please provide feedback via QR link – encourage children to submit examples of pupil work to social media.

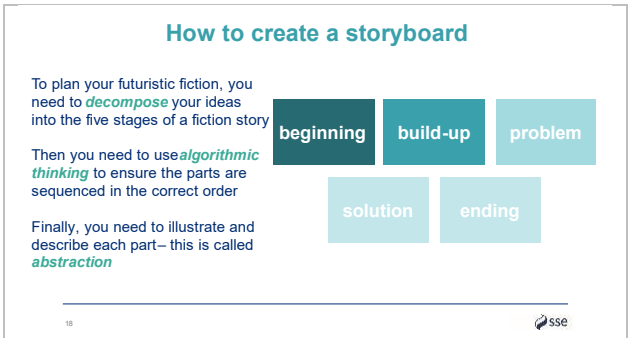
A more detailed lesson plan can be found in the SSE ‘Power Changers’ Primary booklet.

FUTURISTIC FUTURE

Lesson 2

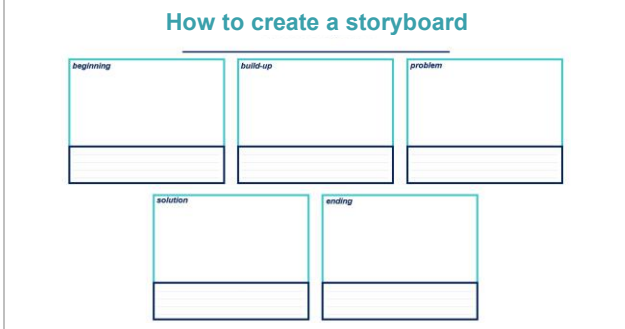
	Introduce yourself as the educator.
	Briefly introduce yourself and explain who SSE are and what they do.
	**Do Now (5 mins)** Leave the following question on the board for pupils to engage with: *'Why do computer scientists develop robots?'* Ask pupils to discuss with their talk partners and share their ideas aloud – the facilitator may refer them to examples from the previous lesson e.g. robot dog, robot waitress, robot hoover and drone
	Explain key words used in the lesson
	Remind the pupils of the previous lesson. Use side-by-side pictures to compare the problems to the robotic solutions Pupils should discuss with a talk partner before sharing their ideas with the class

	Introduce what the lesson is about – imagining futuristic fiction around how the development of a robot could help others
	Get pupils to begin thinking about which problem they are going to solve and how they could invent a robot that could fix this
	Introduce Speaking as the skill used to transmit information or ideas. Explain that whilst creating a storyboard, children will be using their Speaking skills by making points in a logical order. A logical order is putting ideas in an order that means they make sense when they follow on from each other. Optional: Describe when you have demonstrated this skill step in your own role
	Explain that pupils will need to envisage themselves as active members of the community and think of a story where they help others through developing new technologies
	Discuss the three computational skills required to create a storyboard and explain what they mean Emphasise how everyone can practise these three computational skills e.g. putting something in the correct order and that this will support them in any STEM job they may choose, whether it is robotics or another area of technology

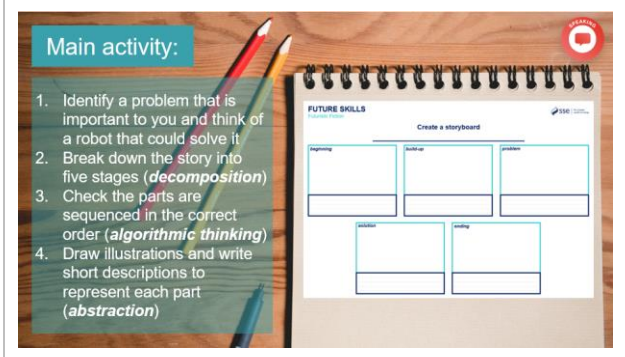


Explain how the three computational skills can be applied in the process of creating a storyboard

Present some example problems which pupils may want to choose from to think of a new robot design (these are optional and pupils should be encouraged to consider what matters to them personally)



Create a shared storyboard taking ideas from the class – Model creating a storyboard as a class taking ideas from the class as you go along

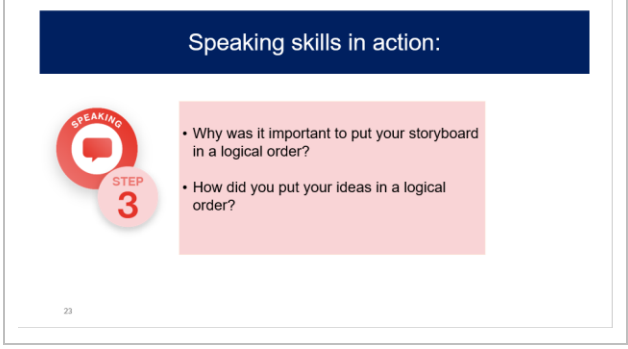


Pupil Practise: Creating a storyboard (15 mins)

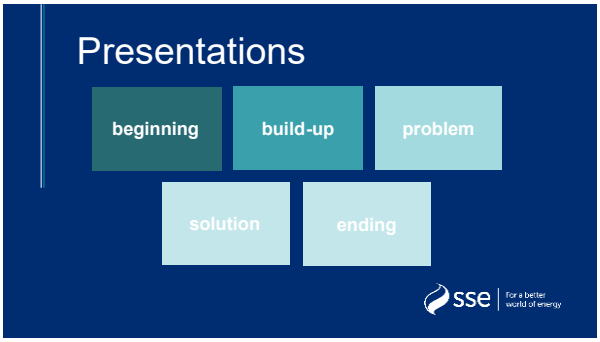
Assign pupils the task of creating a story board of them problem solving following the instructions

SEND pupils can focus use a starter picture featuring a problem to prompt them on how a robot could help others

Higher attaining pupils can illustrate and describe their storyboard in depth using any ideas they choose



Use the reflection questions to guide discussions around how children have used their Speaking skills during the lesson. This discussion will help children understand and communicate the skill they have focussed on alongside their knowledge.



Review of learning: Presentations (10 mins)

Ask pupils to orally retell their futuristic fiction by referring to their storyboards – promote a discussion on how their robot could impact the real world

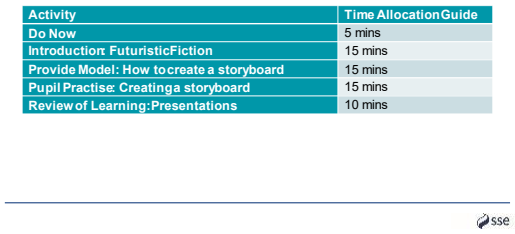
Encourage pupils to ask questions about each other's designs:

What do they like or dislike?

Do they understand the design and agree?

How would they improve it?

A glossary for facilitators to refer to if they need help defining technical vocabulary



Activity	Time Allocation Guide
Do Now	5 mins
Introduction: Futuristic Fiction	15 mins
Provide Model: How to create a storyboard	15 mins
Pupil Practise: Creating a storyboard	15 mins
Review of Learning: Presentations	10 mins

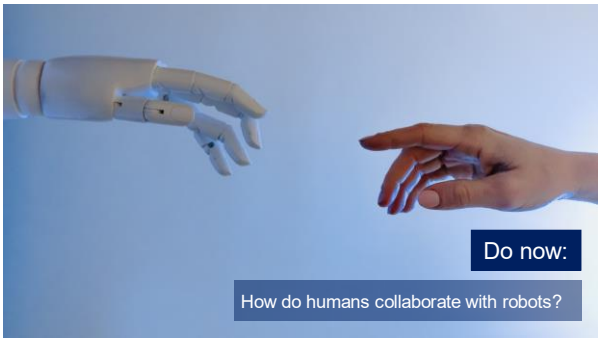
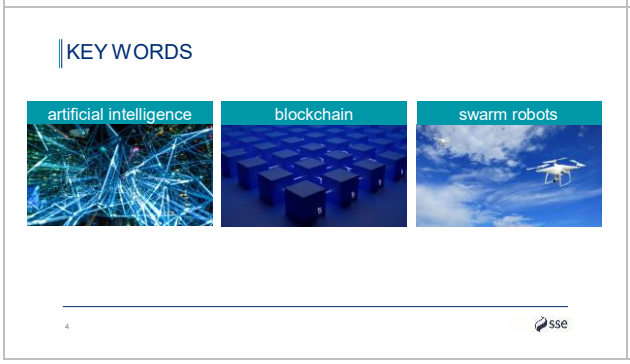
Use these timings as a guide – this can be adjusted for the session being led

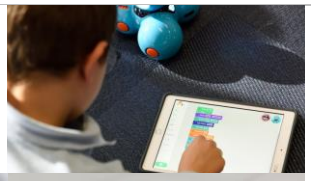
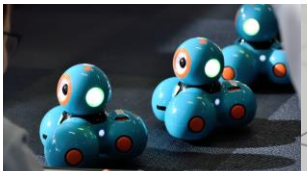
Please provide feedback via QR link – encourage children to submit examples of pupil work to social media.

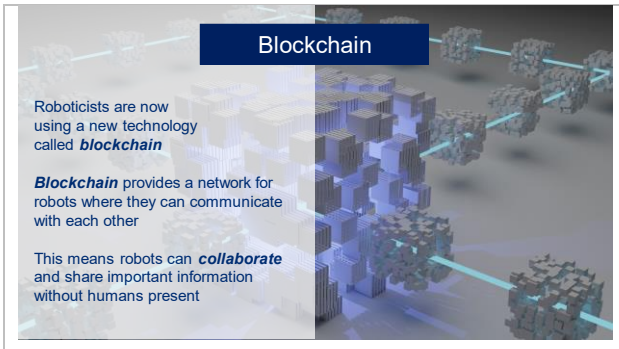
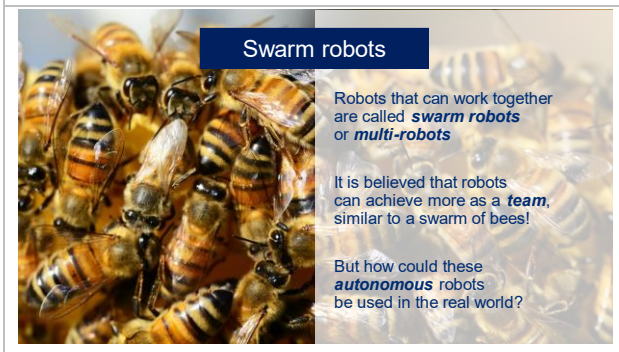
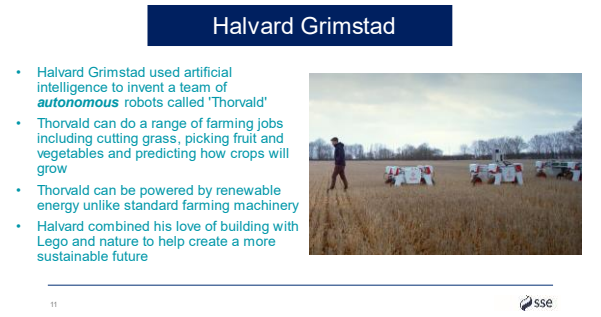
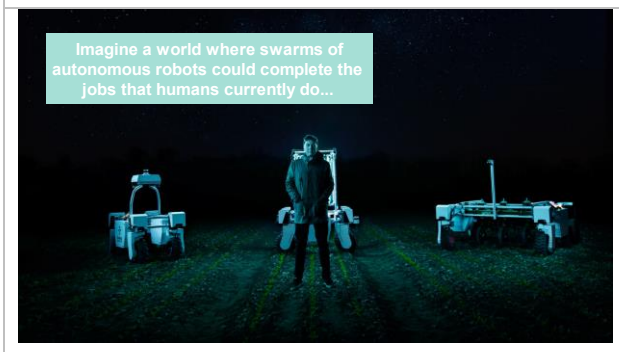
A more detailed lesson plan can be found in the SSE 'Power Changers' Primary booklet.

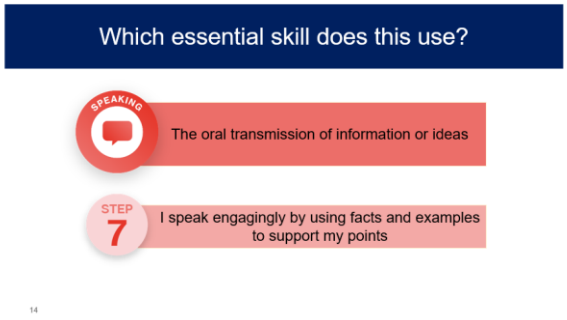
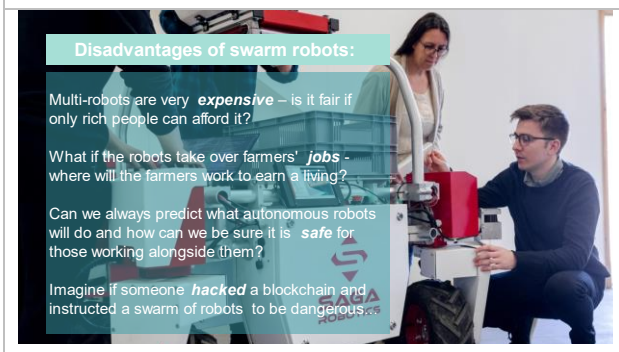
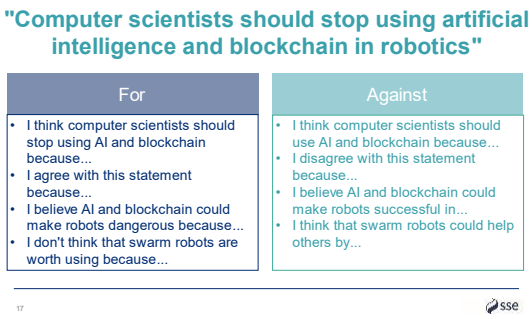
A ROBOT REVOLUTION

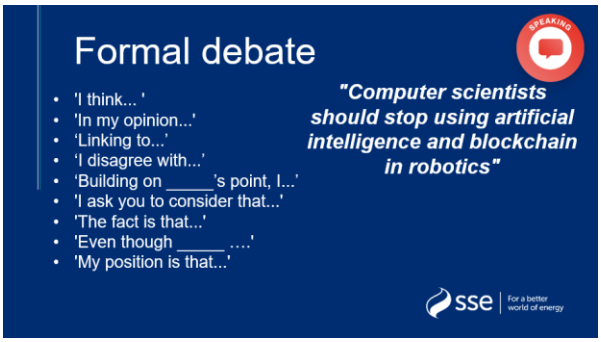
Lesson 3

	Introduce yourself as the educator.
	Briefly introduce yourself and explain who SSE are and what they do.
	**Do Now (5 mins)** Leave the following question on the board for pupils to engage with: *'How do humans collaborate with robots?'* Pupils should discuss with a talk partner before sharing their ideas with the class– the facilitator may refer them to familiar programming and coding languages e.g. Bee-bots and Scratch
	Explain key words used in the lesson

What is programming? ***Programming*** is when we control a device or machine by giving step -by-step instructions, often in ***code***!   	Explain how devices and machines require precise step-by-step instruction, often in the form of a coding language – pupils may be familiar with Bee-bots and Scratch - pupils should discuss with a talk partner what programming or coding they have used previously used before sharing with the class
 **When do we use programming?** Many of the devices and machines used in our daily lives require the use of ***computer programs***  	Discuss the different devices and machines we use daily which require programming e.g. washing machine, coffee machine and smart phone – can pupils think of anymore? - Pupils should discuss with a talk partner before sharing their ideas with the class
   **Collaborating with robots** We also use ***computer programs*** and ***code*** to control robots and tell them exactly what to do	Explain that we also use programming and code in robotics e.g. controlling a drone or toy robot
  **Artificial intelligence (AI)** Roboticists have taught some robots to 'choose' what they do in response to their environment This is called ***artificial intelligence***  	Raise the question '*Would you like it if you were controlled by just one person?*' Explain that roboticists have developed a technology called artificial technology (AI) which enables robots to 'choose' what to do, making them autonomous Discuss examples: Bionic arm – responds to signals from an individual's brain, muscle and nerves Robot vacuum cleaner – responds to obstruction via sensors Digital assistant e.g. Amazon Alexa – responds to human speech via voice recognition

	Ask pupils to imagine a world where robots can collaborate with each other Introduce the concept of blockchain – a network which allows robots to connect – e.g. drones can share their location to prevent flying into one another
	Introduce swarm robots – multiple robots that can work together without humans – remind pupils what autonomous means (robots being able to 'think' for themselves) Ask pupils how swarm robots could be applied in real life situations - pupils should discuss with a talk partner before sharing their ideas with the class
	Introduce pupils to Halvard Grimstad – a robotic engineer who is developing robots to build a more sustainable future
	Watch the video about Halvard Grimstad, a Norwegian engineer who grew up around farms and loved playing with Lego – he combined his interests in nature and assembling things together to make an agricultural robot to improve farming https://www.youtube.com/watch?v=Z2-G7wY6DCE
	Ask children to imagine a world where swarms of autonomous robots could complete the jobs that humans currently do - pupils should discuss with a talk partner before sharing their ideas with the class

	Recap Speaking as the skill used to transmit information or ideas. Explain that all scientists use the skill of Speaking when presenting their ideas to peers. Explain that whilst preparing for and having the debate, children will be using facts and examples to support their arguments. Optional: Describe when you have demonstrated this skill step in your own role
	Explain that like with all new technologies, there may be some disadvantages Discuss some disadvantages of swarm robots
	"Computer scientists should stop using artificial intelligence and blockchain in robotics" (pupils will essentially think about the moral ethics of using swarm robots)
	Explain guidelines for debate – ask pupils if there are any other rules they can think of e.g. not interrupting a peer
	**Pupil Practise:** Preparing for the debate (10 mins) Assign pupils the task of arguing for or against the talking point – they can work individually, in small groups or as a whole team to verbally prepare for the debate (encourage them to use stem sentences to build their arguments) Ensure that pupils are balanced fairly and that groups have mixed attaining pupils in them to support each other

	Explain the importance of being able to present your point of view in a discussion with others, whether it's using short simple stem sentences (appropriate for SEND) or explaining using your own words (appropriate for higher attaining pupils), as they will be required to think about their opinion and tell others aloud in almost any STEM job they may choose, whether it is robotics or another area of technology
	**Review of learning**: Formal debate (15 mins) Host a formal debate on the assigned talking point: "Computer scientists should stop using artificial intelligence and blockchain in robotics" Encourage each pupil to express their opinion at some point during the debate using the sentence stems – try to allow pupils to invite others into the discussion themselves Provide pupils with the opportunity to declare what their final opinion is – have they changed sides and why?
	Use the reflection questions to guide discussions around how children have used their Speaking skills during the lesson. This discussion will help children understand and communicate the skill they have focussed on alongside their knowledge.
	A glossary for facilitators to refer to if they need help defining technical vocabulary

<table>
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<table>
<tr><th>Activity</th><th>Time Allocation Guide</th></tr>
<tr><td>Do Now</td><td>5 mins</td></tr>
<tr><td>Introduction to collaborating with robots</td><td>15 mins</td></tr>
<tr><td>Provide Model: Guidelines for debate</td><td>15 mins</td></tr>
<tr><td>Pupil Practise: Preparing for the debate</td><td>10 mins</td></tr>
<tr><td>Review of Learning: Formal debate</td><td>15 mins</td></tr>
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<td>Use these timings as a guide – this can be adjusted for the session being led</td>
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HOST FEEDBACK
Host Feedback
Can you make your robot design using junk modelling or Lego Mindstorms?
Please share your work with us on social media using our hashtag #STEMatSSE
@SSE
@SSEplc
Contact us at stem@sse.com to request a volunteer from SSE to deliver the lesson


</td>
<td>Please provide feedback via QR link – encourage children to submit examples of pupil work to social media.</td>
</tr>
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A more detailed lesson plan can be found in the SSE ‘Power Changers’ Primary booklet.