

**BRONZE
LEVEL**



**Industrial Strategy Grand Challenges:
AGEING SOCIETY,
ARTIFICIAL INTELLIGENCE,
CLEAN GROWTH,
FUTURE OF MOBILITY**



COLLECTION

This pack contains nine project ideas which allow students to investigate the four Industrial Strategy Grand Challenges of Ageing Society, Artificial Intelligence, Clean Growth, and Future of Mobility.

#AgeingSociety
#ArtificialIntelligence
#CleanGrowth
#FutureofMobility

IN PARTNERSHIP WITH



HM Government

TO DELIVER



**INDUSTRIAL
STRATEGY**

How to run CREST using these activities



Preparation

Ready to get going with CREST? Enter your student Award by signing up for a CREST Account here: crestawards.org/sign-in

Create a new Bronze Award project with the name of the student and the title of their project. If you don't have all the details, you can fill these in later!

Run the project

We have some super handy workbooks and profiles for your students to use when running a CREST Award. You can download these when you create your CREST account by following the link above. Encourage your students to use the workbook or profile to plan and carry out their project, keeping a record of all their amazing progress. Make sure you consider safety and risks!

Reflection

So, your students have been hard at work and completed their CREST project, but don't let this be the end of their learning. They should now fill in any remaining sections of their workbook. This is a chance for them to reflect on all the interesting things they've learnt and the invaluable skills they have used.

Enter your project for a CREST Bronze Award

Hard work deserves a reward! Celebrate and certify your students' achievements by entering their project for a CREST Bronze Award. Simply log in to your CREST account at crestawards.org/sign-in

Select the project and upload a sample of the students' workbooks or other project evidence. Check the participating students have met each of the criteria on the teacher assessment page. Finally, complete the delivery and payment details to order your snazzy certificates. Congratulations on completing CREST Bronze!

What next?

The scientific discovery doesn't need to end here. Students can have a go at the next level up – CREST Silver. Don't keep all the fun to yourselves, encourage others to take part in CREST projects and share the wonder of science. For free ideas on how to get started, see crestawards.org



Looking for some support?

Find a mentor by contacting your local STEM Ambassador hub: stem.org.uk/stem-ambassadors/local-stem-ambassador-hubs

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Instructions for teachers



These resources will help your students explore the four Industrial Strategy Grand Challenges and the impact they have on lives now and in the future:

- Ageing Society
- Artificial Intelligence (AI) and Data
- Clean Growth
- Future of Mobility

The resources in this pack have been developed with some of our partners, who have kindly contributed resources on the Grand Challenge topics.

In this pack you will also find pages that can be used as a handouts for students. These are indicated in the titles and contents page.

Choosing a project

We want young people to use their project to explore innovative ideas and solutions. Encourage them to consider local and personal connections with the Industrial Strategy Grand Challenges. What do they imagine the future could be like? What problems might arise with new technology and these changes in society? What most interests and excites them? Students can use the project ideas on pages 11-19 as inspiration or use the activities on page 5 to help them design their own project around the theme and topic which most interests them. They could work individually or in small groups on the same project.

Resources

There are new developments around these areas all the time. The resource links on the project pages give a starting point for students to research but they could also search local and national news articles for more recent developments on each theme.

Project outcomes

Your students could design and make a new product, carry out a practical investigation, do a research project or create a communication campaign for their target audience. Encourage them to consider the impact of their project on people's lives now and in the future. Students should record their work in a final project report or presentation.

Supporting students to complete their project

Each project should involve approximately 10 hours of student work from start to finish. The project should be led by the students. As a teacher or mentor your role is to:

- Act as a sounding board for students' ideas and nurture the students' work;
- Check your students' project plans before they begin the next stage;
- Help students see mistakes and setbacks as an opportunity for positive learning and lateral thinking (leading to creativity);
- Where relevant, support students to access professionals or experts who could support them;
- Provide access to the Internet, library books and magazines;
- Help students to complete their project and record their findings;
- Encourage them to reflect on their own performance and learning.

Health and safety

Students should be encouraged to make their own risk assessment before they carry out any activity, including surveys. They can use the CLEAPSS student safety sheets to help them science.cleapss.org.uk/Resources/Student-Safety-Sheets/.

They should write out their project plan, identifying the risks involved in each stage and the control measures and precautions they will take. In all circumstances this must be checked by a competent person.

Students using specialised equipment should be supervised at all times. Students may want to set up unorthodox experiments and you may need to seek specialist advice. Contact CLEAPSS directly cleapss.org.uk for advice if you are unsure. Teachers in Scotland should refer to SSERC www.sserc.org.uk.

Unless stated, no external links have been checked by CLEAPSS. Safety checked but not trialled by CLEAPSS.



Get your students thinking about the Industrial Strategy Grand Challenges

1. What do you know already?

Collect 2-3 images relating to each of the four Grand Challenge themes. Ask students to discuss what words, themes and topics are represented in the images. Ask them to think of other similar examples, encouraging them to consider things which are local and personally relevant to them.

You could ask students to collect and add their own images but using examples from their local area, community, interests and hobbies. They should provide an explanation for each one including why they have chosen it.

Alternatively, you could use news articles and headlines linked to the four themes. Ask students to research other examples in the local and national press.

2. Connecting questions

In small groups of 3 or 4, ask students to list the things that are important to them in their everyday lives and write these on cards. Ask them to consider each one in turn and think about how it might be affected by an Ageing Society; new technology using Artificial Intelligence and Data; new transport options and Clean Growth. Challenge them to come up with a question to frame their investigation. E.g. Could an artificially intelligent machine replace my sports coach?

3. Where do you stand?

Using some of the questions students have generated, ask students to decide where they stand on the issues and to explain their position. Challenge them to think of other potential dilemmas linked to the Industrial Strategy Grand Challenges.

4. Selecting a project idea

Ask students to create a mind map to show how the four themes link to their lives and interests before deciding which ideas they are most interested in investigating further. They could choose a project from the ideas in this pack or come up with their own idea linked to their interests.

Make sure students check their project plan with a teacher or mentor before they begin.



The Industrial Strategy Grand Challenges

Student handout



The four Grand Challenges of the UK's Industrial Strategy are Ageing Society, AI & Data, Clean Growth and Future of Mobility – four global trends that the Government believe the UK should be at the forefront of tackling today and in the future.

It is hard to imagine any part of our lives which won't be affected by one of these Grand Challenges in some way. They will affect the jobs we do, the homes we live in, how we get around, how we spend our money and the design and manufacture of the products we use.

By exploring them further you will be helping to identify the challenges and opportunities they present and come up with new products, business ideas, original research and communication campaigns to improve the lives of people of all ages and backgrounds.



Ageing Society

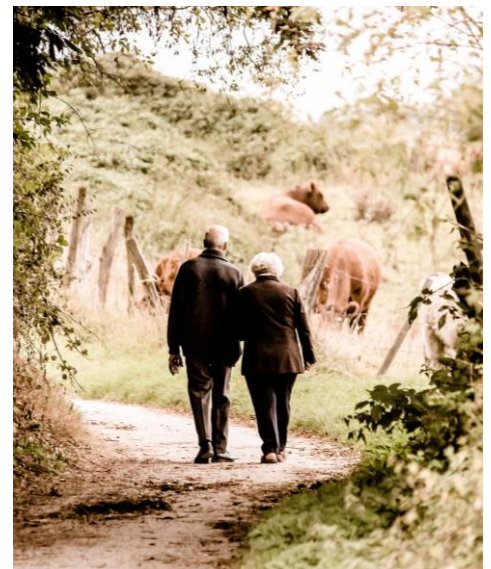
What would you do to help us all age better?

How do you think your life will be different to that of your parents or grandparents? The UK population is ageing – with 1 in 3 babies born today expected to live to a 100 – this will have an impact on everyone, not just older people.

We're living longer, but we need to do more to improve our quality of life – we want everyone to age better. This might affect the skills you need throughout a longer career, how you will care for an older relative, the type of home you live in and who you live with. As people live longer, older people will be a much bigger market for new products, technology and services, to help healthy ageing and living independently.

Technology could help people live healthier lives, work more efficiently, give them better access to services and could even help care for older people. New home designs might need to accommodate more multigenerational families, transport will need to be more accessible and solutions found to combat loneliness and isolation in old age.

We have an obligation to help our older citizens lead independent, fulfilled lives, continuing to contribute to society. If we succeed, we will create services, technologies and products which work for everyone, regardless of age.



The Industrial Strategy Grand Challenges

Student handout



Artificial Intelligence and Data

Would you trust a computer to buy clothes for you? If you shop online, you might find that intelligent computer systems are already influencing your decisions.

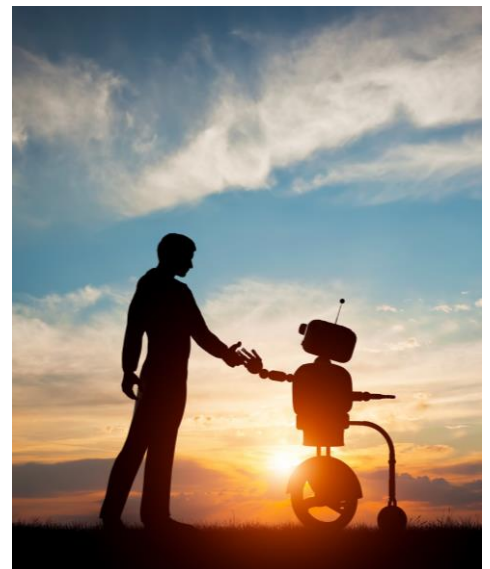
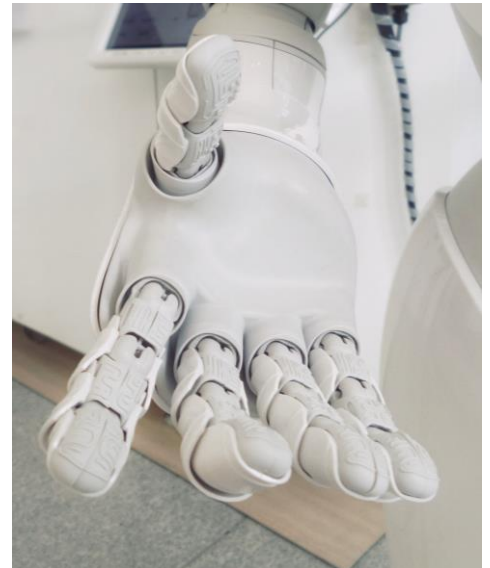
Artificial intelligence (AI) is when a computer thinks and makes decisions like a human being. These decisions might be too difficult or time consuming for humans or just too mundane.

The more data we give the computer, the better the decision it can make; very often this is a better and much faster decision than any human could make.

AI is the foundation of smart technologies, such as driverless cars and personal digital assistants and it also might affect what you see on your social media feed and recommendations on shopping sites.

These technologies are already a part of your life and are starting to transform the global economy. They can identify better ways of doing complex tasks – from helping doctors diagnose medical conditions more effectively to allowing people to communicate across the globe using instantaneous speech recognition and translation software.

However, with new technology come concerns about security of data and the limits of machines. The more data that is collected the higher the risk that it could be used in way that is unethical or puts lives at risk. What would you not trust a computer to do for you?



The Industrial Strategy Grand Challenges

Student handout



Clean Growth

How could you heat and light your home or school if the power was cut off?

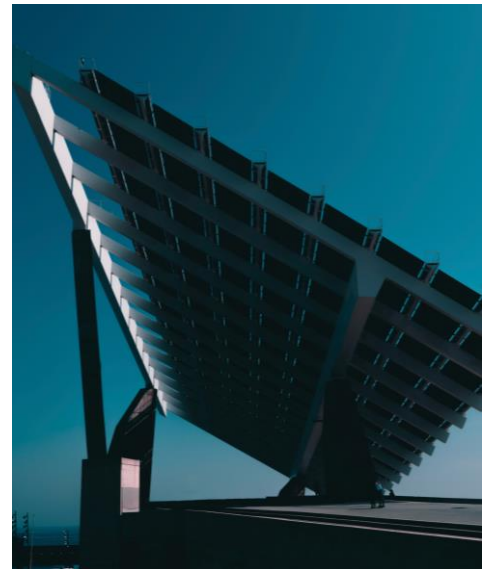
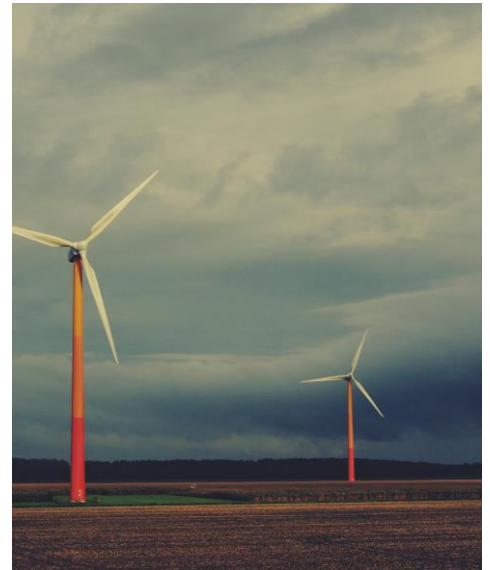
In order to combat climate change, we need to move towards a low carbon, more resource efficient way of life. We need to develop new technologies for energy generation as well as products and services which ensure everyone has access to sustainable and affordable energy. That means using renewable sources of energy, reducing waste and improving efficiency to reduce our energy use.

In future, energy might be produced more locally using solar panels, wind turbines or biogas generators.

As well as generating energy, the development of battery technology is vital to ensure that energy is available when it is needed. This will affect homes and schools too. Improvements in the design and construction of buildings will help us reduce the amount of energy we need.

The government has announced a mission to halve the energy we use in new buildings by 2030. It has also announced plans to hold a competition to design a home of the future – to build more energy efficient homes for all generations, with high quality affordable design.

What would your ideal home of the future be like?



The Industrial Strategy Grand Challenges

Student handout



Future of Mobility

Would you travel on a bus powered by human waste?

Everyone needs to be able to get around – from travelling to school or work to visiting friends or going to the shops. We're reliant on our transport systems to get from A to B.

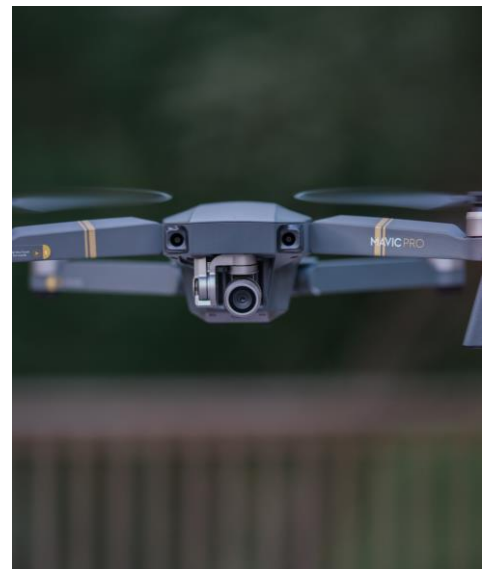
But it isn't just people that need to move around, products need moving too – from warehouses to shops or direct to your home.

Planning for the movement of people, goods and services around our towns, cities and countryside is a big challenge. Solutions might include driverless cars, more shared transport, electric bikes, drone delivery, low carbon air travel and using mobile apps to get people walking more.

The important thing is to ensure that transport is available when we want it, where we want it and how we want it.

Future mobility solutions must also meet the needs of everyone including older people and those with disabilities who might currently find it more difficult to travel around.

How would you improve the transport in your local area?



TOP TIPS

for students completing a Bronze project

1. Understand the problem

Find out more about the Industrial Strategy Grand Challenges and make sure you are clear about the problem you need to solve and the time you have. If you are developing your own project idea, discuss your ideas with your teacher or mentor.

2. Plan your approach

Draw or write a plan showing how you will approach the problem, the tasks you'll complete, the resources you'll need and how long you'll spend on each task. Ask your teacher or mentor for feedback on your plan.

3. Watch out!

Identify any risks to health and safety or ethical concerns you think there will be. Decide how you will limit or overcome these risks. Show your risk assessment to your teacher.

4. Research

Consider finding a professional mentor by contacting your local STEM Ambassador hub: stem.org.uk/stemambassadors/localstem-ambassadorhubs

Find out more by doing some research using the suggested links on the project page.

Research relevant news articles, blog posts and other media sources.

5. Use your research to improve your plan and generate ideas

Use your research to help you come up with a possible solution or to select the best experiments to use in your practical work.

6. Finalise your idea and carry out practical work

Carry out any practical work including experiments, surveys, designing and making activities. When testing your ideas, make sure you make it a fair test and record all your results clearly. You could also use photos and a diary to record your project activities.

7. Concluding your project

What have you found out by doing your project?

Did you come across any problems, how did you overcome them?

What is the impact of your project for other people, how could it be developed further?

Has it changed how you feel about the Industrial Strategy Grand Challenges?

8. Choose the best way to communicate it

Tell others about what you did. You could use a written report, a digital presentation, a blog or a poster display. Make sure you include each stage from planning through to the conclusion.

AI and Data

How can you create a trustworthy machine?



Activity created by

THE
ROYAL
SOCIETY

Project brief

In this project you will select a target audience and create a survey to find out what they know and feel about machine learning and what would be needed to create machine learning systems that people trust. You will then use your survey findings to make recommendations to developers to ensure artificially intelligent computer systems are trustworthy.

Consider the following questions. How far would you trust a machine to:

- help with your shopping?
- teach you a foreign language?
- diagnose an illness?
- post photos on your social media page?
- drive your car?

For each one, consider how *useful* it would be for a machine to carry out the task and what value or *risks* there might be in using these systems.

You need to find out how other people feel about machine learning and what they would consider a 'trustworthy' machine too.

Do some research into machine learning to find out what it is, how it relates to people's lives and what people might have different views about. What might computers be able to do for us in the future? What might the risks or opportunities be?

Next you need to create your survey. Make sure your questions are balanced and unbiased. Think of ways you could make your survey interesting and engaging and allow people to express their views on a scale.

Once you have collected together the responses you will need to present the results and recommendations in an informative way.

Things to think about

- What do you need to understand about machine learning and AI in order to carry out this project?
- What makes systems trustworthy or not?
- How much do your audience know about machine learning?
- What are people's main concerns about machine learning?
- How important is it to ask the public what they think?

Useful resources

- royalsociety.org/topics-policy/projects/machine-learning/what-is-machine-learning-infographic/
- royalsociety.org/topics-policy/projects/machine-learning/machine-learning-in-the-world-around-you-infographic/
- sciencebuddies.org/science-fair-projects/references/how-to-design-a-survey

Health and safety

To avoid any accidents, make sure you stick to the following health and safety guidelines before getting started:

- find out if any of the materials, equipment or methods are hazardous using science.cleapss.org.uk/Resources/Student-Safety-Sheets/
- assess the risks (think about what could go wrong and how serious it might be);
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- make sure there is plenty of space to work;
- clear up slip or trip hazards promptly;
- make sure your teacher agrees with your plan and risk assessment.

Clean Growth Wind Power



Activity created by



Project brief

In this project you will investigate wind power as a sustainable energy source and design a simple wind turbine capable of lifting a cup off the floor up to bench height.

Over a third of the world's population have no access to electricity. Because it is vital in lifting people out of poverty, the UN identified affordable and renewable energy as one of the Global Goals to solve poverty by 2030.

List all the things you use electricity for in a typical day. Think about all the different ways in which electricity is generated, including renewable energy. Do some research to find out more about the advantages and disadvantages of different sources.

Use your STEM skills to design a simple machine that uses wind (from a hairdryer set to cold) as the power to turn blades and lift a cup off the floor. Think about the design of the blades, how to attach the blades to a shaft and how to attach your machine to the desk.

Test your machine then try adjusting size, number, shape thickness and angle of the blades and test again. After each test, record what works and what could be improved. Think about how to make testing different designs a fair test, e.g. ensuring the hairdryer is a fixed distance away from the blades.

How could you make your design more sustainable, for example, by changing the materials you used or the amount of material?

Things to think about

- What happens when you increase the size, shape, thickness, angle or number of the blades?
- Could you rely solely on wind power to generate electricity for your home? If not, why?
- What materials could you use for a full-size version?
- Where would be the best place for a wind turbine in your school or local area?
- How do you think access to energy would change the lives of people living in the mountains of Nepal?

Useful resources

- practicalaction.org
- globalgoals.org/7-affordable-and-clean-energy
- youtu.be/usISdE-WSWU

Materials

- Scrap card
- Sellotape
- Masking tape
- Blu tack
- Split pins
- Pencils
- Scissors
- String
- Paper/plastic cup
- Weights (gram weights or pennies)

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- assess the risks (think about what could go wrong and how serious it might be);
- Ensure the hairdryer is set to cold
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- make sure there is plenty of space to work;
- clear up slip or trip hazards promptly;
- make sure your teacher agrees with your plan and risk assessment.

AI and Data

Fighting fires with the Internet of Things



DESIGN & MAKE
PROJECT



Activity created by



Project brief

In this project you will explore the needs of a modern firefighter, their working environment and the equipment they use. Using this research, you will generate a design for a new product which uses data collection to enhance the efficiency and/or safety of firefighters and those they help to protect.

The Internet of Things is a network of connected devices such as cameras, vehicles, and sensors which interact, exchange data and automate tasks. This exchange of data and automation of tasks can be used by firefighters to help them do their jobs more safely and more efficiently.

Do some research to find out more about the Internet of Things, what it is and how it is being used.

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.

Using your research, think about where the Internet of Things or connected devices could make firefighters' jobs safer and more efficient (saving time, materials, money). You might choose to improve a piece of existing equipment or invent a completely new one.

Record all your ideas and decide which one you would like to continue to develop. You could use materials like cardboard, paper, textiles and sticky tape to create a model of the final idea.

If you have support from a teacher or mentor, you could try prototyping how the data collection part of your idea will work using a micro:bit or another programmable controller.

Things to think about

- When they aren't working to put out a fire, what other tasks do fire fighters do as part of their job?
- What tasks would a machine be better at than a human?
- What do you think the role of a firefighter will be like in the future?
- Could you contact a firefighter to see what they think of your idea?

Useful resources

- stemlearning.wistia.com/medias/i58xdbw1ma
- Programmable board (i.e. micro:bit, crumble etc.)
- Contact with a fire station visit or professional firefighter

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- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- check your plan for using tools and materials with a teacher before beginning any practical work;
- make sure your teacher agrees with your plan and risk assessment.

AI and Data

Debating digital privacy



Activity created by



The Royal Institution
Science Lives Here

Project brief

In this project you will participate in a group debate about the privacy implications and potential benefits of our phone microphones 'listening in', before deciding on whether there should be changes in the law.

Phone microphones can listen to noises and sounds around them, even when you aren't on your phone. As a group, discuss the possible advantages and disadvantages of this technology. Now consider the question: "Should mobile phones be banned from having microphones permanently switched on?" Record what people think: "yes", "no" or "not sure yet".

Working in a group of 4-6 students, divide the character cards between you. Take turns to read out the first section in your card. What do the others in your group think about each character? Next take turns to read out the facts. Does this change any opinions? Now take turns to ask a question to another character in your group. Once the debate is over, vote "yes", "no" or "not sure yet" again. Have opinions changed? Why?

Use the internet to research the issues further.

Find out what the law says about digital privacy and how this might impact smart phone technology. What might happen in the future as new technology becomes available?

Either individually or as a group, decide on where you stand and whether or not there should be a ban or changes to the law to protect privacy. Select the evidence which best supports your position.

Prepare a presentation with your ideas and reasons.

Things to think about

- Who might benefit most from phones which are always listening?
- Who should decide how technology is used in our lives?
- Should there be changes to the law?

Useful resources

- Printed character cards from debate.imascientist.org.uk/privacy-resources
- Access to the internet

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Accessible messenger



Activity created by

The
Tech She Can®
Charter

Project brief

Technology is changing the way we communicate, often making it faster and easier to get the message across. It is important that technology is improving everyone's lives and is accessible to all age groups. In this project you will try out apps which improve communication. You will interview people of different ages at home and in school to gather data about how they use tech to help them communicate and what, if any, barriers they face using technology. You will need to communicate your findings in a magazine article, blog or vlog post.

Does your social media feed suggest responses to you? How would you quickly translate a message that was in a foreign language? What other examples can you find of how artificial intelligence is being used to improve communication?

Find and try out a range of web or mobile applications which use tech to help people communicate. You could include apps which translate between foreign languages and/or apps which help people with hearing impairments, visual impairments or dyslexia. Compare the apps, recording the target audience, the purpose and the features they offer.

Design and carry out a survey to find out how people of different ages currently use tech to communicate, what challenges they face and what they think of the current apps available. You could ask them what methods they use to communicate including what apps (if any) they use. You should aim to ask people of a range of different ages including older adults.

Research the future of communication technology. Will it help to solve some of the challenges people currently face?

Write a magazine, blog or video blog post to communicate the findings from your survey and research.

Things to think about

- How has communication changed since you were younger?
- What communication channel do people of different ages use most often?
- Are the latest communication apps accessible to everyone? Is anyone missing out?
- Which apps were most useful in helping people translate between different languages?
- How do you think artificial intelligence will improve communication in the future?

Useful resources

- A smartphone and access to free apps
- Access to the internet for research
- Access to volunteers of different ages to interview

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- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- take care if collecting any personal data in your survey;
- make sure your teacher agrees with your plan and risk assessment.

Create an App for Good



DESIGN & MAKE
PROJECT



Activity created by



Project brief

In this project you will design an app to make a positive difference for people in your local area. For example, it might help people travel around more easily, prevent waste going to landfill or get people together to overcome loneliness. You will need to create an app outline showing what it will look like and a short report explaining how the app works, who the target audience is and how you came up with the idea.

Ask your teacher to sign up to Apps for Good and create a passcode for you at: <https://www.appsforgood.org/teachers/new>

You can access resources from Apps for Good to help you through all the stages in designing a concept for a new app.

Start by listing local issues related to the Grand Challenges that you'd like to solve. For example, you could consider accessible transport, services for older people, renewable energy or reducing waste. Perhaps there is a problem which is relevant to your local area or community, or you might choose to tackle a problem in your school. Choose one problem and the target audience.

Next search for free apps which relate to the problem you are trying to solve. You could each find one and try it and then explain it to the rest of the group. Who is the audience? What does it do? What data does it collect and how is this data used?

Finalise the ideas for your own app. Create a wire frame of your app to show the different screens the user will see. Write a short report explaining who the target audience is, the problem it will solve, what data it will collect and how it will work.

Things to think about

- Who is your target audience; what are their needs?
- What apps already exist for this?
- Can you adapt one to make it better?
- Are there any ethical risks to your idea?
- How will you ensure data is kept securely?

Useful resources

- appsforgood.org

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- assess the risks (think about what could go wrong and how serious it might be);
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- take care if collecting any personal data;
- make sure your teacher agrees with your plan and risk assessment.

A Home for Everyone



DESIGN & MAKE
PROJECT



Activity created by



Project brief

There's been lots in the news about a UK house shortage. Your challenge is to design a house that is safe, comfortable, accessible and secure, that supports health and well-being; a house that is truly a home.

You'll need to produce a site plan, floor plan and elevation drawings along with a report explaining how you approached the project.

Start by downloading a copy of the Home for Everyone resource pack which has case studies and web links to help with research and tips for completing this project.

Designers, engineers and construction professionals are working together to create the ideal inclusive house.

Get your team together for a discussion about what "inclusive design" means.

Read the case study for Anytown Street from the resource pack and think about the range of people who live in your community, those who live on your street and in your town. Decide who your target audience will be. What are the needs of the family as whole and as individuals? Are their needs likely to change?

Do some research to find out about best practice in inclusive house design. Find out how smart technology can be used to improve new homes and how they can be made more energy efficient.

Get in touch with local built environment professionals in architecture, landscape, surveying, energy and engineering; local house builders can help too. Find out about the different ways your house can be powered.

If you're good with pens and pencils, get creative on paper. If you prefer a digital approach, you could use any drawing/modelling software to present your designs.

Things to think about

- Can you make your house more energy efficient?
- How could technology improve people's lives?
- What might you include, or even invent to make life easier?
- Consider what types of vehicle need parking and how much space will be needed to get in and out.
- Will your house be accessible for everyone?

Useful resources

- You can access the 'Home for Everyone' resource pack by contacting STEAM@classofyourown.com
- You can find more design and construction related projects as well as information about careers in this sector at designengineerconstruct.com

Health and safety

To avoid any accidents, make sure you stick to the following health and safety guidelines before getting started:

- find out if any of the materials, equipment or methods are hazardous using science.cleapss.org.uk/Resources/Student-Safety-Sheets/
- assess the risks (think about what could go wrong and how serious it might be);
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- make sure your teacher agrees with your plan and risk assessment.

Clean Growth

Design a waste free lunch



Project brief

The idea of this project is to introduce a school lunch programme to your school or college. The programme should encourage pupils to use recycled or re-usable packaging for their lunches. Produce a leaflet and/or poster presentation for the school. You will also carry out some tests on reusable packaging to check it's suitable.

Start by testing alternative packaging. You should think about what alternatives might be used to store packed lunches. Then you should carry out some tests to make sure your ideas still keep food fresh, for example: Crisps usually come in a packet that gets thrown away. So why not buy a bigger bag and bring just enough crisps each day in a different container. When you've thought of a few alternatives, carry out a 'sogginess' test. Leave different containers of crisps for a day and see which ones remain crunchy. Make sure you use the same type of crisps in each container. Store all the containers in the same place. Leave a normal packet of crisps for a day as well – this will be your benchmark.

Drinks often come in cans or plastic bottles that also create waste. Find out what sort of cans are best for recycling. You could also tell people how and where to recycle cans. The other alternative is to buy a big bottle and bring just enough for one day in a reusable container. Again, you could carry out a test to make sure your alternative container keeps the drink fizzy.

You should also test your packaging's strength. Packed lunches can often get bashed around in your school bag, but you don't want squashed sandwiches or broken biscuits. Design an experiment to see what happens to your packed lunch when it gets bashed about. Work out a way of simulating how much a packed lunch gets bashed around during a school day. This might include dropping the packed lunch to see if anything gets damaged.

Finally, design a communication campaign to share your top tips with other students for preparing a waste free lunch. You could use a leaflet or poster to share your ideas.

Things to think about

- What sorts of packaging people use at the moment to store their packed lunch?
- How much of it is reusable?
- Which bits of waste from your packed lunch are biodegradable?
- How do you think they will be disposed of?
- Can any packaging be recycled? If so, how and where?

Useful resources

- packagingdigest.com/sustainable-packaging
- trendhunter.com/slideshow/sustainable-food

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- assess the risks (think about what could go wrong and how serious it might be);
- Ensure you complete this experiment in a food tech room, not a lab. Food that has been handled in a lab should never be consumed.
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- remember, never consume or taste food or drink in the laboratory or which has been opened in the laboratory;
- make sure your teacher agrees with your plan and risk assessment.

Future jobs



Project brief

It is difficult to imagine a career sector which won't be affected by one of the four Industrial Strategy Grand Challenges: Ageing Society, Artificial Intelligence, Clean Growth and Future of Mobility.

In this project you will explore how one career sector might be affected by one or all of these global trends. You'll need to report back and make recommendations about the changes needed in your chosen sector.

Begin by selecting a career sector to focus on. Keep it broad rather than a specific job. For example, you could choose healthcare, agriculture, construction, TV and media – whatever you are most interested in.

Research your chosen sector; find out what its purpose is, how many people are employed in this area, the latest technology being used and the impact of the sector on the environment. You could focus on a few key jobs and use a careers website to help you.

Consider how the Industrial Grand Challenges might impact on jobs. Will some jobs be replaced by machines? What kind of environment will people work in? If people are living longer and there are more older people, what problems and opportunities might there be?

Next, search for evidence to support your ideas. You could start by using scientific magazines such as New Scientist and Wired magazine to search for relevant articles. Ask your teacher to help you contact someone in a relevant job to interview. You will need to prepare a list of questions to find out about their current job and how they think it will change in future.

Reflect on what you have found out from your research and from your interview. What are the new opportunities and the challenges in this sector? How do you think it will look in ten years' time?

Finally, consider the wider impact of your research. What changes do you think need to happen to help prepare for the future in your chosen sector?

Things to think about

- Which of the Grand Challenges will have the most impact?
- How will artificial intelligence and data make jobs easier?
- Will anyone lose out or lose their jobs?
- How does your chosen career sector compare with others?
- What new technology might be needed to overcome the challenges?

Useful resources

Volunteers who can help:

- stem.org.uk/stem-ambassadors
- inspiringthefuture.org

Media sites to research online:

- [wired.com](https://www.wired.com)
- [newscientist.com](https://www.newscientist.com)

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