

DEDTECH: SUSTAINABLE HARDWARE USAGE

Alan O'Donohoe describes practical, sustainable solutions for making the best use of dedtech — technology we no longer see a use for

There's something wonderful about unboxing a new gadget and setting it up, whether it's a mobile phone, tablet, or computer. However, you may have noticed that gadgets don't stay shiny and new for long. Technology is getting replaced at a faster and faster rate. Every day, notifications pop up on our devices telling us that updates are needed. Unfortunately, these updates often no longer support older devices, which shortens their lives. We're only witnessing very small incremental improvements in function, power, and performance over purchases made a couple of years ago, but this hasn't stopped equipment manufacturers trying to devise new features to make their devices appear compelling in their sales and marketing campaigns.

When it comes to managing the use of technology in education, particularly older hardware, schools therefore face some common challenges:

- **End of life:** managing the disposal of obsolete equipment ethically
- **Practical experiences:** difficulties teaching students about the maintenance of hardware, software, and networks
- **Sustainability:** providing meaningful experiences to help students understand more sustainable approaches to acquiring and using technology
- **Digital divide:** supporting students who lack access to suitable devices out of school
- **One size fits all:** replacing PCs with tablets and Chromebooks, and how that can restrict learning opportunities

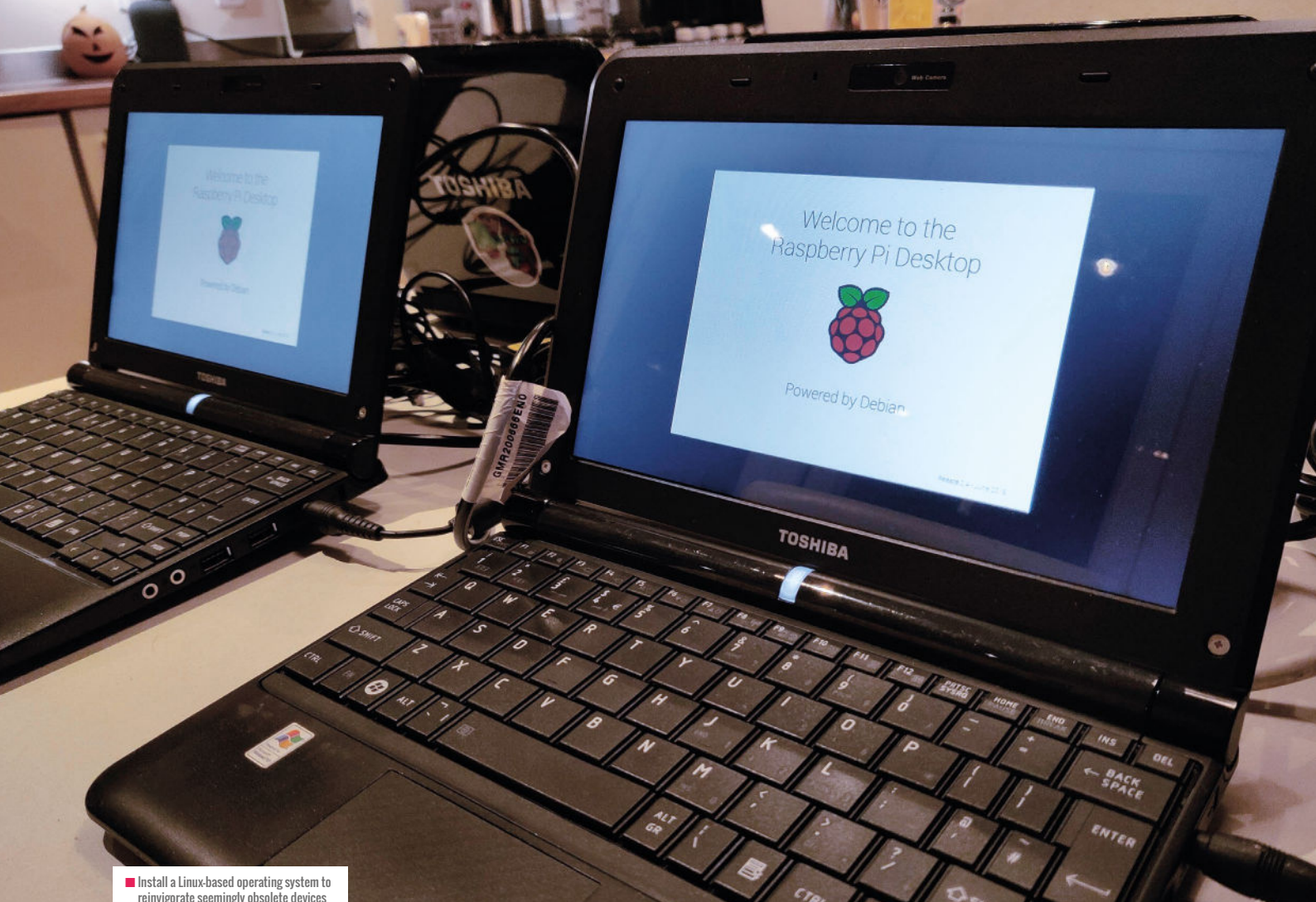
In this article, I will share some practical and sustainable solutions for making the best use of dedtech — a term I coined

to describe the technology we consider to be as good as dead, whether it's damaged, decommissioned, dirty, discontinued, or otherwise done for!

Switch to Linux

First things first — we may be able to salvage dedtech simply by switching its system software. I have done this with donated hardware. As part of my work, I lead digital maker workshops in community spaces. It's rare for anyone attending these workshops to bring a device with them, so I have a set of donated netbooks I use. Despite being ten years old, these netbooks are well built and in near-perfect condition. They had been purchased new, shortly before the donating school updated all their devices to a later version of Windows. This change meant that these obsolete devices were no longer of use to the school. For my workshops, though, I simply installed a version of Linux available for free from the Raspberry Pi website, which includes Scratch, Python, Google Chrome, and other software; it's called Raspberry Pi Desktop for PC and Mac (helloworld.cc/rpidesktop).

Linux is an operating system (OS) that is offered as a free alternative to paid operating systems such as Windows and MacOS. Many different versions of Linux are available — Ubuntu and Mint are popular in education, and they work particularly well on older computers. It's possible to boot Linux on a PC from flash memory (for example, a USB thumb drive). This might be unreliable for regular use, but can help you decide which version to use without making lasting changes to the PC. It always amuses me how much workshop participants enjoy using these devices, which otherwise would have been gathering dust in a cupboard. This is just one example of how some dedtech has been repurposed to meet alternative needs.



■ Install a Linux-based operating system to reinvigorate seemingly obsolete devices

Upgrade an old laptop

Sometimes, extending the life of an old device won't be as easy as changing the software you use, and you'll need to get a little more hands-on with the hardware! For example, computing teacher Mark Weddell (@markfromlondon) recently upgraded a laptop he had originally purchased in 2012. When he bought the PC, it had all the latest specifications — but years later, it was really showing its age. It took a long time to boot up and would often freeze for a few minutes at a time. The laptop was barely usable, and the battery had deteriorated so badly that it needed to be kept plugged in to use it, but the rest of the hardware was still in great, clean condition.

Mark took the following actions to upgrade his laptop:

- 1. A fresh install of the operating system:** a registered version of Windows 10 had previously been installed on the laptop, so it was possible to choose a fresh install from the website and remove all previous software.
- 2. A new SSD:** Mark replaced the previous magnetic hard drive, which was slow, with a new solid-state drive (SSD). This cost him £50 (about \$60) for a 500GB drive. In order to check that the dimensions and specifications of the replacement would work correctly, Mark first removed the old drive from the laptop and compared it with online photos of the replacement.
- 3. A new battery:** after removing the battery, Mark was able to note its part number, the power requirements, and the

specification rated in milliampere hour (mAh). He found that original manufacturer parts were expensive and difficult to source, so he purchased an unbranded replacement instead. There are risks associated with the use and disposal of batteries, and readers are advised to follow all guidance.

“ WE CAN ENJOY USING DEVICES THAT OTHERWISE WOULD BE GATHERING DUST

Convert to Chromebook

It is also possible to convert mobile devices with keyboards into Chromebooks (computers that use Google's Chrome browser as the OS). Although Chrome OS isn't available to download, there is an open-source version, managed by Google, called Chromium OS. Installing it is not a simple process, but it can go a long way towards extending the useful life of a laptop. One solution that makes it easier is CloudReady: Home Edition. This is free for individual use; all you need is a USB thumb drive to install it. It's meant for use in education, there are site licence options, and the devices can be managed remotely. If you search online, you'll find plenty of tutorials and videos showing you alternative approaches. ▶



■ You can dismantle devices for a junk modelling craft activity

- It's worth noting that Chromium has some limitations. For example, it reduces the option of installing conventional software such as Scratch or Python — but fortunately, web-based alternatives are available for those programs. Neither does Chromium support licensed media codecs such as MP3 and H.264, which means it's challenging to play media. In order to watch videos from streaming sites such as YouTube and Netflix, codecs may need to be installed manually.

ALTERNATIVE SOLUTIONS

If none of the ideas mentioned in the article pique your interest, here are a few more suggestions:

- Preserve old devices for a stimulating classroom wall display or collection
- Use the devices to build a sandboxed network built by students
- Repurpose a device as a dedicated media player, as a games system, or to access older stored media

Technology teardown

For devices that are too expensive to repair, a terrific option is to use them as practical hands-on learning resources. The Science Museum has a resource called *Wreck Your Tech* (helloworld.cc/wrecktech), which you can use to help your students learn how devices are assembled, investigate parts of the machines they can't normally access, and make their learning more concrete.

If you plan this activity just right, and supply the right resources, devices can be carefully disassembled and then reassembled afterwards, and used time and time again. While it can be entertaining to tear a device apart using brute force, if it can't be restored to its original condition afterwards, how useful is the experience? Show the students methodical, non-destructive approaches. Screws should be carefully collected, stored, and labelled. Take photographs at key stages of disassembly to aid with reassembly. Your students will be learning about sustainability and developing life skills that will help boost their confidence and technique when it comes to repairing devices at home. It's likely you'll need some special tools such as torx screwdrivers and tweezers.

It's helpful to connect these kinds of activity to real-life uses. Ask your students, for example, to consider how valuable teardown activities might be to commercial organisations. (Products are acquired so that competitors can learn about the components and techniques used, and boost their own research and development.)

When a piece of equipment is no longer suitable for reuse as a device, you can also tear down the components for a junk modelling craft activity in which students construct robots, imaginary creatures, or items of jewellery, for example. This can be a great way to connect computing to other subjects, or to extracurricular clubs. The unusual shapes of connectors and the brightly coloured wires have high visual appeal and can spark creative minds. You'll see some very creative, inspiring ideas on Pinterest under the 'computer repurposed' heading.

Wrecking and junk modelling activities can be incredibly enriching, but they are not without risk. Students need to be briefed on the health and safety risks, which vary depending on the equipment being dismantled. Devices with larger batteries and optical drives that use lasers need to be handled with care. See the 'Important considerations' section for more information about risks.



■ You can preserve old devices for a stimulating classroom wall display or collection

Donation

You can extend the life of your tech by donating items you no longer need. When schools were forced to close due to the Covid pandemic and lessons took place online at home, there was a rush to provide students with devices to support their learning, but the demand for devices overtook the availability. It's likely that there's a local charity near you that refurbishes computers for worthy causes, and there are national charities that will organise collection.

WeeeCharity, for example, is a not-for-profit UK-registered charity that will collect your old computing equipment from your home free of charge (weeecharity.com). They can also securely wipe your data, again free of charge. If they are unable to repurpose a device, they dispose of it in an environmentally responsible way. You can read more about the power of donating devices in James Abela and John Ling's article on page 24.

Important considerations

While repairing, reinvigorating, and donating your tech are all worthwhile activities, there are a few risks that you'll want to consider before diving in:

Data sanitisation: Steps may need to be taken to safely and securely ensure that no data remains on a device. Although advice varies, physically removing any storage media (for example, the hard drive) before donation provides the highest levels of security. Low-level formatting software can also be used to remove data from drives (for example, Windows 10 factory reset options allow you to permanently delete data, or install HDD LLF from HDDGURU; helloworld.cc/hddllf).

Transfer of ownership: As policies vary from school to school,



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it's worth consulting your institution's policy and discussing your plans with an appropriate member of staff, such as the business manager. This will help you to understand what is permissible when equipment reaches the end of its life and the necessary steps that must be taken.

Safety: Any learning activities that involve disassembling hardware and the use of tools will require a comprehensive risk assessment beforehand, and ought to include demonstrations of the correct procedures for the use of tools; wearing PPE (personal protective equipment); adequate levels of adult supervision; the identification and removal of hazard threats (for example, lasers in optical drives); the isolation of mains power; and the safe handling of equipment. It's recommended that any mains power leads are removed, or plugs cut off completely.

While the suggestions outlined in this guide can revitalise technology destined for landfill, they also go much further, providing valuable experiences that positively impact young people, as well as the planet. These activities will lead to lively discussions among your students, model the attitudes of responsible consumers who use resources in a sustainable manner, and develop within them the confidence and capacity to repair and refurbish rather than destroy or dispose. Hopefully, this guide will instead encourage you to be the teacher who champions dedtech and thinks twice before ordering and unboxing that shiny new gadget! **(HW)**

FURTHER RESOURCES

- A video exploring dedtech in use at Todmorden Makery, a community workshop for makers in the UK: helloworld.cc/todmorden
- Raspberry Pi Desktop for PC and Mac, a good OS option for old computers: helloworld.cc/rpidesktop
- Pinterest board showing creative uses of old computer parts: helloworld.cc/pinterestcomputers
- WeeeCharity, a UK-based charity which repurposes old devices: weeecharity.com
- Computer Aid International, a charity that matches donated computers to organisations: computeraid.org