



Acceleration of E-learning in Australia and Impacts of E-waste: Approaches to reforming e-learning in the 21st century

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Abstract

This research tracks the rapidly growing use of Information and Communication Technology (ICT) in Australian educational institutions and the resultant increase in the generation of waste electrical and electronic equipment (e-waste). Recognising the inevitable continuation of growth in ICT use in education programs, this research identifies possible interventions in curriculum development to minimise the creation of e-waste, and for the effective management of the e-waste that does result from increased ICT use in education.

Australia, like many other countries, is accelerating the transformation of teaching and education through enhanced e-learning and increased usage of ICT [10].

As outlined in the strategy paper, Digital Education Revolution (DER) [2], the Australian Government has provided significantly increased funding for education ICT facilities through a growing number of education programs and policies to support all aspects of e-learning in classrooms. The DER includes a reform program intended to introduce and support a one-to-one computer to student ratio for years 9 to 12.

As ICT innovation and usage becomes ever more prevalent in everyday life and in classrooms, e-waste has become the fastest-growing waste stream globally [11]. Worldwide, approximately 50 million tonnes of e-waste are generated each year. This increasing waste stream is exacerbated by the growing number of education programs focused on e-learning and associated increased ICT usage.

Keywords: E-Learning, E-Waste, Australian curriculum reform.

1. Introduction: ICT Trends in Australia

Over the past decade, the Australian Government has invested heavily in digital education, highlighting the link between technology and economic prosperity [10].

One educational reform program responsible for catalysing the rapid adoption of ICTs in classrooms was the 2009 Digital Education Revolution (DER). The DER was designed to support a 1:1 computer to student ratio for years 9 to 12 under a \$2.1 billion budget [6]. This was supported through the provision of educational software, necessary e-learning resources, wireless infrastructure, on-site technical support, and policies to support digital learning [6]. To support the DER, the National Digital Economy Strategy (NDES) was implemented. The NDES offers a framework that aims to put Australia at the forefront with a world class digital economy by 2020 [7]. One of the digital economy goals is to grow online education by 2020 in the hopes that all higher education institutions will extend the facilities, services and resources available to face-to-face students to students only available for virtual and digital learning [7].

ICT strategies are now embedded within the Australian Curriculum. The Australian Curriculum sets the standard for learning and determines capabilities students from Kindergarten to Year 12 develop [1]. Throughout the key points of the curriculum, however, there is no mention of waste or end-of-life management of ICT. Instead the curriculum looks to build competencies in using ICT such as understanding productivity, effective communication, managing digital data, recognising intellectual property and identifying social impacts [2]. While this is imperative for learning, there are opportunities to include developing an understanding of the impacts of end-of-life procedures and even outline procurement behaviour, particularly as educational e-waste becomes more of a sustainability concern.

2. E-Waste Trends in Australia

Australia is one of the world's biggest producers of e-waste, as Australians are among the highest users of new technology [12]. It is estimated that in 2009 to 2010 approximately 109,000 tonnes of

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televisions and computers ended up in landfill, with an estimated 10% of these electronic products undergoing recycling [3]. With the rate households, schools, businesses and consumers adopt new technology and replace old devices, there is increasing urgency to effectively develop an e-waste strategy that can support the empowerment of people through using technology without it being an unsustainable practice [14]. This is particularly crucial with educational institutions.

From 2014 – 2015 the number of Australian households with access to the internet was ~7.7 million people, or 86% of the total number of households [4]. In 2014 to 2015, for Australian households with children under 15, 97% had access to an internet connection [4]. In comparison to households without children under 15, 82% had access to the internet [4].

In households with an internet connection, the following is a breakdown of the type of devices that are used to go online:

- Desktop or laptop computers (94%)
- Smartphones (86%)
- Tablets or iPads (62%) [4].

Of all these devices, a combination of these ICTs are present in many Australian households. The mean number of devices used to access the internet was 6, and for households with children under 15 the mean number was 7 [4]. In consideration of these statistics, connecting to the internet at home is arguably a necessity and for households with children under 15. Each year this has grown. In 2008 - 2009 an estimated 2.2 million children aged 5 - 14 years (79%) reportedly had access to an internet connection and in 2006 this was at 65% [4]. This can be attributed to the introduction of the Digital Education Revolution and the government's push to adopt technology in classrooms.

3. Australia's E-Waste Response

Australians are advocates for the digital life, as seen through how digital technologies pervade every aspect of modern Australian society. Over the past few years the Australian Government, in partnership with State and Territory Governments, developed the National Product Stewardship legislation to provide a framework that promotes and enforced recycling [9]. The National Product Stewardship Act came into effect in August of 2011 and was designed to provide a framework that would oversee the safe disposal of products while adhering to environmental and health regulations [13]. Mandatory product stewardship involves enabling regulations that require people to take, or not to take specified action in related to the product [13].

Introduced in 2011, the aim of the National Television and Computer Recycling Scheme (NCRS) is to:

- Provide access for households and businesses around the country to be covered by an industry-funded recycling service;
- Increase the recovery of reusable materials in a safe and environmentally sound manner; and
- Reduce waste headed for landfill and responsibly treating/disposing of hazardous materials found in e-waste [8].

The highest target has been set for 2021 - 2022 to cover 80% of all end-of-life televisions and computers in Australia [3]. Up until now the Australian government reports over 130,000 tonnes of television and computer waste has been recycled and has supported the opening of more than 1800 collection services [3].

In consideration of these targets, over the first two years of operation the NCRS exceeded all outcomes. In the first year from 2012 - 2013 an estimated 137,756 tonnes of televisions and computers reached end of life, of which 40,813 tonnes was recycled [3]. In this year, the recycling target was 30% to be recycled, which was almost met at 98.8% [3].

The following year (2013 - 2014) the total target was increased to 33% [3]. In this year, the total amount of televisions and computers that reached end of life was 131,000 tonnes and the total amount of this that was recycled was 52,700 tonnes (121.4% achieved) [3].

Large volumes of e-waste have, as a result, been turned away as recyclers and government arms cannot afford to recycle the full 130,000 tonnes, leaving many households and businesses uncovered by the legislation [3]. The scheme also only funds recycling within the targets, so there is no requirement on the manufacturers, importers, government bodies, or recyclers to fund the excess e-waste [13].



4. Recommendations

Even though Australia faces similar e-waste challenges as other countries, the solutions and strategies in place lack comprehensive coverage for many ICT users. The high usage of ICTs in the education sector highlights one of the many industries accelerating the rapid uptake of ICT, demonstrating the need to develop strategies that provide e-waste coverage for education-specific ICT consumption. Australia's response to e-waste only tackles televisions and computers, excluding e-waste generated in other forms of ICTs such as tablets and iPads. With educational e-waste receiving little attention in research and academic spheres, points of intervention need to be identified for potential opportunities to successfully manage educational e-waste.

State, territory and local government strategies are an essential component of co-regulatory arrangements in Australia and overall delivery of policies and legislation. Government programs that have been designed to support the roll-out of ICT include:

- Online Curriculum and Assessment;
- Technology in Schools;
- The Broadband-Enabled Education and Skills Services Program;
- Pathways in Technology Early College High School (P-TECH) pilot; and
- Inspiring All Australians in digital literacy and STEM [2].

These programs offer a mixture of pathways that support development around ICT usage [2]. Government bodies are currently supporting specific learning objectives to integrate deeply with technology and ICT, however leave out end-of-life management for schools. By using the existing government programs, all government bodies can push for sustainable management of e-waste that will consequently be generated as an outcome of other educational ICT programs.

5. Conclusion

This paper aims to explore e-waste strategies and opportunities for the education sector to highlight the significant amount of e-waste excluded from current solutions. This paper found that the task of innovating Australia's e-waste solutions is left primarily up to the private sector, not-for-profit initiatives and one co-regulatory arrangement known as the National Television and Computer Recycling Scheme [10]. These responses are not sufficient to responsibly account for the growing e-waste streams being generated in Australia and do not provide enough coverage to capture the current ICT trends. The findings from this paper can be put forward to further investigate the points of intervention for e-waste opportunities in education.

Introducing e-waste reduction and management initiatives and requirements into the national education curriculum provides schools with a framework to complement a nationally-led e-waste reduction management solution. This also allows educators and students to better understand the potential e-waste consequences and impacts of increased ICT usage, and their respective shared responsibilities regarding sustainable management and minimization of e-waste. ICTs are integral to a successful education system, valued across much of Australian educational policy and households with children. Australia's e-waste policy has the potential to frame e-waste challenges in a way that will benefit our continued use of ICTs, effectively tackling the challenges of the 21st century.

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