STEM innovators

Apps to the rescue

Part 1: Research and analysis

Educator notes

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Learning objectives

- Develop an understanding of mobile applications and how they can be used to detect, predict and adapt behaviour
- Analyse hidden sensors within smartphones and their relationship with mobile applications

Curriculum links

- Science
  - Analysis and evaluation
- Computing
  - Undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users
- Design and technology
  - Exploring, identifying and understanding user needs
  - Identify and solve their own design problems and understand how to reformulate problems given to them

Resources required

- Apps to the rescue part 1 presentation slides
- To set up a Google form information sheet
- Data analysis student sheet
- Hidden sensors student sheet

Equipment needed

- Sticky notes
- Access to smartphones, tablets, laptops or desktop
- Drawing equipment (pencils, eraser, rule, ellipse templates, circle template)
- Rendering equipment (colouring pencils, marker pens, fine liners, pastel crayons)

Preparation: 10 minutes

- Ahead of time, use the **Setting up a Google form information sheet** at the end of the educator notes to build a form to use with your students. This will be a key part of the Data analysis activity within this module

Time needed: 50 minutes

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Slide 1
Introduction

Introduce the lesson by sharing the following:

- According to statistics, 1 in 5 people in the world have a smartphone
- Statistically we are spending more time with our smartphones than in front of PCs – 85% of users prefer mobile devices to desktops and the average time spent on mobile devices now exceeds desktop web usage
- On average, people spend about two hours per day with their smartphones. Most of this time is spent using mobile applications
- You can now choose from over five million applications available on markets

Slide 2
Mobile apps

Give students a quick overview of the evolution of a mobile app – here are a few facts you can share:

- Apps emerged from early PDAs (Personal Digital Assistants) – handheld computers that functioned as personal organisers, as well as providing email and internet access
- In 1994, IBM introduced the first PDA with full telephone functionality – this is considered to be the first smartphone
- Many versions of smartphone and PDA later, in January 2007, Apple announced the first iPhone. This was a giant leap towards the evolution of mobile applications
- The digital keyboard, multi-touch display and a functional web browser revolutionised the way people were using their phones, and the applications on them
- The functionality to stay connected, and still be productive while on the go, has created user demand for the development of new apps in a plethora of different categories
- Nowadays it seems like there's an app for everything, from monitoring our behaviour to tracking our movements and anticipating our needs
- The development of apps for the modern smartphone is also opensource; this means that anyone with the skills, knowledge and equipment can build an app
- There are now over fifty different categories of app available, but research highlights that only seven of these categories manage to reach more than 3% of smartphone users

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Slide 3

Research, analysis, develop

- Explain to students that technology has dramatically changed the healthcare industry. It's now possible to use the information detected and predicted from devices, apps, and users to adapt healthcare services
- Instruct students to first think about:
  - What information does your phone have about you?
  - What would that information possibly be useful for in a health setting?
  - How can that information inform future app design?
- Students will likely already be familiar with the design process of research, analysis and develop. Using the slide, explain that there are three main ways we can apply technology to this process:
  - Research: detecting your behaviour patterns
  - Analysis: predicting your future behaviour
  - Develop: finding a solution that leaders to adaptation

Slide 4

Data analysis (research)

Activity 1

Data analysis (research)

10 mins

- Allow students access to digital devices if possible, these will be necessary for this activity
- Hand out the **Data analysis student sheet**, explaining that this sheet is for detecting information for the research element of the design process
- Share the form you created using the **Setting up a Google form information sheet** with the class
- Ask students to complete the online survey. The results data will populate automatically enabling you to share and analyse the results of the completed questionnaires
- Invite students to interpret the information and conclude any findings using the table within the **Data analysis student sheet**. Students can choose to analyse individual responses or whole group statistics
- Ask students to write a brief summary of their findings, responding to the questions on their student sheet

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Extension/homework

- The following is a chance to emphasise the data analysis element of this module further. You will need to spread the activities over two lessons if using this extension
- Divide the results into sets based on one factor, e.g. those with more than 25 apps on their phone and those with less, male and females
- Split the class into groups and ask your students to discuss one set of results, and then compare with another group who looked at another set of results
- Invite discussions around any trends or differences they see when comparing the groups

Slide 5

Hidden sensors (analysis)

Activity 2

Hidden sensors (analysis)

15 mins

- Explain that along with surveys, like in activity one, information about us is constantly being detected by the sensors hidden in our phones. Explain that:
  - Applications are designed for the device they'll be used on, taking advantage of any specialised capabilities they have
  - Sensors bring intelligence and awareness to our smartphones; today's mobile devices are packed with nearly 14 sensors that produce raw data on motion, location and the environment around us
- Handout the **Hidden sensors student sheet** and ask the class to suggest an app they use that requires at least one of the sensors on the slide (also in the table below) – they can do this in small groups or individually
- Encourage students to think about their most used apps from activity one, and which hidden sensors the app is using to function

Top tip

Share the following STEM career as food for thought with your students:

- The job of a data analyst is to use data to acquire information about specific topics. This usually starts with a survey to gather the information needed. The data is then analysed and presented in charts or reports
- Data analysts may also put their survey data in online databases for others to use
- Individuals looking for data analyst jobs must be knowledgeable in computer programs such as Microsoft Excel, SharePoint, and SQL databases
- The average salary for a Data Analyst in the United Kingdom is £35,000 (Source: Technojobs)

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Slide 5

Hidden sensors (analysis) Continued…

Type of sensor
▪ Camera ▪ Wi-Fi ▪ Bluetooth/Near Field Communication (NFC) ▪ Heart rate sensor ▪ GPS ▪ Accelerometer/gyroscope ▪ Ambient light sensor ▪ Touch screen ▪ Proximity sensors ▪ Microphone

- Ask students to record the different sensors in the table provided on the **Hidden sensors student sheet** and fill in the 'app uses' column with an app that might use that sensor (the app can be real or theoretical, if students are struggling)
- Once students have spent a few minutes coming up with ideas, discuss their suggestions as a class

Slide 6-8

Diagnosis by smartphones

- Present **Slide 6** to the class and ask for ideas about where the sensors they've recorded on the **Hidden sensors student sheet** might be located in the smartphone
- Move to **Slide 7** and ask for quickfire responses on the possible medical or safety uses for a few of the featured sensors

Optional: If completing this module over more than one lesson, you may have time to discuss them all

- Explain to students that sensors detect information and are a method of monitoring characteristics, behaviour patterns, lifestyle profile and health and wellbeing. The data collected can then be analysed and used to make predictions about future behaviour (the second phase of the design process: analysis)
- Explain that along with their 'core' function (camera for taking photos, microphone for phone calls), sensors can also gather information about your behaviour in general
- This allows devices to predict everything from when you go to sleep to the traffic on your commute and when you're likely to do a particular task
- Explain that these sensors are facilitating healthcare technology advancements that allow doctors to monitor patient health data in real time
- Introduce the term used to describe this tech as 'Smart health', an emerging concept that refers to connecting information technologies and healthcare
- 'Smart health' has opened a world of possibilities in medicine. When connected to the internet, ordinary medical devices can collect invaluable additional data, give extra insight into symptoms and trends, and enable remote care

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Educator notes

Slide 6-8

Diagnosis by smartphones Continued…

- Continue to **Slide 8** and highlight a couple of types of sensor (use the same ones you discussed earlier), along with how they might be used in a medical context. These examples are in the presentation slides, and below here:

Type of sensor	Example of use
Camera	Tracks facial expressions that may reveal mood and anxiety states, eye movements that may reveal medication side effects and offer clues to diagnosis.
Wi-Fi	Tracks location when GPS is not available; can tag specific sites, such as a gym or a workplace, or track your running route.
Bluetooth/ Near Field Communication (NFC)	Tracks proximity to other Bluetooth devices; useful for measuring social relationships or check-ins at doctor appointments.
Heart rate sensor	Detects changes in the nervous system, which could indicate things such as increased anxiety.
GPS	Tracks social rhythms; useful information for treatment of a range of disorders. Could also be useful in combination with other sensors to provide patient location to doctors in emergency situations.
Accelerometer/gyroscope	Tracks general physical activity; potentially relevant to a range of disorders.
Ambient light sensor	Can offer information about sleep environment or help guide or calibrate light therapy for seasonal affective disorder.
Touch screen	Tracks response time and time to complete tasks; useful in inferring elements of cognition.
Proximity sensors	Tracks social behaviour; potentially useful in treatment of a range of disorders.
Microphone	Tracks tone of voice and ambient social environment; useful in a range of disorders.

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Slide 6-7

Diagnosis by smartphones Continued…

- Lead the class in a brainstorm, asking them to think of what 'Smart health' technologies they know about. These could be apps that standalone, like step tracking apps, or smart devices like glucose monitors. Below are some examples to help the conversation, including some useful links:
  - Medication tracking and reminders
  - Step and exercise tracking apps
  - Continuous glucose monitoring for diabetics and automated insulin delivery
  - Connected inhalers
  - Ingestible sensors to measure gut health
  - Condition and symptom monitoring e.g. depression, blood pressure, asthma
  - Fast low-cost coagulation sensors

Slide 9

Conclusion

- Wrap up and let students know that the next lesson will follow on from this one and will give them an opportunity to develop their own smart health idea
- Remind students to keep their student sheets from this class and bring them next time

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Setting up a Google form information sheet

Apps to the rescue part one requires an online form for completion of the **Data analysis activity**. In order to collect student responses, you will need to set this up ahead of time. All you need to create a Google form to use with your class is a Google account.

Note: If you don't want to make a Google account, you can also create this form following a similar process on the platform JotForm.

- Open your browser and enter the URL: **forms.google.com**
- Log into your Google account, or create one
- From the 'Start a new form' section at the top of the page, select 'Blank'
- Title your form 'Mobile phone use questionnaire'
- Add the questions below
- Remember to make all questions required questions

To share the form with students:

- In the top right corner of Google forms there will be purple button with 'Send' on it
- Click on this button and you will get options allowing you to directly email students a link, or get a link that you can copy and share with them directly

Mobile phone use questionnaire

Q. Name
Type: Short answer

Q. Age
Type: Short answer

Q. Gender
Type: Multiple choice
Choices: Male, Female, Other, Prefer not to say

Q. Which of the following devices do you own?
Type: Checkboxes
Choices: iPhone, iPad, iPod touch, Android phone, Android tablet, Windows phone, other smartphone or tablet

Q. Have you every downloaded any additional apps for your device?
Type: Multiple choice
Choices: Yes, free only, Yes, paid only, Yes, both paid and free, No

Q. How many apps do you have on your phone or tablet?
Type: Multiple choice:
Choices: 0-4, 5-9, 10-15, 16-25, 25+

Q. Which of the following categories of app do you use?
Type: Checkboxes:
Choices: Games, Education, Productivity (email, calendar), Lifestyle/Shopping, Utilities, Music and podcasts, Travel, Food, drink and nutrition, Health and fitness, Books and reading, Video (TV on demand, Netflix, YouTube), Social media

Q. Name your three most used apps
Type: Short answer.

Q. How many of your apps would you say you use every day?
Type: Multiple choice:
Choices: 1-2, 3-5, 6-10, 10+

Q. How much time do you spend using apps each day. Your phone may tell you this information, but if it doesn't have a think and make your best guess
Type: Multiple choice:
Choices: Less than 1 hour, 1-2 hours, 3-4 hours, 4-6 hours, 7+ hours

Q. Which app do you use the most and why?
Type: Long answer question.