

# Devices for Remote Teaching and Learning



## Introduction

The nature of the Coronavirus and its continuing evolution means that while pupils in the UK have, at the time of writing, mainly returned to school, there is no guarantee that sporadic outbreaks of COVID-19 will not require some pupils to be taught at home. Remote teaching looks set to be a fact of school life for some time to come.

This will affect all pupils to some extent but will be more disruptive and damaging to those in some households with limited access to appropriate devices and all those living in geographical locations where internet access is poor.

It is an unfortunate fact of life that neither the government, local authorities, or individual schools have the resources to supply every disadvantaged pupil with their own computer and broadband access. To help overcome these educational inequalities, schools should be aware of the range of devices that are already available to their students, their limitations, and how best to leverage them to support remote teaching and learning.

We hope these notes will help inform those discussions so that the inevitable disadvantages can be mitigated.

This guidance note is specifically related to disadvantages brought about by not having access to the most appropriate hardware and the internet: it says nothing about other factors which make studying at home difficult for many. In particular, having a quiet place to work without distraction, family competition for access to a limited number of household devices, and the general stress of living in "lockdown", all of which must be taken into account when considering the support needs of individual students.

Similarly, we have not attempted to cover any physical or mental challenges pupils may have. In the case of SEND students, we are assuming that similar levels of IT support will be provided to students when working remotely as are available to them when in school. In particular, the special accessories (large screen, screen readers, high-contrast keyboards, etc.) that can be connected to a school computer can be provided to them to use at home.

Finally, these notes are about hardware and the internet. We do not cover how remote learning is presented, except insofar as we consider that much of it will be accessed via a web browser and learning environment (MS Office 365, Google Classroom, etc.), and various "live" interaction applications like Zoom, MS Teams, GoogleMeeting, Skype, etc.

What follows will consider the range of devices that pupils may have in the home already, which can be used for remote or home learning. For each type, there is a description and a list of "pros" and "cons". The devices covered are:

- Desktop (Windows, Mac, Linux)
- Laptop (Windows, Mac, Linux, Chromebook)
- Tablet (iPad, Amazon Fire, Samsung, etc.)
- Mobile Phone/Smartphone (iPhone, Samsung, etc.)
- eBook Reader (Kindle, Kobo, etc.)
- Games Console (Xbox, Playstation, Nintendo, etc.)
- RaspberryPi

## **Desktop Computer**

### Description:

The typical office form factor of a "box" housing the main processing unit, hard disks, and various ports (USB, Video IN/OUT, Audio In/Out, Speakers, etc.). In addition, the desktop will include a keyboard, mouse, and screen, usually purchased as one complete system. In most cases, the individual elements can be replaced with third party versions as required by, for example, adding a high-quality microphone for recording, a higher definition screen for graphical work, or a better camera.

The different desktop solutions come with a range of software options.

Firstly, there is a choice of the basic operating system: the three main ones being Windows, MacOS, and Linux. Much less common on desktops are AndroidOS and ChromeOS.

All the operating systems come with a browser to access the internet as well as a range of other software: the exact bundle will depend on the OS but will, typically, include an "office" suite as well as software for graphical manipulation, video and sound editing. There are also freely available apps for the three most common video-conferencing solutions (Zoom, GoogleMeet and MSTeams) as well as other communication software like Skype, Telegram, etc.

### Pros:

- Adaptable (accessories and software can be added easily)
- Few limitations with regard to remote learning software, support, etc.

### Cons:

- Size, uses more space than other devices
- Less mobile, once set up, it needs to stay in the same place.

## **Laptop Computer**

### Description:

The other common form factor in general use in business, education and the home, a laptop contains all the main elements (screen, keyboard, processor) in a single “clam-shell” with most modern ones using a trackpad to control the cursor. Laptops come with a variety of “ports” to connect other accessories such as a larger screen, external disk, etc. The vast majority include Bluetooth for wirelessly connecting peripherals like keyboards and mice, and Wi-Fi for connecting to the local network or internet router.

Laptops generally come with the same range of software options as desktops depending on the operating system: software available for, say, a Windows desktop will also run on a Windows-based laptop. Similarly, laptops are available with the three main operating systems (Windows, MacOS, Linux), but, in addition, there are many ChromeOS based laptops ("Chromebooks") that are very popular in schools.

### Pros:

- Adaptable (accessories and software can be added easily)
- Few limitations with regard to remote learning software, support, etc.
- Portable - very light and battery-powered, so a laptop can be used anywhere in the house.

### Cons:

- A laptop's portability can encourage it to be used in less ergonomically sound positions (e.g. in bed or on the sofa), which can be damaging if used for long periods.
- Chromebook's reliance on an internet connection may be a disadvantage where access is poor (slow, unreliable) or expensive (using a Wi-Fi Dongle with limited data).
- Limited screen size
- Relative position of the keyboard and screen can cause muscle strain after long periods of use. This can be mitigated by using an external keyboard and a stand to raise the screen to eye level.

## Tablet

### Description:

A tablet-style computer ("tablet") has all the elements of a computer inside a thin, flat package. A touchscreen covers the surface area of the package with a software keyboard, which appears when text entry is required. All tablets can connect to their local network over Wi-Fi, and some also include a mobile phone chip to access the cellular network.

There are two distinct tablet families: those based on Apple's iOS mobile operating system (iPad) and the rest based on the Android OS (e.g. the Kindle Fire or Samsung Galaxy). They come in a wide variety of sizes and prices. While it is generally considered that few Android tablets can compete with the iPad's ease of use and range of apps it is also true that iPads tend to be the more expensive option.

Tablet screen sizes (measured across the diagonal) vary from about 20cm to 33cm. While the touchscreen is designed for finger use, they can all also use a stylus (or "pen") for finer control.

At least one camera and microphone are standard, so tablets can be used on all the main communication platforms (e.g. Zoom, Teams, Meet, Skype, etc.) used for remote teaching.

There is a very wide range of Apps available from "office" software to graphics, music, education, games, and, of course, each will include at least one web browser. Each tablet type has its own "Store", where approved software can be downloaded. Both stores include a large number of free apps as well as those that require purchase.

In addition to Wi-Fi, all tablets include Bluetooth, so external devices can be easily connected: perhaps the most useful of these is a keyboard which may also be integrated into a combined case and stand.

### Pros:

- Very portable: light, easy to carry
- Cellular connected tablets are always internet-connected and normally have Bluetooth.
- Screens good for reading books and web browsing.

### Cons:

- Software keyboard if used for extended writing (unless an external keyboard is added)
- Touchscreen can be difficult to use for fine control (e.g. graphics, accurately placing the cursor for text editing, etc.)
- Processing power is generally less than a typical Laptop or Desktop of the same age.
- Lack of "ports" on the device makes it hard to add accessories.

## ***Mobile Phone / Smartphone***

### Description:

Mobile phones (or “smartphones”) are very similar to the tablets described previously. They tend to use the same operating systems (iOS, Android) and have a similar range of applications and facilities. The only differences are that (a) a smartphone always has cellular access to make voice calls and access the internet and (b) have smaller screens.

The size of the smartphone's screen is its main drawback for remote learning. The small screen size is clearly a limiting factor on the size of the software keyboard, making text entry very cumbersome. A smartphone's usefulness can be greatly increased by connecting a bluetooth keyboard. Writing an essay on a smartphone's software keyboard is not something anyone would want to do: adding a cheap bluetooth one (they can be found for just £16 online) will transform the experience.

The very small screen size is also a problem for students with poor eyesight: this can be addressed by connecting the smartphone to a monitor or TV via an HDMI cable. Some other connectors/cables may be required depending on the make, but there are instructions online ([iPhone](#), [Android Phone](#)).

### Pros:

- Many students already have one
- Large range of Apps available to support learning
- Always on internet access, but be wary of data costs and limits
- Bluetooth and Wi-Fi connectivity
- Range of accessories available but at an extra cost

### Cons:

- Small screen
- Small software keyboard
- Data limits can prevent usage, especially when using certain apps like video-conferencing

## *eBook Reader*

### Description:

Designed specifically for reading books and other text-based documents. There are two incompatible versions: Amazon's Kindle range of eReaders and the others. Kindle formatted (azw or mobi) books can only be downloaded and read either on a Kindle device or via the Kindle App, which is available on multiple platforms (e.g. iPad, Windows, AndroidOS, etc.), but you cannot read or download them onto other eReaders.

The converse is also true: you cannot read the other popular eBook format (ePub) on a Kindle. There is a wealth of free, open-source, as well as paid-for content, which is only available in ePub format.

ePub books can be converted to the mobi format (with Calibre, for example) if you want to make an ePub book available to students who only have a Kindle. Calibre can also strip the Digital Right Management (DRM) from a Kindle book and convert it to ePub for reading on other devices, **BUT THIS IS NOT LEGAL** and will break copyright laws, so should not be done. A Kindle book must be treated just like a physical one: you must buy a copy for each user.

All eReaders have Wi-Fi to connect to the local network for downloading books from the internet, and many include a limited browser.

These restrictions make eReaders of limited value for remote teaching: but they are good for reading books!

### Pros:

- Good screen for reading (non-reflexive, variable contrast)
- Lightweight
- Can hold many thousands of books

### Cons:

- Specialist device (designed only for reading)
- Limited browser
- No other applications or “ports” (other than for headphones) to adapt its use

## Games Console

### Description:

After the smartphone, a Games Console may be the most common computer to be found in the home! While they are designed specifically for gaming, these consoles are still just computers with a particular objective - to provide a good gaming experience. They may appear to be an odd choice when considering which devices students have access to for remote learning, but they do have great potential: they are internet-connected (most games are now bought via download and include multi-player elements) and offer a range of non-game software through their app stores.

The range of software available is quite extensive and includes a browser and apps for, amongst others, Zoom, MSTeams and GoogleMeet making them good platforms for remote teaching and learning.

There are three main versions: Xbox, PlayStation, and Nintendo. All have their own differences but also share common facilities. Perhaps the main difference between a standard console and desktop computer is that there is no keyboard, mouse, or screen included. Consoles are usually connected to an external TV or Monitor (via HDMI) and use a "controller". Consoles can, however, also accept input from keyboards and mice. Care needs to be taken when buying a keyboard for a console to make sure it is compatible. Most will accept USB (either with a wire or wirelessly) or Bluetooth keyboards, but the *Xbox One*, for example, will not connect to third-party Bluetooth keyboards.

A note about the Nintendo Switch: the main Nintendo Switch can either connect to a TV or use the small screen which is included. Switch Lite is an all in one console with a small, integrated screen but will accept a USB keyboard.

Connecting a keyboard and mouse is usually straightforward, and instructions for any particular device can be found online: for example, attaching a keyboard and mouse to [Xbox](#) or [Playstation](#).

### Pros:

- Already set up with internet access
- Relatively powerful computer
- Good graphics
- Range of applications

### Cons:

- Needs third-party keyboard/mouse to make it usable for remote learning
- Usually connects to the TV, so it may be difficult to use for remote learning in a family unless using a separate monitor.

## RaspberryPi

### Description:

The Raspberry Pi was designed for teaching computing skills but has since found a range of uses as a very cheap processor for hobbyists. While few students will already have one of the RaspberryPi computers they are worth considering as a very inexpensive way to provide a computer to students. The cheapest versions (Pi3 and Pi4) retail for about £35, but these are only the circuit board so a keyboard, mouse and screen (or they can connect to the TV over HDMI) also need to be provided. RaspberryPi produces a housing, which gives the bare circuit board some protection.

The Pi400 is a new product where the processor is built into a keyboard. This costs about £70 but does require a few other accessories. A kit with the Pi400 and all these extras is available for about £100. *NOTE: the HDMI cable supplied with the Pi400 kit is very short, so you may need to buy a longer one to connect it to a TV.*

A range of operating systems can be installed from their own PiOS desktop environment to a full Linux build. It is even possible to install Windows but performance may be very limited.

Once set up and connected to the internet, the whole range of desktop software is available to download and install, making it a good platform for remote learning. It has all the advantages of a Desktop or Laptop while having a small form factor and being much cheaper.

NOTE: the most recent update (Dec 2020) to the RaspberryPi OS has reportedly fixed issues with using Zoom, Teams, and GoogleMeet, but we have not been able to test this.

### Pros:

- It's cheap
- Range of Operating System choices
- Wide range of software
- Built for education

### Cons:

- Initial set up requires a certain level of technical knowledge
- Performance of "heavy duty" apps may be poor
- Can be very fragile unless the housing is purchased
- Limited video-conferencing (reportedly fixed in recent update)

## *Accessories and Connectivity*

A few definitions:

**Cellular Data:** access to the internet over the mobile network (3G, 4G, 5G). Mobile phone contracts generally include a limited data allowance. Data over this limit will be charged for and can become very expensive.

**Wi-Fi:** used mainly to describe wireless access to the internet. This may be within the home (i.e. the device supplied by the ISP will provide internet access to multiple devices in the home over Wi-Fi) or other locations (e.g. a local Café).

**Wireless:** access method for connecting peripherals. Often a small dongle is connected to the computer's USB port which then connects wirelessly to the peripheral. Keyboards and mice are often connected this way.

**Bluetooth:** another wireless connection, but in this case, Bluetooth software is built into the computer and can "discover" Bluetooth enabled devices nearby (typically 10m range) which can be "paired" to allow them to connect. As well as keyboards and mice, many other devices use Bluetooth to communicate (e.g. headphones, speakers, even other phones).

*Accessories:*

There are many devices already found in the home of students that are not traditionally used for remote teaching and learning, but with some ingenuity, assistance and a few extra accessories can be used quite successfully.

The key additions are a **Keyboard** and **Mouse**. These can be bought very cheaply online. Keyboards can be connected by a USB cable, wirelessly via a USB dongle, or over Bluetooth. Not all devices have Bluetooth, neither do they all have USB ports, so check carefully before buying any accessory.

Another very useful addition is a pair of **headphones** - either full "over-ear" or "in-ear". These come in a huge range of prices and quality but can be found cheaply online. For maximum flexibility, it is best to use wireless/bluetooth in-ear headphones, which can be less than £10. Ear-buds (no wire connecting the two earpieces) tend to be much more expensive and offer little additional benefit. When using video-conferencing apps, headphones will improve sound quality as they prevent speakers feeding back into the microphone, which is the cause of many sound issues.

Devices that have touchscreens (mainly Tablets and Smartphones) can benefit from having a **Stylus** as this can improve the precision with which selections can be made: particularly: when editing text or using graphics applications. Again, they come in a range of prices, but there are cheap versions available (e.g. MEKO do an iPad stylus for £13 whereas the Apple one is £90).

## *Internet Access*

By no means all households currently have internet access which is, of course, a prerequisite for remote teaching and learning. For those that do have a reasonable connection, all the devices above can easily access the internet - typically over Wi-Fi but also by directly connecting the device to the local network using an ethernet cable.

For those households without good internet access, there is the option of connecting to the mobile cellular data network: this can be expensive, so schools must be aware of this and possibly offer financial support for the most disadvantaged pupils. One possibility is for the school itself to purchase Wi-Fi data contracts before lending the device (see below) to their pupils. Good mobile coverage is not universal for all providers, so checking the signal strength before purchase is essential.

What options are there given the potential expense and the data limits that need to be monitored?

(1) A Wi-Fi dongle for a single device. Usually, in the form of a USB stick, this can be connected to a single device and cannot be used for tablets (as they don't have a USB port!).

(2) Mobile Broadband Device (Mi-Fi). Essentially similar to a Wi-Fi dongle, it connects to the cellular data network but also emits a Wi-Fi signal so multiple devices can connect to it at the same time to share the connection. In households with more than one pupil, this may be a more cost-effective option than having multiple dongles.

(3) Mobile Broadband Router. Some mobile providers offer a router to connect to the cellular network. These tend to offer more generous data limits than dongles or Mi-Fi routers. These may not be available in all areas, but where they are, they may prove to be the most cost-effective way of providing internet access.

(4) Tethering. Most smartphones can share their cellular data access and provide a local Wi-Fi hotspot which another device can connect to. As most households have a least one mobile phone, this may be able to provide at least some internet access to other devices. However, as noted above, mobile phone contracts tend to have strict data limits, which can easily be reached when used for remote learning.

## ***“Bridge the Divide”***

While this document has concentrated on how the range of devices already in many homes can be utilised for remote teaching and learning it must be noted that many schools, LAs, and regional “Grids” have done, and still are doing, as much as they can to supply students with suitable equipment where none exists. For example, “[Bridge the Divide](#)” is a large national procurement project, led by the LGfL, that schools can use to buy up to 2 million devices at very low cost to support their students.

## **Staying Safe**

With the expected increase in the need for remote teaching comes an even greater responsibility for schools to offer support and advice to parents on how to keep their children safe online. The DfE provides some guidance on the [safeguarding and security settings](#) available on a range of devices. The NEN also have a [guidance note on web content filtering](#). More general advice on child safety online is offered by a range of other sites. Three good examples are [Childnet](#), [NSPCC](#), and the [ThinkUKnow](#) site run by the National Crime Agency. All these offer very valuable advice applicable to both school and privately owned computers, tablets and mobile phones.

## **Intended Audience**

*Senior Management, Staff with responsibility for Safeguarding policy,  
Heads of IT/Computing and other technical staff.*

## **Summary**

Ideally, for remote learning to be successful, pupils need a suitable environment (a room free of distractions, for instance), the availability of appropriate hardware and software, and reliable internet access. Pupils will be at a disadvantage whenever any of these preconditions are not met. Schools cannot solve all of these problems but should be aware of how they impact their students and do all they can to mitigate the effects.

A major problem in some households is not just that the traditional devices are not available but that, even where there is a device, it is often shared between family members. This can lead to conflicts where two, or more, siblings need to complete work that has been set for them online. So “availability” must be read as resources being available “per student” not “per household”.

In these notes, we have concentrated on which devices may already be available in many households: from the PC and laptop to devices that are not traditionally associated with remote teaching (Games Consoles, for example) and can be overlooked.

The usability of many non-traditional internet-connected devices can be greatly enhanced with the addition of a few simple peripherals: in particular, a full keyboard and mouse. These can be bought cheaply online and could be supplied by the school for the most disadvantaged pupils.

Internet access is the other major problem in many households, particularly (but not exclusively) in rural areas. If they do not have "wired" broadband from BT, Sky, Virgin Media, etc., then we outline the cellular internet access options that can be explored either for a whole household or an individual.

Over the last year, teachers have worked hard to provide remote education and some daily structure for their pupils. As we go forward, it is likely that teachers will be expected to be able to offer both remote and at-school teaching to their pupils. In order to do this successfully, it is crucial that they are aware of and do their best to support pupils who have severe constraints on their ability to access it. This may involve loaning peripherals to leverage whatever devices are already in the home, loaning computers, or supplying cellular internet connectivity.