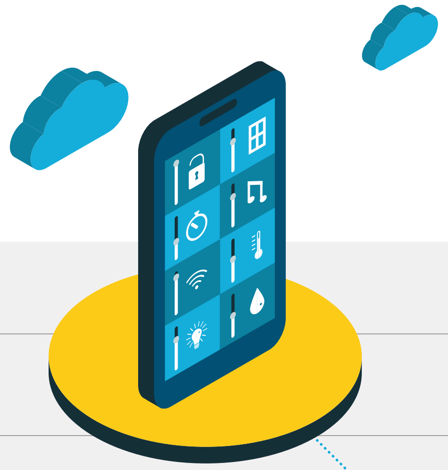
LITTLE BIG FUTURES

Delivery guidance document for STEM Ambassadors

Contents



Introduction

This booklet will provide you with additional background information to the CISCO Little Big Futures projects, with handy hints and guidance to help you deliver the activities confidently in schools.

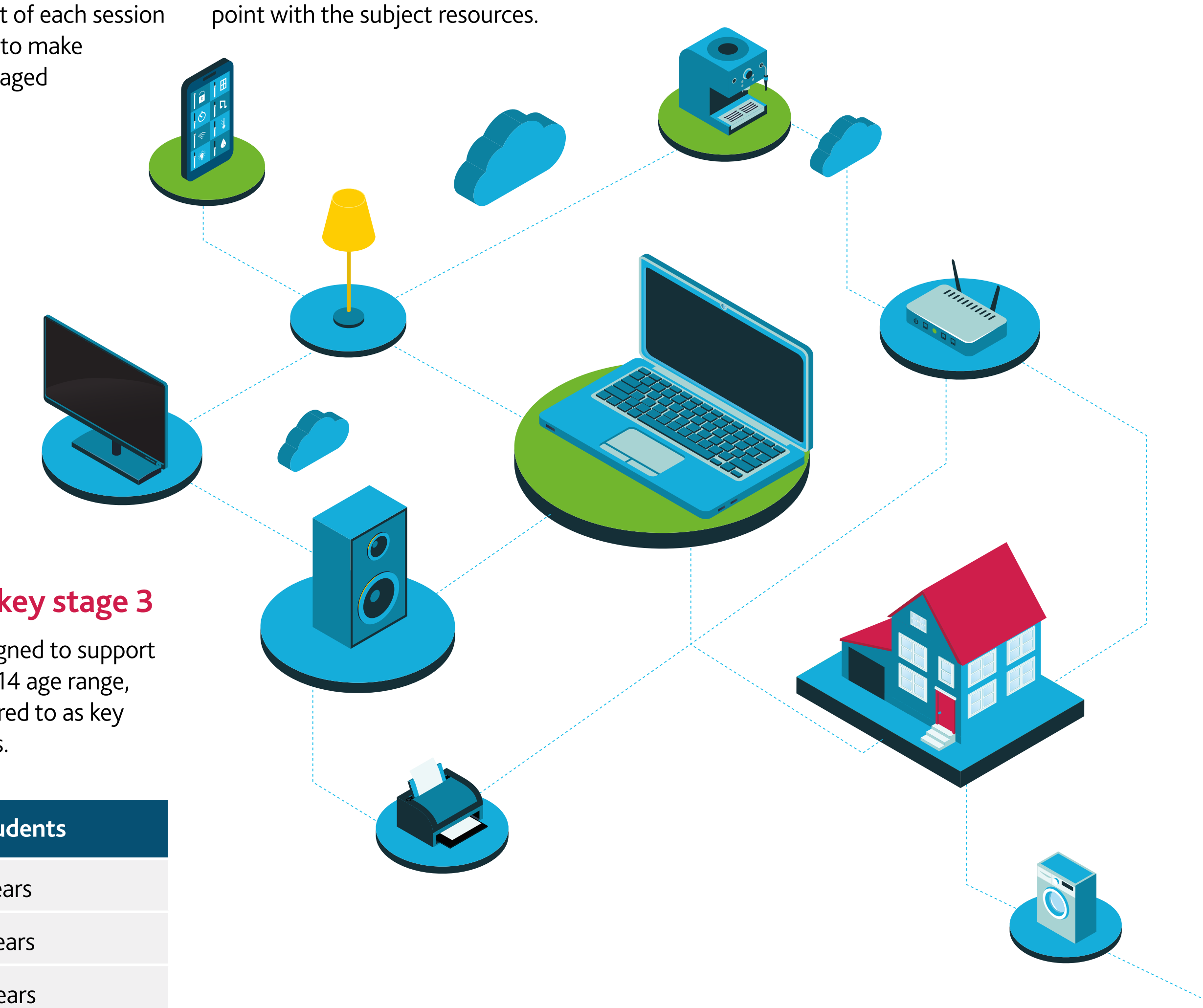
As a STEM Ambassador you'll be bringing your experiences into the classroom and the resources to life as you demonstrate the value of STEM in the real world. Drawing on your own experiences and sharing current applications will help students to contextualise their learning and relate it to other areas of their studies. It will bring their learning to life.

Practical suggestions will help you to clearly communicate a passion for STEM to students and manage different learning scenarios in school. For example, one section looks at tried and tested questioning techniques to get young people talking at the start of each session or managing group work to make sure that everyone is engaged with the task.

Resources have been created to capture students' interest with the internet of things (IoT) and promote STEM career pathways in four curriculum areas – Computing, Science, Maths, and Design and Technology. Additionally, a series of resources have also been created to use with groups joining an extra-curricular STEM Club.

Each section comprises an introductory 1-hour session and a 4- or 5-hour exploration linked to accreditation through the CREST Awards initiative. Liaising with a teacher at the school that you'll be supporting, you'll be best placed to make a decision on the most appropriate starting point with the subject resources.

Fire safety is a topic that can provoke extreme emotional reactions, and it is possible that some of the students may have suffered trauma as a direct result of fire. They are likely to be aware of fatal incidents which have received extensive media coverage. Whether or not your students have any actual association with victims of fire there is a need for accuracy, sensitivity and respect when discussing in the classroom.

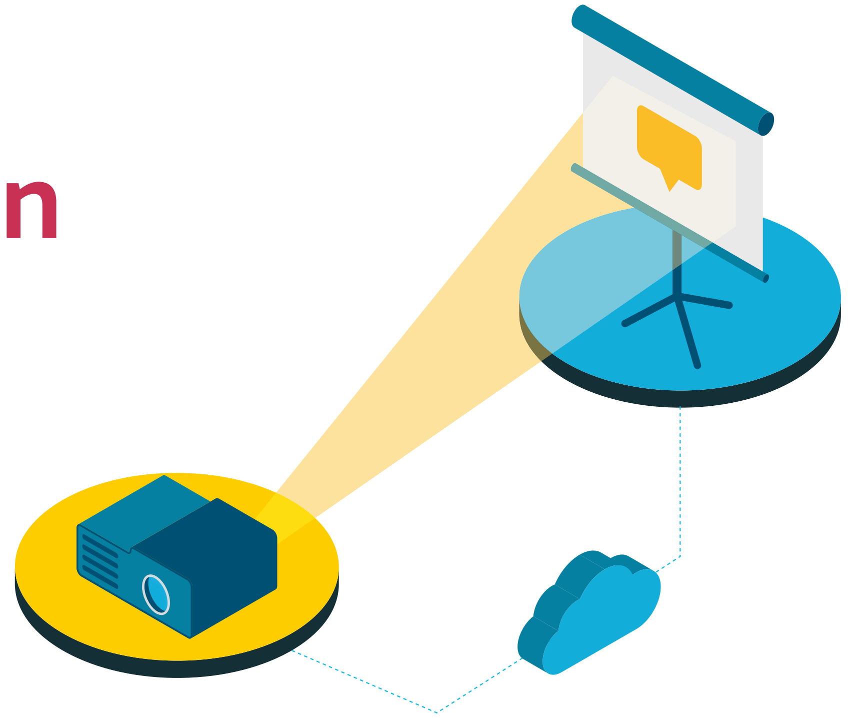


Easy reference to key stage 3

Activities have been designed to support learning across the 11 to 14 age range, which is commonly referred to as key stage 3 (KS3) by teachers.

Year	Age of students
7	11 to 12 years
8	12 to 13 years
9	13 to 14 years

Presenting information



Talking sense and sensors

Be yourself when visiting a school and working with young people. Giving a personal anecdote or sharing a funny story, as well as information about your job title, will stick in students' minds after you've left. Want to inspire the next generation of STEM professionals? Describe the steps you took in your own career pathway to reach your current role, and remember that sometimes the challenges or complexities that you may have faced are the most interesting for students. That doesn't mean forget about any exciting projects and memorable moments though!

Leave any acronyms and work jargon at the school gate and use plain English when you start to share an enthusiasm and passion for your field of work. Once you've built a rapport with the group, and their understanding of new concepts, terms and projects has increased, it might be time to turn the mouthful that is the 'internet of things' into 'IoT'. You'll know when it's time when you've checked their understanding – see the section about scaffolding learning for other useful tips.

Effective presentations

If you find yourself in a position to give a more formal presentation or talk to a group of students, apply your own communication techniques from the workplace to the classroom and think about prioritising visual aids over text.

Audio visuals will help students to capture and focus their attention on your key message; do not underestimate the phrase 'a picture is worth a thousand words'. Learning about the architecture of the IoT, or relating the transfer of data to another project, is difficult for some students to grasp and much clearer to explain with a diagram.

The human brain processes images 60,000 times faster than text, and 90% of information transmitted to the brain is visual; worth remembering as you reduce the amount of text from presentation slides to include photographs, sketches, audio or short video clips that will reinforce and clarify your verbal message. Bringing a model of a solution or hardware and sensor components into the classroom is also a powerful way to explain a concept. Students will love the opportunity to see and relate that real-world relevance brought into their own school.

If you're introducing our connected world with the IoT, consider a range of user cases that will appeal to the different interests of young people.

Check students' understanding to find out which examples they're already aware of, such as smart home or transport solutions, and widen their perspective with other themes.

Projects that improve health, conservation and the environment could also be the hooks to enthuse a group and become a catalyst for deeper learning.

Websites such as www.pexels.com are a great place to find free stock images if you're unable to share your own projects.

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Promoting STEM pathways as a role model

One of the most effective ways to encourage students to consider particular fields in STEM is to introduce them to diverse role models. People that they can relate to. Your time spent with young people in school is a brilliant opportunity to share a passion for your role and boost attitudes and perceptions of career pathways.

Attitudes might have been skewed by stereotypical stories of what it's like to work in science, technology, engineering or maths (STEM) fields. Students might not be aware of the creative or collaborative career opportunities that match their current skills and interests. Sharing what your working day and week can look like and how you collaborate and interact with colleagues can change those perceptions.

A common misconception is that scientists work alone in a laboratory setting and this might affect the motivation of some young people to pursue a possible career path. Research highlights that women and girls in particular value working with others and using skills in STEM to change lives. Describing your role, responsibilities and how you work can change perceptions and open up new possibilities for students to consider.

Personal stories will engage students and help them connect to your life and career. They'll enjoy hearing about your own dreams and aspirations whilst at school, describing how your own career pathway developed or if you've ever dealt with challenges along the way. The route to your current job will form an important part of supporting, inspiring and establishing a working relationship with a new group of students in school.

- What qualifications or skills did you need to have in order to apply for your job?
- Does your diary need to be flexible and ever-changing in response to findings?
- Who has helped you to make decisions about your career over time?
- What advice would you give to yourself if you were just starting your career or at school?
- What are the roles of other colleagues who you work alongside or collaborate with?

Relating specifically to the IoT, try to share the range of job descriptions and diverse roles of colleagues connected to the industry. For example, what does a 'day in the life of a colleague' look like working in one of these areas:

- Sales and marketing
- Design
- Hardware and software development
- Engineering
- Science
- Cyber security

Managing learning

Questioning

Effective questioning strategies will engage the students and extend their understanding of the IoT and career pathways in STEM. Try some of these techniques in the classroom to build on young people's existing knowledge and facilitate interactive sessions.

Ask open-ended questions

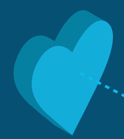
- Phrase the question so that students can't give a yes or no answer, for example "How might the internet of things improve fire safety?"
- Develop questions and build to 'higher order' questioning techniques, such as "What would happen if… real-time data from across a city was shared through a dashboard?" or "How does that compare to collecting data in the past?"

Ask one question at a time

- Give the group 5 to 10 seconds to process the question and then ask for responses
- Acknowledge and praise everybody's input to show that you value their answer
- Use other words to rephrase the question if students don't respond

Spark curiosity and imagination in students by using a different approach, for example:

- "If this is the answer… what is the question?"
- "One more question" – get students to work in pairs or small groups to come up with a final 'quality question' about a theme to extend their learning. What would they like to ask?
- Build a 'question wall' in the classroom with students adding their own questions written on individual Post-it notes. Encourage every student to contribute to the request for more of your insights and remind them that each note can be anonymous.



Peer review

Facilitating an activity based on peer review will challenge the group to think critically as they synthesise knowledge gleaned from other people's projects. Students will need to recognise and understand the concepts and skills used, communicate a response based on intended learning outcomes and make recommendations for improvement. Ask the teacher in school if they have a peer review template already or create one with the group of students as an activity in itself.

Example questions might include:

- Is the intended audience and purpose of the project clearly established?
- What did you most like about the design or project?
- What would you change?
- What other suggestions could help somebody to improve their project?

Scaffolding learning with scaffolding techniques

Instructional scaffolding is a technique that you can use in classroom settings to support students and promote a deeper level of learning.

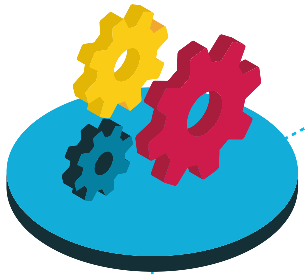
It's an effective tool to support their stronger understanding of new terms, knowledge and skills. Scaffolding will ultimately help students to become more independent and confident in their own learning journey. Just like physical scaffolding on a construction site, this support is temporary and can be removed when students demonstrate higher levels of mastery. Success is observing students managing their own research and learning by implementing these scaffolding strategies independently.

Scaffolding is sometimes referenced as a way to bridge learning knowledge. You can help students to fill any current gaps in knowledge by connecting your experiences of STEM in the workplace to real-world applications and relating that back to what they're learning in school. Making connections is a really effective way to build knowledge and understanding.

Example scaffolding techniques to try in school

Technique	Example
Think-Pair-Share	Pose a question to the students and give them 2 minutes to think about their response. For example: "What equipment do firefighters use in their role?" Get them to write down their answer or thoughts on a mini whiteboard or piece of paper. Now get them to talk about their responses with another student as you pair them up and they consider both views to refine or construct more ideas. Allow about 5 minutes for this task and then bring all of the group's thoughts together as you lead a discussion and ask for input from each pair. It's useful to collate and theme this information at the front, perhaps on the board, as the group shares their collective thoughts with each other.
Modelling	Model an answer to a question or share a process by drawing out the steps and talking through your thought process. For example: "How might fire prevention systems that connect to the internet save lives?" 'Think-aloud' statements are a great way for students to observe you making connections and inform next steps to answer your question or finish a design process. Vocalise your thoughts as you map out your answer.
Access prior knowledge	Write the question or challenge that the students are responding to on the board or a piece of paper. Using questioning and discussion, start to map out what they know already about the subject or particular concept. What knowledge or ideas can they bring from other subjects and from what they have learnt outside of school? You'll be able to show students how they can link all of this information and use it to build on what they know already. Explore links and connections to the IoT from science, maths, computing and engineering. These could include solving real-world problems, scientific investigation or data handling and analysis.
Contextualise learning	Building blocks for learning. When you've understood what students already know, you'll be able to build on that prior learning. Taking a step-by-step approach with new knowledge, your examples within a work context will help students to construct their own understanding. You might take what they know already from maths about handling data and make connections with the IoT. Measuring temperature with a single sensor and interpreting findings can lead to real-world links with data sets and big data collected from programmes using the IoT. How can the fire service use connected data from across the city to save lives? Which data sets are important to them as indicators of potential danger?
Visualise	A picture is worth a thousand words and drawing a diagram or a mind map can really support a student's understanding. If you've got a digital application example in mind, and you can take the equipment into school, the students will be able to construct knowledge using the hardware as a conceptual base. Visualising a problem or project is a great scaffolding technique to help students organise their thoughts. If you're presenting new information then a photograph or an image, particularly of a real-world application, model or an artefact, will help young people to realise their relevance in the digital world.
Check understanding	After you introduce a new concept or skill, give the students time to assimilate the information and then ask questions to reinforce their learning. Through discussion you'll be able to judge when they make progress beyond just recalling information and demonstrate a deeper understanding. A really good method to use with students is to get them to organise and summarise their learning. You could give them a real-world user case of the IoT and ask them to explain the flow and direction of data between sensor, device, cloud and data dashboard.

Facilitating group work



In school you'll have a teacher in the room to support and implement classroom management strategies. When you're planning and thinking about your own activities beforehand, there are some proactive steps that you can take to enhance the learning experience and curb the chaos of hands-on projects or group challenges.

Group decisions

- Ask the link teacher to help with dividing the students into smaller learning groups.
- Group sizes will depend on the activity and roles to be allocated, and will probably be between three and six.

Be clear

- Provide clear instructions for each activity or practical task.
- Consider writing a step-by-step guide on the board if you're asking students to evolve their project over a longer period of time.
- Set an expectation of what students should produce or share within a timescale, for example, "Over the next 10 minutes, discuss why people install fire detectors and write down three reasons to share with the rest of the group. Think about the location of detectors at home or in school and add that to your response".

Assign roles

- If you've given a task for groups of three students to discuss a solution or question, assign one person as chair, one as recorder and the other as reporter to share their discussion with the wider group.
- Extended and practical projects over a period of weeks might suit a larger group of six students better. The team might include roles for paired programming, design, build, testing, data collection and analysis etc.
- Consider rotating the groups and roles each session.

Guide each activity with time

- Students will engage and respond to a deadline for questions or activity.
- If groups are working on a longer task, separate the project time into smaller and more manageable chunks. For example, give them 20 to 30 minutes to work on an activity and then reconvene with a discussion to assess progress. That way you'll be checking understanding and sharing best practice from each group.

Stipulate closure for each group activity

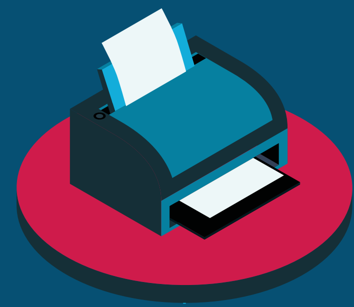
- Let the students know what's expected from them after their group discussion or shared project. For example, one person will verbally report back with suggestions to the wider group, share their design for collecting temperature data on a PowerPoint slide from the front of the room or talk about their project during a carousel of 'show and tell' table demonstrations.
- Include time for feedback and reflection.
- Be flexible and respond to changes in noise levels!

Computing

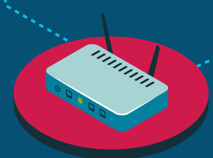
Students' prior knowledge

Computing became a new subject in the curriculum during 2014 as it replaced ICT (Information and Communication Technology) and is divided into three strands of study:

1. Computer Science – CS
2. Digital Literacy – DL
3. Information Technology – IT



The overarching purpose of the curriculum is to equip students with the knowledge and skills to use computational thinking, creatively solve problems and demonstrate a mastery of programming to better understand and change the world.

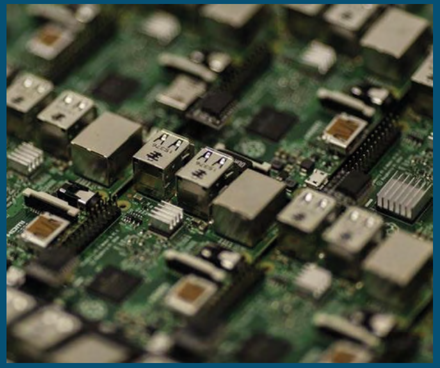


Computing in key stage 3

The curriculum helps students to develop their logical thinking, problem-solving skills and resilience in both practical and theory-based learning scenarios. They'll explore concepts that include abstraction, sequencing, decomposition and core programming constructs.

Students will use a range of hardware and software chosen by the teacher, creating programs and learning how computers work. You might hear them talking about learning to code with physical computing projects using a Raspberry Pi minicomputer or the BBC micro:bit. Both of these examples, and a range of other devices and microcontroller boards, enable students to connect sensors to the hardware and explore the possibilities of collecting data through the IoT.

In Years 7 to 9, students should have used at least two programming languages and one in a text-based environment. Scratch and Blockly are popular visual programming languages installed and taught in schools. In recent years, Python has established itself as one of the easiest text-based languages to learn to program in. As a result a large number of teachers are utilising it in their programming courses.



Aims of the curriculum

By the end of key stage 3 all students will be able to:

- understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation (Computer Science)
- analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems (Computer Science)
- evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems (Information Technology)
- be responsible, competent, confident and creative users of information and communication technology (Digital Literacy)

Activities within CISCO Little Big Futures

In the 5-hour activity, teams will design a fire-safety solution, making use of connected technologies and the IoT, and work together to integrate the different aspects of the solution. As they work through the project and challenges, students will develop skills in self-management, problem solving, teamwork, research and communication. They'll also have the opportunity to draw upon knowledge from across other curriculum subjects and outside of school.

Students will be able to build on learning from all three strands of the computing curriculum as you introduce the topic and activities around a theme of the IoT.

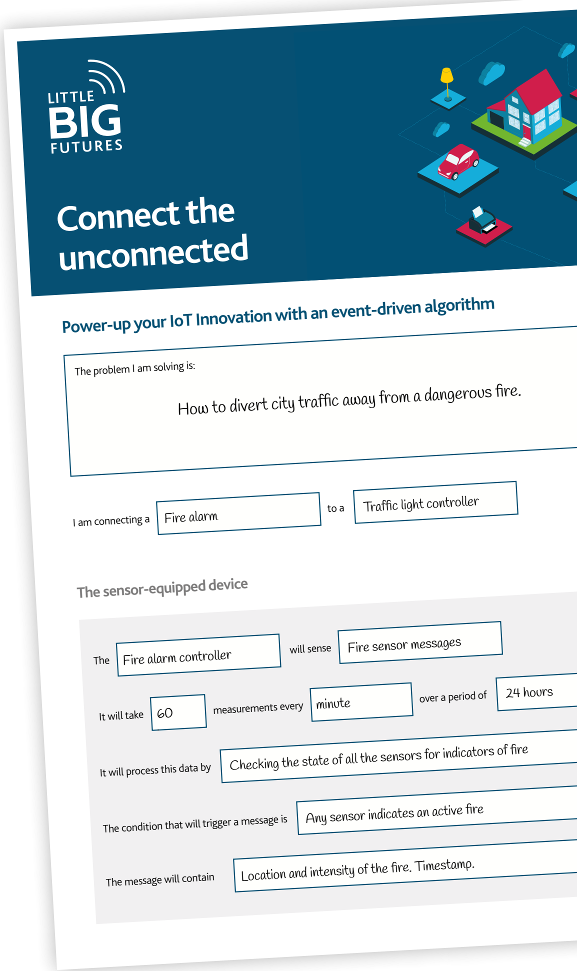
For example:

- designing a simple IoT system made up of sensors, wireless network connection, data analytics and programming the control software (Computer Science)
- aspects of cyber security and the safe use of technology alongside data privacy (Digital Literacy)
- undertake creative projects and select the right application to use to collect and analyse data from an IoT sensor project (Information Technology)

Extending learning opportunities with real-world examples

Relevance of application to real-life scenarios will bring alive learning in the classroom so, if possible, take along some examples of user cases or project hardware to talk about in school. The 'Devices card for computing' resource in this section is a useful guide to what's covered in this module.

Likewise, for the 'Connect the unconnected' task, which is a writing frame, modelling an answer based on your own experience will give the students another opportunity to talk about computing in industry and recognise further careers information and guidance.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Connect the unconnected

Power-up your IoT Innovation with an event-driven algorithm

The problem I am solving is: How to divert city traffic away from a dangerous fire.

I am connecting a Fire alarm to a Traffic light controller

The sensor-equipped device

The Fire alarm controller will sense Fire sensor messages

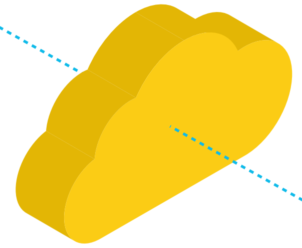
It will take 60 measurements every minute over a period of 24 hours

It will process this data by Checking the state of all the sensors for indicators of fire

The condition that will trigger a message is Any sensor indicates an active fire

The message will contain Location and intensity of the fire. Timestamp.

Design and technology



Students' prior knowledge

Design and technology (D&T) is a practical subject where students use their imagination and creativity to design and make products to solve real-world problems.

Groups will be able to draw on your enthusiasm and context around maths, science, computing, engineering or art to improve their current understanding and you'll be supporting them to go on and develop more complex and creative solutions.

It's not all about subject knowledge, though. The D&T curriculum equips young people with the skills and knowledge needed to become capable citizens, and that includes being resourceful, enterprising, resilient, taking risks and using an innovative approach with design. Context from your own experiences and work-related examples of these skills can add a fresh perspective to students' perceptions of learning in design and technology and future STEM pathways.

Aims of the curriculum

At the end of Year 9 students will be able to:

- develop the creative, technical and practical expertise needed to perform everyday tasks confidently and to participate successfully in an increasingly technological world
- build and apply a repertoire of knowledge, understanding and skills in order to design and make high-quality prototypes and products for a wide range of users
- critique, evaluate and test their ideas and products and the work of others
- understand and apply the principles of nutrition and learn how to cook

Design and technology at key stage 3

The curriculum is often organised by teachers taking the following areas of design and technology to deliver a rotation timetable. Students across KS3 may spend a term at a time learning and applying each area during Years 7, 8 and 9:

- Product Design
- Systems and Control
- Textiles
- Food Technology and Nutrition

Activities within CISCO Little Big Futures

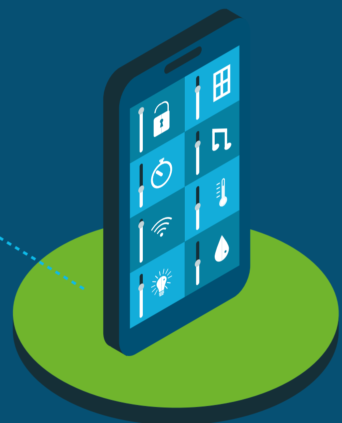
The D&T activities will support you to take exciting real-life scenarios into the classroom and ignite inspiration. Students will develop projects to explore and improve safety equipment used by fire and rescue services, and consider how the IoT can save lives and improve the safety of firefighters themselves.

If you're supporting students over the extended 5-hour activity, they'll have the opportunity to design and build a working prototype of their own new product. Guide them with scaffolding techniques to structure their research into existing firefighting equipment. This will be an effective way for them to manage their design process, consider the art of the possible and develop an idea with embedded sensors and the IoT.

Your input will be valuable when researching firefighting equipment to develop new design ideas with the IoT.

Extending learning opportunities with real-world examples

Students will design an improvement to an existing piece of equipment or uniform used by firefighters, so examples of a design process from industry will be really useful for students. That real-world context, shared as a paper-based resource or multimedia presentation, will support their own design iterations as they make progress from paper-based prototyping to building a physical computing project.

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Fighting fires with the Internet of Things

DESIGN AND TECHNOLOGY STUDENT BOOKLET

Objective:

Design a piece of equipment that can be used by a firefighter that demonstrates how the Internet of Things (IoT) can make their lives safer and their work more efficient.

Design context:

Every day, firefighters perform a range of tasks and overcome challenges to keep the public safe. Your task is to research the different tasks that firefighters perform, the equipment they use and the environments they work in and using your knowledge of the Internet of Things, improve the equipment that they use to make their jobs safer and more efficient (eg saving time, materials and money).

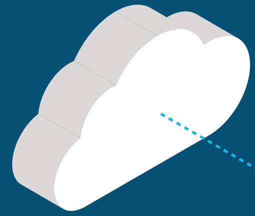
Research

Find out about the types of tasks firefighters do. When they aren't working to put out a fire, what other tasks do they do as part of their job?

Once you have a clear idea of the tasks that firefighters undertake, record the environments that they work in, the types of equipment that they currently use to do these tasks and the challenges or problems they face.

Top tip! Could you contact a firefighter and ask them about their job? Designers often research new ideas by interviewing people that use their products.

Maths

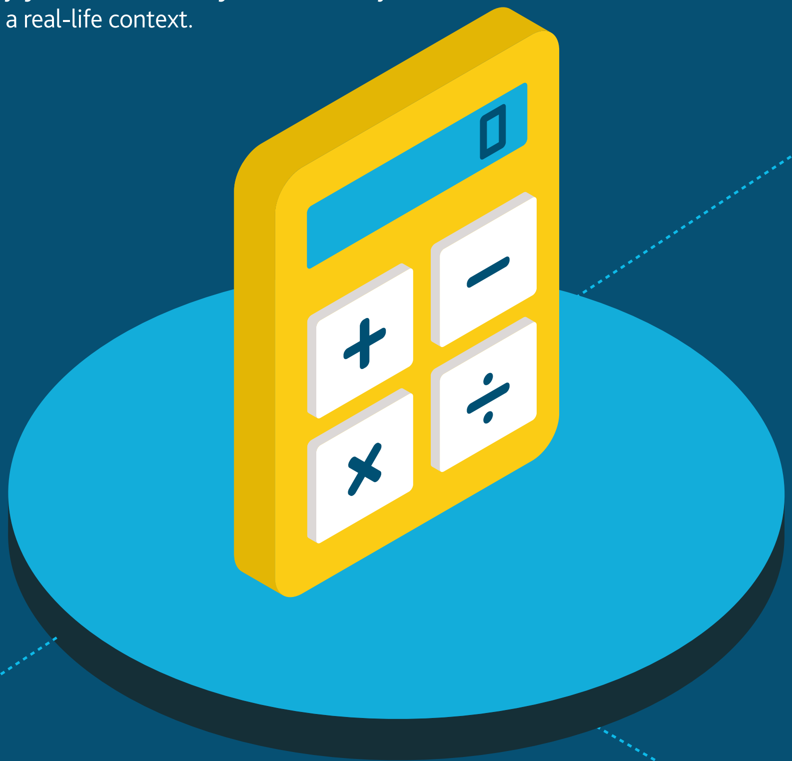


Students' prior knowledge

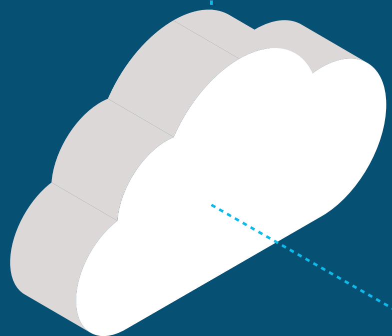
In maths lessons across Years 7 to 9, students learn about mathematical concepts and develop skills in the key areas of Number, Algebra, Ratio and Proportion, Geometry, Measures, Statistics and Probability.

The subject is essential to everyday life and will underpin different parts of CISCO Little Big Futures; not just specific to the maths section. It will be critical to science, technology and engineering, and the ability to reason mathematically will extend through data challenges and the IoT.

You'll be able to build on a foundation for understanding the world, the ability to reason mathematically, an appreciation of the power of mathematics, and a sense of enjoyment and curiosity about the subject in a real-life context.



Aims of the curriculum



At the end of Year 9 students will:

- become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that students develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately
- reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- be able to solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions

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Maths at key stage 3

Students will develop fluency and be taught to:

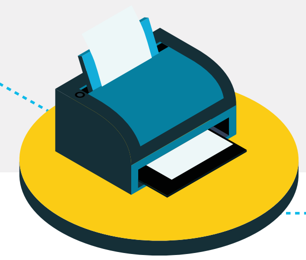
- extend their understanding of the number system and place value to include decimals, fractions, powers and roots
- rearrange and simplify expressions

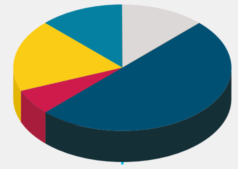
Students will be able to reason mathematically and taught to:

- make and test conjectures about patterns and relationships, look for proof and counter examples
- begin to reason deductively in geometry, number and algebra, including using geometrical constructions
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning

Students will be able to solve problems and taught to:

- solve and evaluate the outcomes of multi-step problems
- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics





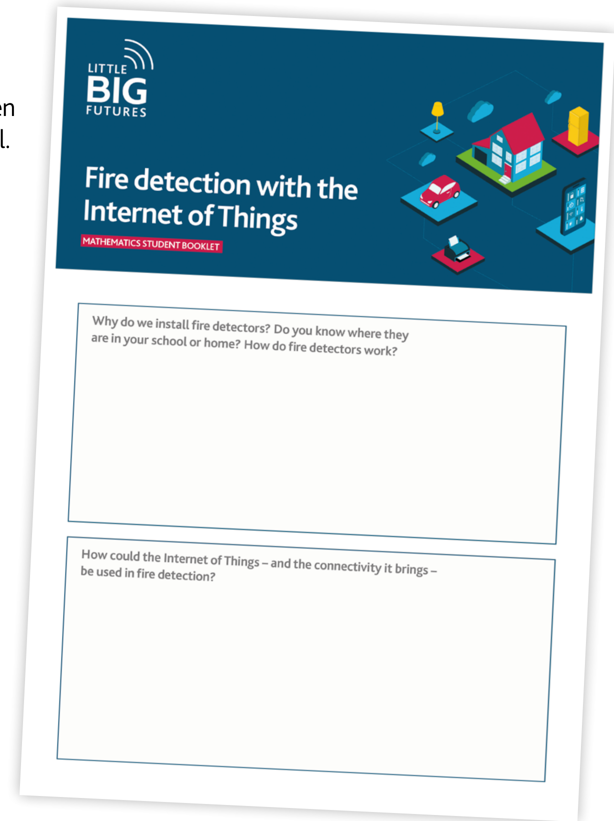
Activities within CISCO Little Big Futures

In the 5-hour mathematics teaching pack, students are asked to consider how the IoT can connect the previously unconnected, and how this can be used in fire detection systems. They're asked to work towards a CREST Discovery Award by designing a connected fire detection system in teams and presenting their work.

Groups of students will construct loci, use geometrical representations and scale drawings, consider pricing strategies and calculate averages, as well as develop their problem-solving, reasoning, modelling and teamwork skills.

Extending learning opportunities with real-world examples

You might consider getting the students to carry out this investigation in between the sessions when you're in school. Liaise with the teacher and see what's possible so that between the group they can map the school's detectors and perhaps talk to an adult onsite with responsibility for monitoring the devices. With this fire detection activity, you could also bring examples from the workplace and start a discussion around similarities and differences in the models.


LITTLE BIG FUTURES

Fire detection with the Internet of Things

MATHEMATICS STUDENT BOOKLET

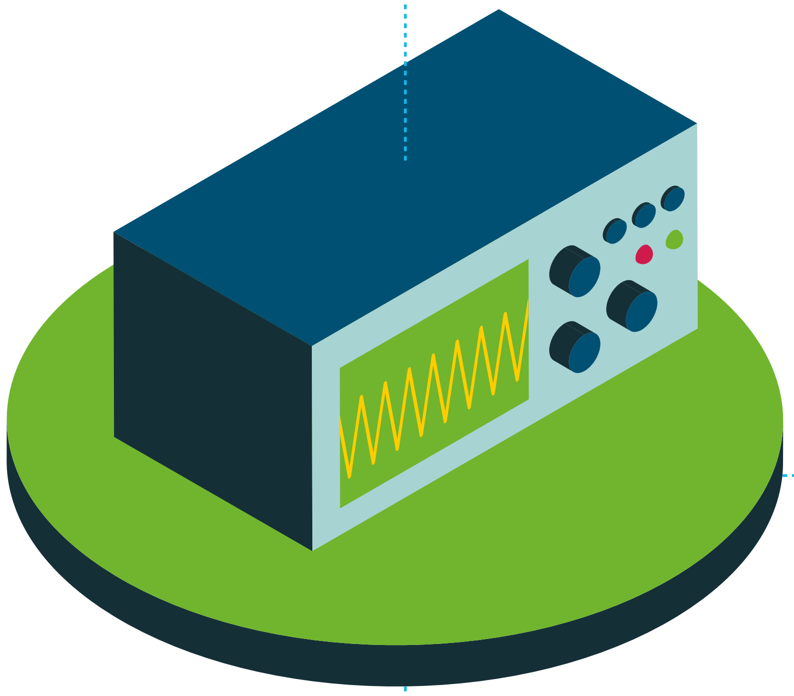
Why do we install fire detectors? Do you know where they are in your school or home? How do fire detectors work?

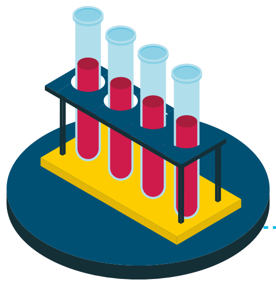
How could the Internet of Things – and the connectivity it brings – be used in fire detection?

Science

Students' prior knowledge

Science education across years 7 - 9 provides the foundations for understanding the world around us through the three distinct lenses of biology, chemistry and physics. Pupils are taught essential aspects of the knowledge, methods, processes and uses of science as they develop their use of scientific vocabulary. They are encouraged to understand how science can be used to explain what is happening around them, predict how things will behave, and analyse causes.





Aims of the curriculum

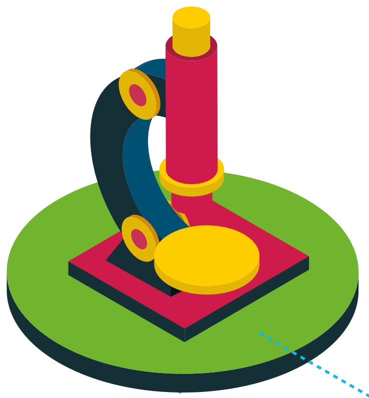
At the end of Year 9 students will be able to:

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
- understand the uses and implications of science, today and for the future

Science at key stage 3

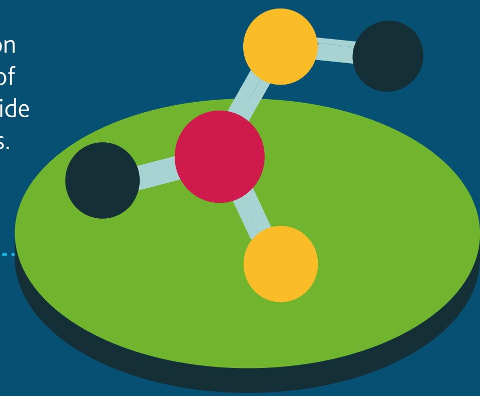
The main focus of science teaching in key stage 3 is to develop a deeper understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Students will begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding.

Examples with links to the IoT include energy, electricity, relationships in an ecosystem and investigations centred on the Earth and atmosphere. Students will be able to use modelling and abstract ideas to develop and evaluate explanations related to fire detection and safety.



Activities within CISCO Little Big Futures

In the extended 5-hour communities and fire safety challenge, students work in small groups, to design, make, test and evaluate an electronic system to provide early warning in the event of a fire breaking out. They will explore a range of methods of fire detection and understand the advantages of electronic systems that can provide an input into computer networks.



Extending learning opportunities with real-world examples

The fire detection discussion activity lends itself to bringing industrial examples into the classroom to reinforce ideas and learning. Question 3 asks students to describe the advantages of connecting fire detection systems to the internet, which is a great opportunity to open the discussion to a wider context and contribute with your examples of internet-enabled projects that make a difference in the digital world.


LITTLE BIG FUTURES

Fire detection discussion questions

SCIENCE ACTIVITY 2

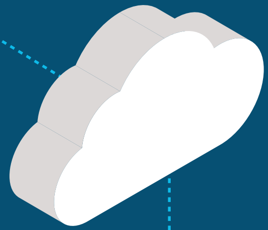
Working with your group, discuss the following questions and prepare an agreed, group answer for each one. Marks will be awarded for your group's reasoning.

Question 1 – how might a fire detection system that does not rely on electrical circuits work?
In the days before electricity do you think there were there such things as 'fire alarms' that could automatically warn people when a fire broke out? How might these have worked?

Question 2 – which type of sensor is better, digital or analogue?
The input device that activates the fire alarm could be a simple on/off switch (digital). Alternatively the input could be an analogue device that can measure a range of temperatures or toxic gas levels.

Question 3 – how might fire detection systems connected to the internet improve fire safety?
What advantages might be gained by connecting fire detection systems to the internet?

STEM Clubs



Students' prior knowledge

STEM Clubs are an extra-curricular activity that will run after school for an hour every week.

Clubs can be a fun and engaging way to inspire young people with STEM subjects, and spark interest in project-based learning related to real-world scenarios. Don't forget that every student has chosen to attend the session so you won't need to 'sell' the club to them at the beginning. They'll soon see the significance of developing practical, teamwork and leadership skills that will increase confidence and support their classroom learning.

Students will most likely attend from Years 7, 8 and 9 so there'll be a range of knowledge and understanding to support in the group. Use the differences in age and experiences to form dynamic groups and introduce peer mentoring as a support mechanism for new students joining the group.

STEM Clubs offer real-world experiences and different ways to learn and engage in activities as students self-select and choose to collaborate. The informal environment will give those involved an opportunity to explore the IoT with you in imaginative and inventive ways and gain an insight into STEM-related careers.

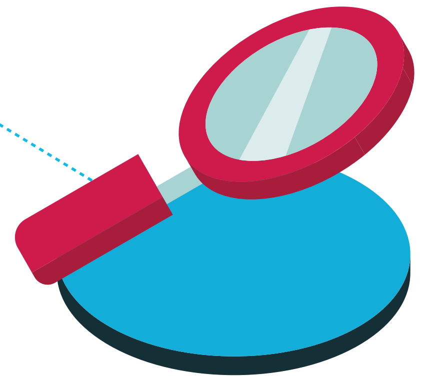
Activities within CISCO Little Big Futures

In the 5-hour STEM Clubs teaching pack, students will examine ways in which communities can put measures in place to make sure people and properties are safe. Activities will also focus on how the IoT can bring additional benefits as students describe and design new strategies to improve fire safety.

You could think about supplementary and complementary activities with the 5-hour series of resources. Students will be able to build a smart sensor project if the school is suitably equipped with physical computing hardware, and work through data collection, analysis and visualisation as data scientists. Further resources to support such activities can be found through the STEM Ambassador dashboard.

Extending learning opportunities with real-world examples

In the first session, students will benefit from examples of how the IoT has changed lives or had a positive impact at work over time. Examples of how connected technologies have changed a process through digital advancement will reinforce their learning as you talk about how it's made a difference.



Beginning with what students know will support their learning, so you might want to explore prior knowledge of internet-enabled applications at home:

- talk about selecting music or films and ask about voice-activated assistants such as Alexa or Echo
- do any of them have, or know somebody who uses, a wearable fitness tracking device that connects to an app on a phone to display physical activity?
- what other examples can the group think about at home? Heating or security solutions?

You could also take into school, or talk about, examples of an application in the workplace such as:

- smart cities and automated transport solutions
- health systems that connect information to patients
- retail applications that allow companies to gather more insights into consumer spending and habits
- automation in the manufacturing process to detect inefficiencies or report faults
- tracking large assets such as agricultural machinery
- exploring a particular application with sensors to collect big data and help decision-making or ensure quality control

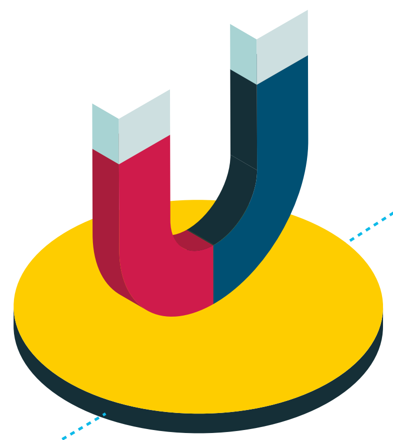
LITTLE BIG FUTURES

Lesson activities

(1 hour duration; may be extended if appropriate)

	Activity	Resources
Activity 1 (5 mins)	Explain that previously unconnected devices are being connected to bring about huge changes in how the world works. This is the basis of the 'Internet of Things'. You could also link in the video and an article on the Wooolworth shop fire in Manchester 1979, which led to changes in the law on fire safety. These should be remote enough not to worry younger students, but check before using it.	Streaming videos: General introduction to the 'Internet of Everything' https://youtu.be/HTUSTejjjzE http://www.bbc.co.uk/news/uk-england-manchester-20598600
Activity 2 (10 mins)	Students will think, pair and share what buildings they can think of that humans use. Think on their own for 2 minutes Pair and write some down 3 minutes Share as team and start grouping the buildings together. The groups are up to them to categorise, but may some assistance in their thinking. Students will hopefully identify different types of homes, commercial businesses, factories, entertainment and sporting buildings along with other types like space stations and castles. The groupings are up to the students but you could prompt them to think of similarities between them such as ▪ residential (eg a terraced house) ▪ commercial (eg shoe shop) ▪ industrial (eg factory producing chocolate) ▪ educational (eg primary school) ▪ historical (eg stately home)	Post it notes, cards. For think pair and share activity
Activity 3 (10 mins)	Students then need to evaluate the types of risks in terms of fire safety that each group of buildings has. This can be done by adding post it's on to the groupings. Students may need help in terms of the risks and what they can do to minimise them in a building. Prompts could include: ▪ what are the effects of fire (smoke/heat/flames) ▪ escape routes ▪ types of people ▪ activities that happen in a particular building ▪ flammable material or chemicals ▪ sources of ignition ▪ proximity to other buildings ▪ types of fires ▪ fire safety equipment or warnings they may have seen at school or home	Post it notes, cards

You might find that students become particularly engaged by examples about ethical considerations, privacy of data or cyber security.



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STEM LEARNING