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Examining digital disruption as problem and purpose in Australian education policy

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Young people's relationship to the digital economy is a key site of popular and policy attention within the context of shifts in labour market conditions globally. The massification of digital media and rapid growth of digital markets globally have brought significant challenges for policy makers in what counts as work and how best to prepare young people to engage with it. This has manifest in a proliferation of initiatives and policy orientations across much of the global North which have tended to focus on the importance of science, technology, engineering, and mathematics occupations, and, in particular, computing aimed at preparing young people for jobs of the future. The formalization of learn to code programs in school curriculum has been one such initiative. Despite the proliferation of coding and computational thinking curriculum across many countries, there remains a relative paucity of scholarship examining their embedding in educational policy debates. This article follows the announcement of the 'coding in schools' policy in Australia since its formal announcement by Opposition Leader Bill Shorten in his Budget Reply speech in May 2015. The announcement followed similar moves in other countries and has cemented 'coding in schools' as a literacy of 'the future' in the Australian political landscape. This article suggests that, while a policy focus on technical and instrumental skills such as computer coding may help young people to interact with dominant technologies of the present, they also risk weakening a more substantive conversation around educational participation and purpose in the present, and for the future.

Keywords: coding; digital transformation; education policy; Hansard; STEM

INTRODUCTION

Despite the rapid rise of coding and computer programming in school syllabuses across the global north, there exists a relative paucity of scholarship examining their positioning in educational policy debate. The dispersed nature of these programs, both in their take-up and embedding in school-based curriculum, means that, beyond the reported statistics of each initiative, it is difficult to glean an accurate indication of how many programs exist, their constitution, and their embeddedness in formal school curriculum. A cursory search of the website of the market-leading provider, code.org, states that over 20% of US school students use the platform, and 10% "of the world's students have tried the Hour of Code", their proprietary program (code.org, 2017). In Australia, codeclubau.org boasts over 65,000 student accounts across hundreds of school sites. While these numbers currently represent a modest slice of the 1.4 million primary school students in Australia, they reflect a growing concern for coding as a

core competency young people should be encouraged to develop. As I argue below, this is symptomatic of the broader orientation in response to the rise of computer-mediated interactions in the labour market and represents a technical solution to an instrumental set of logics around networked technologies.

This paper examines official Hansard debates by Australian Federal Ministers that followed the announcement of the "coding in schools" policy in Australia from its formal announcement by Opposition Leader Bill Shorten in his Budget Reply speech in May 2015 up to the time of the federal election in July of 2016. The announcement came after similar moves in other countries and cemented "coding in schools" as a literacy of the future in the Australian political landscape. This article provides a critical analysis of parliamentary debates, media releases, and engagements by government and opposition federal ministers to consider how the re/articulation and embedding of Science, Technology, Engineering, and Maths (STEM) education takes up an idealized notion of 'the future' as tech-enabled and in need of policy response to 'the new.'

The analysis highlights three lines of debate that have emerged in operationalizing and responding to educational policy in the wake of the digital labour market disruption: first, the rise and reach of networked infrastructures into traditional modes of life and work; second, the future value of existing and proposed programs of study; and, third, the implications for resourcing in the wake of the Global Financial Crisis and uneven economic recovery. Despite concentrating on the Australian context, the issues raised in this paper around coding in schools resonate with conversations around the technologization of work and life on a global scale. Combined, this paper argues that, while policy focuses on technical and instrumental skills, such as computer coding, may help young people to interact with dominant technologies of the present, they also risk weakening a more substantive conversation around educational participation and purpose in the present and for the future.

THE RISE OF CODING IN SCHOOLS

The term 'coding' in relation to schools is often used as a catch-all for a range of activities and pedagogies within visual programming environments that employ a simplified programming language (Corneliussen & Prøitz, 2016). Many of the current iterations use a project-based approach that draws, at least in part, from the work of MIT Media Lab pioneer Seymour Papert and his use of turtles along with the LOGO interface beginning in the late 1960s (Papert, 1972). As Corneliussen and Prøitz (2016) describe in their recent work, in practical terms, this work often involves children engaging with "boxes that represent parts of the code while editing other parts of the code themselves to produce a game or a story told with moving objects on the screen." These projects are often shareable or playable, giving the students an opportunity to run the program that they have created. There are an ever-increasing number of programs, projects, and offline forms that this instruction can take, such as through proprietary products such as *Scratch*, *LEGO Mindstorm*, and *Tynker*, which leverage the *Minecraft* platform (see, e.g., Sáez-López, Román-González, & Vázquez-Cano, 2016). What is common to each is a focus on combining aspects of gaming with the fundamental building blocks of constructing executable programs in a visual, assisted coding environment. In this sense, current discussions around coding have emerged within a longer conversation around computational science in schools that has three key elements, which I consider here in turn: the development of curriculum;

pedagogical instruction; and organizational policies around data capture, management, and reporting.

Computing curriculum has a longer history in schools, and there have been significant calls for its embedding across the curriculum in Australia for well over two decades—as is the case in many other countries. Specific calls around 'learning to code' are more recent, with a particular surge in interest over the last decade. Williamson (2016, p. 39) notes that "the idea of 'learning to code' . . . has grown from a minority concern among computing educators, grassroots computing organizations, and computer scientists into a major curriculum reform." Within this, significant corporate interests have invigorated debate both within and beyond the schoolyard context, with calls to embed the computational capacities and the skills of 'digital citizenship' within educational frameworks worldwide.

The coding landscape is uneven, with multiple resources often operating within and across national borders as well as within state and local jurisdictions. In a comprehensive review of computing curriculum globally, Falkner and Vivian (2015) show "coding" as emerging as a key part of policy discussions and formalized part of the curriculum at a national, regional, or local level, especially in Europe and North America. Their analysis shows that the resources deployed across these jurisdictions differs greatly, with some systems mandating the use of specific proprietary programs but the majority making use of those supporting "free and open usage," and providing less explicit guidance around "on the ground" implementation (Falkner & Vivian, 2015). What is common across their analysis, however, is an increasing expectation in many countries that children interact with digital and networked technologies as part of their formal education from a very early age.

Despite the enthusiasm for integrating computer science curriculum in schools, there remains an ongoing debate about the teaching of programmatic thinking within the classroom environment. Proponents of programmatic thinking have espoused its relative merits as a cognitive process for well over four decades, and many highlight the dramatic rise of computer science in all facets of modern life as a key indicator of the need to ensure students understand coding as the building blocks of computer science (Robins, 2015). Sáez-López et al. (2016) note that the growing interest in learning to code "driven and disseminated by organizations such as 'codecademy.com' and 'code.org' [is posited] not only for future job opportunities and growing demands in this field, but for the educational advantages and benefits that coding in education provides" (p. 130). Accepting this proposition, there nevertheless remain significant challenges around what constitutes computer science in the classroom, how it should be deployed, and to what end. Vivian, Falkner, and Falkner (2014) highlight the lack of learning and teaching research in computer science education research, particularly around teacher preparation, effective pedagogy, and resources development. For many, providing opportunities for young people to engage in computational thinking both "plants a seed" for potential future recruitment into computing (Corneliussen & Prøitz, 2016) and provides a necessary foundation for interacting productively with the tech-enabled labour market of the future (Schmidt, Resnick, & Ito, 2016).

Reviews of the current landscape acknowledge that research into computer science in a K-12 context is a "relatively young field" (Vivian et al., 2014, p. 392). Vivian, et al. (2014) suggest that, to date, practical considerations around teacher preparation, curriculum design, and the use of specific programs have dominated the field of

inquiry. In their view, policy analysis, though scant in the Australian context, has tended to interrogate the challenges that national and local governments face in preparing teachers and young people to participate in computer science in schools. This finding reflects the global trend. For example, in a review of current research into learning and teaching programming, Robins et al. (2016) suggest that coding related activities are "usually addressed from a psychological/educational perspective" with research focused on "program comprehension and generation, mental models, and the knowledge and skills required to program" (pp. 138–9), rather than how these programs interface with, and operate at a policy level.

In Europe, there has been a recent surge of interest in what is termed "informal" computer science curriculum (DiSalvo, Reid, & Khanipour Roshan, 2014), and a report on school-based coding initiatives across Europe identified curriculum initiatives across 16 countries (Balanskat & Engelhardt, 2015). While these examples differ in terms of their focus on upper secondary and tertiary curriculum, what is common to both is a recognition of the unevenness of the field in terms of resources, approach, and support content, and the relative paucity of policy research in computer science education. With the formalization of many of these programs into a political imaginary predicated on their value for young people's engagement with the future, there is a pressing need for their examination.

EDUCATION POLICY AND THE FUTURE AS OPPORTUNITY AND THREAT

A dominant presumption of recent education policy reform on a global scale has been to shape young people's growth and development in such a way that they can participate in the economy of the future. In their recent comparative review of global efforts in digital innovation in education, the OECD (2016) suggests that "education can prepare young people for work in the sectors where new jobs are expected to be created in the coming years" (p. 67). Implicit throughout this report is an overriding market-logic of embedding digital technologies as fundamental to innovation in the present and towards the future.

In many post-industrial nations, innovation-focused reforms are often framed as a response to the broader embedding of networked technologies in many parts of the economy at a global scale. In this characterization, the market becomes the litmus test against which decisions are made, and, as Adams (2016) argues, "the values and ethos of business provide an ethical base for operationalising education and for defining how success might be judged" (p. 291). Here, for the OECD and others, tensions emerge from navigating the link between local conditions and larger patterns in economic and policy structures, and how those relationships play out between public and private sector entities. As is noted in recent policy scholarship (Ball, 2016; Lingard & Keddie, 2013; Scholz, 2013;), the marked increase by corporations in the production and circulation of market-oriented policy has had a profound impact on the shape of schooling systems at a district, state, and national level. As Lingard and Keddie (2013) show, these interests increasingly operate through networks that, in a significant way, construct, promote, legitimize, and then sell solutions to real and imagined 'crises' of educational provision and practice.

At a policy level, coding in schools has been tied to two emerging lines of debate in recent times that are useful for this analysis. The first extends discussions around teacher preparation and resourcing towards what Williamson (2016) suggests is an emphasis on digital governance or, what he terms, "political computational thinking' (p. 40). The second emerges from an increasing economic concern from governments globally around the proper preparation of young people within the context of digital disruption, the rise of networked technologies, and fostering innovation in the future.

To elaborate both: Williamson (2016) cites the shift in English curriculum policy from ICT to computational thinking as indicative of a pivot towards algorithmic thinking and data analytics across a broad range of education disciplines which mirrors the "disparate social, political, cultural, and economic contexts, across governmental, civil society, and industrial sectors, and in scientific, social science, and humanities disciplines" (p. 40). These concerns are not limited to education policy. As Srnicek (2017) suggests, the broader ways in which forms of labour have undergone a material, as well as symbolic shift that mark the continued expansion of the networked economy are key sites of anxiety for policymakers and, as this article shows, animate policy conversations around life, learning, and labour.

The instrumentalization of current practices in educational thought overwhelmingly tend to be presented in terms of rational thought, and the technologization and quantification of an increasing body of social and cultural practices. Gulson and Webb (2017) consider this as the embedding of a "computational rationality". In their view, "systems of thought . . . [can usefully] . . . be understood as intensifying an instrumental set of logics in educational governance and decision making" (p. 16). They continue, "the development, design, implementation and evaluation of policy solutions (i.e. the 'policy cycle') . . . [involves the sequencing of] social policy as a logic", reflected either as "forward mapping" in terms of predicating a particular outcome, or "backward mapping" in defining, in advance, a set of desired behaviours in order to develop a set of objectives (p. 17). Both are at play in the push towards coding in schools; the former for defining success in terms of future engagement with the digital economy and the latter for orienting schools, teachers, parents, and young people towards digital technologies as a sort of rational behaviour. Gulson and Webb are critical of this orientation, noting how "these rationalities are situated according to the dominant representation of the problematic situation and rarely analyse how problematic situations have come to be represented" (p. 18). Similarly, for Selwyn (2016), the "digital improvement/transformation/ disruption of education clearly require[s] problematising" (p. 18) in its articulation through forms of policy governance, and in its implementation in and around schools. I expand on both of these lines of debate in the latter part of this article. Alongside this, I take Williamson's (2016, p. 55) suggestion that coding in schools is implicated as a form of digital governance in which it comes to stand-in for particular forms of solution-making.

RECURRING PROMISE(S) OF THE NEW

Notions of futurity and the 'new' within the digital information economy have played a prominent role in popular and policy discourse in Australia. While these calls have a much longer history, as McLeod and Wright (2012) note in their exploration of 'the promise of the new' at key historical moments in Australian policy in the early 20th Century, there has been a long-standing tendency towards 'innovation' and 'new

industries' as a point of departure from the present and for aspiration towards the future. However, as Doherty (2017) argues, optimism for young people's place within the 'future' illustrates only half of the picture, with national policy frameworks such as the *National Partnership Agreement on Youth Attainment and Transitions* (COAG, 2009) reflecting a deep anxiety around perceived precarity of young people's work and life opportunities. What is brought together in this complex policy network is, for Doherty, a conflation of youth and educational policy around increased participation in secondary and tertiary education, individualization of responsibility onto young people rather than the state, and anxiety around the ongoing effects of labour market changes that have accelerated alongside the rise of networked technologies.

As McLeod and Wright (2012) remind us, "[t]he call of the 'new' underpins much educational reform discourse, from utopian strands and grand gestures to the more formulaic rhetoric found in declarations of new policies for new times" (p. 283). McLeod and Wright's analytic invites examination of the adjective 'new' in relation to what it is affixed, used to justify, and enable. Brought into a close reading of the pervasiveness of utopianism in educational scholarship and practice, McLeod and Wright's (2012) analysis points to the "complexity of educational change and works against simplified views that are either overly optimistic or pessimistic" (p. 286). It is the relationship between these 'grand gestures' and declarative policy directives which underpins my reading of "coding in schools" in this article.

Anxieties around the 'new' are embedded in discussions about young people's lives in terms of policymaking around specific initiatives like coding—as is the concern of this article—as well as in broader conversations in popular discourse. A full consideration of the composition of various calls to the new is beyond the scope of this article, however two observations are pertinent here. First, as Amsler and Facer (2017) argue, education policymaking is "often dedicated to the formation of future persons, the realization of social futures, and the advancing of historical projects." The effect is that policy instruments often imagine an idealized kind of future subject and seek to anticipate the challenges and opportunities they will find there. Policy 'futures' have both predictive and constitutive elements.

Second, policies, and perhaps especially those concerning digital transformations, are made up of multiple histories converging on a problem of the present, which is then mapped forward as a kind of genesis from which the future progresses. I have considered this at length elsewhere with regard to senior secondary and Higher Education policy (Duggan, 2018), as well as in aspirations and young people's orientations to the future (Duggan, 2013, 2017). Here, Barbara Adam's (2010) distinction between future presents and present futures is useful; the former guiding anticipation for change and the latter taking up the everyday tasks of prediction and enactment. Adam (2010) argues: "[c]ontemporary daily life is conducted in the temporal domain of open pasts and futures . . . [which are] . . . projectively oriented towards the 'not yet'" (p. 47). Future orientation is a necessary precondition for participation in many aspects of social, cultural, and civic life, with both our anticipations and anxieties, as well as our predictions and yearning for certainty, making up, in a large manner, our ability to meaningfully plan and act in the everyday. Coding, and calls to the primacy of human-computer interface sits well within that call. In this, individual social mobility is given primacy, bound up in making the future through technological interventions and in engaging with digital tools and practices in

the present. Active engagement with the technical aspects of networked technologies are increasingly synonymous with calls to continual self-improvement and critical self-reflection with identifying opportunities to be entrepreneurial and innovative in 'making' the future.

MAPPING CALLS FOR CODING IN SCHOOLS

This analysis reflects on part of a larger study into young people's engagement with digital disruption and the future of work. The study is concerned with two primary questions: first, how is digital disruption framed within dominant popular and policy discussions surrounding young people; and, second, what are the ways in which these framings depict or imagine the future that young people are expected to inhabit? These questions draw together nothing of aspirations, identity, and temporality. In designing this research, I am informed by the body of scholarship seeking to understand young people's lives, and their interaction with hard and soft forms of policy, particularly in relation to formal education. This work is necessarily broad in its definition of 'youth,' and, within this, there is a need to consider how educational policy making concerning the rise of networked technologies implicates the whole educational apparatus, as the analysis below illustrates.

There is a growing body of research that deploys network analysis techniques for tracking the reach, depth, and spread of formal and informal educational policymaking (Au, 2008; Ball, 2016; Hogan, Sellar, & Lingard, 2015). There exists significant "slippage", as Ball and Junemann (2012, p. 4) note, in the use of the term "network" in this field, and, indeed, notions of networked governance have long traditions within and beyond educational scholarship with relation to policy (Lingard & Sellar, 2013), cultural theory (Boyd, 2007), and economics (Benkler, 2006; Biddle, 2013). Ball and Junemann (2012) deploy the notion of the network as "method," in their terms: "a means for tracing and representing social relations within the field of policy, and as an analytic tool" (p. 4).

This article draws on an analysis of 486 records collected from the Parliament of Australia Hansard record of House and Senate debates and Standing Committees, as well as official media releases by Australian Federal Members of Parliament from https://media.australia.gov.au/ between October 2014 and 2 July 2016; from the month preceding US President Barack Obama's video to launch the 2014 "Hour of Code," until the date of the most recent Australian federal election. President Obama's speech was chosen as a start point for this examination because of its popularity (over 200,000 views), and its representation as a major endorsement of coding in schools by a government with which Australia has strong ties. The 2016 election was chosen as an end point because it represents a moment where coding in schools had achieved bipartisan support, with both major parties committing to federal policy.

Records were located using the key words 'coding,' 'computer science,' as well as 'coding in schools', and 'computer science in schools'. Initially over 3,000 records were located; however, of these, around 1,100 were found to be duplicates and a further 1,400 were false-positives. Thus, the search parameters were revised with 'in schools' which resulted in greater accuracy. An initial word level analysis using INvivo found over 1,000 distinct usages of the term 'coding', yet deeper examination revealed three categories that guide the discussion below:

1. The establishment of specific coding in schools initiatives, including but not limited to Federal Opposition Leader Bill Shorten's (2015) plan to introduce "the language of computers and technology. . . taught in every primary and every secondary school in Australia."
2. Explicit links between the introduction of coding in schools and 'jobs of the future'.
3. Linking coding to discussions about innovation and actual or desired growth in the high-tech industries.

Following Gerrard, Savage, & O'Connor (2017), this article conceptualizes "policy and media as discourses in and of the public sphere" (p. 506). It is for this reason that official media releases are included alongside parliamentary records, and an extension of this study will be to supplement the current archive with a broader search with the same parameters of major print and broadcast media channels. The goal of this extended project will be to examine, as Gerrard, et al. suggest, "the inter-relationship between media and policy in the construction of meanings and practices in education" (p. 506).

Central to this analysis is the assumption that policies do not emerge as complete or neat, nor that they are ever wholly new or different, but rather they reflect both formal and informal groupings, underlying logics, and communities of practice (Au & Ferrare, 2015). It is within this definition that I proceed below. I suggest that, rather than any given announcement indicating either the beginning or end of policy, public statements from elected officials form one conduit, among many, along which discourses around networked technologies are taken up, travel, and sediment. Drawing on Ball (2016, p. 4), and with the two guiding questions above in mind, the remainder of this article is concerned with the promotion of coding in schools, asking: In what ways do the terminologies, value propositions, and tensions around coding in schools circulate in Australian federal policy discourse within the context of the rise of coding programs globally? Here, I focus on a relatively small number of examples that illustrate, I argue, the emergence of coding in schools as a policy imperative at a national level, its reinforcement and joining up with the (global) marketplace, and its sedimentation as a common sense in the following election cycle.

THE LANGUAGE OF COMPUTERS AND TECHNOLOGY: INTRODUCING CODING IN SCHOOLS

In late February of 2013, brothers Hadi and Ali Partovi collaborated on a short video titled: *What most schools don't teach*, promoting computer science and decrying its relative lack of support in US Schools (Code.org, 2013). The video, featuring tech elites, including Bill Gates, Mark Zuckerberg, and Jack Dorsey, went immediately viral, becoming the top YouTube video in one day and, at the time of writing this article, has over 14 million views, and has been translated into multiple languages. By the end of 2013, Code.org had established the *Hour of Code* with the express support of then US President Barack Obama, reaching over 20 million students globally in 30 languages. Today, code.org reports that number to be 500 million students trying the *Hour of Code*, with 750,000 teachers and 25 million students extending beyond this to their full computer science course. Beyond their celebrity endorsements, one of the strengths of Code.org's approach is in simultaneously providing classroom-ready digital materials, as well as training, curriculum, and advocacy. Indeed, within the

Australian context, Code.org's proponents included parents and after-school program leaders as much as classroom teachers, which greatly assisted with its rapid growth.

As Falkner and Vivian's (2015) analysis shows, curriculum in the Australian context at this time focused on incorporating digital technologies as a cross-curricular capability, with an emphasis on computational thinking, data, and digital systems. While this certainly included coding, the implementation of the digital technologies curriculum was uneven, and relied heavily on existing teacher knowledge and interest. While there was some support for the *Hour of Code*, and other extracurricular computer science activities, there existed very little formal recognition by policy makers. Indeed, the Hansard and official media records to the end of 2014 indicate no explicit mention of 'coding' programs in schools, though there is some mention of the importance of STEM to the 'jobs of the future', a connection I return to in the following sections.

On Thursday, 14 May 2015, Australian Federal Opposition Leader, Bill Shorten rose for his *Budget Reply* speech, launching a wide-ranging plan for supporting the 'jobs of the future.' In a lengthy section on education, he suggested:

> Madam Speaker,
>
> Productivity is the most important catalyst for our economy.
>
> And the most important catalyst for productivity is education.
>
> Resource booms come and as we discover, they go—but our future depends on investing in our best natural resource: the creativity and skills of the Australian people.
>
> Digital technologies, computer science and coding—the language of computers and technology—should be taught in every primary and ever secondary school in Australia.
>
> And a Shorten Labor government will make this a national priority.
>
> We will work with states, territories and the national curriculum authority to make this happen.
>
> Coding is the literacy of the 21st Century.
>
> And under Labor, every young Australian will have the chance to read, write and work with the global language of the digital age.
>
> All of us who have had our children teach us how to download an app, know how quickly children adapt to new technology.
>
> But I don't just want Australian kids playing with technology, I want them to have the chance to understand it, to create it, and work with it.
>
> We can't do this without great teachers—not now and not and in the future.
>
> (Shorten, 2015)

These aspects of the Opposition Leader's *Budget Reply* speech were generally well received by the public and, as I show below, over the 12 months that followed, both major political parties committed to a national coding in schools policy. There are three moves in this speech that are significant for unpacking the logic of the 'new' that reflect popular anxieties about the future. First, Shorten suggests that "productivity" is a catalytic driver, which follows from the previous section of the speech foregrounding the importance of high-tech and advanced manufacturing in response to global changes. Here, though, productivity is connected to a specific quality: creativity, which is positioned alongside "skills" as the heart of "education" and "our shared future." Second, for Shorten, these skills come together around "the language of computers and

technology" as both an example of creativity and skills in-action and, by proxy, the language of "the future." As Selwyn (2015) notes, this move necessarily positions "Industrial-era" schools as "broken," and, in their place, "various digital technologies are celebrated for kick-starting "twenty-first century learning"' (p. 437). This characterization as to why young people "need" digital technologies often papers over "the complex and compounded inequalities of the digital age" (Selwyn, 2015, p. 437), preferring, instead, broad-brush instrumental solutions to complex, technical problems. Indeed, Shorten's announcement, in many ways, resonates with that of the previous federal government led by his party and their calls to fostering the "education revolution". As Buchanan et al. (2012) note, the education revolution, with its dual focus on significant investment in digital hardware and emphasis on traditional literacies, represented "for the Australian Labor Party the vision of a modern education system that is future proofing Australia's economy through the preparation of workers for the knowledge economy" (p. 103). The call to the provision of "technologically mediated education" is amplified in Shorten's statement, with an accompanying shift from hardware and software to a computational rationality which takes coding as a core (if somewhat conveniently alluring) competency.

The reflexive move towards the end of the above excerpt: "Coding is the literacy of the 21st Century . . . every young Australian will have the chance to read, write and work with the global language of the digital age" elevates "coding" twice over in a way that is significant in the Australian context and is an emerging common sense globally. First, it elevates coding to the status of a "literacy" to be considered along more traditional literacies. This debate has played out globally in scholarly circles since at least the late 1960s (Vee, 2013) but has gained considerable traction among Education Technology companies and coding in schools advocates in the last decade in particular (e.g., Lynch, 2018). However, as Vivian, et al. (2014) suggest, at least in the Australian context, little is known as to the effect this push has had on the reorganization of the curriculum as a whole, especially where those effects are distributed among multiple areas of instruction, as is the case in the Australian Curriculum.

Shorten's announcement is also significant in its positioning of "coding," beyond a literacy, as "the global language." This resonates with recent scholarship which examines the ways in which education policy in recent times operates as an "authoritative allocation of values" (Lingard, 2010, p. 132) that measures, borrows, and learns—on a global scale—against a backdrop of increased commercialization, privatization, and economization (see also, Hogan et al., 2015; Rizvi, 2013). It also calls to what Walsh (2016) describes as a dominant policy discourse that "constructs young people as responsible for aspects of their lives that are shaped by national and global forces beyond their control or influence" (p. 69). Elevating coding in this way responds to calls for its deployment by the various stakeholders described above but also pulls it into the "logics of marketization" that view education at the national level through the prism of international league tables and competition (e.g., Ball, 2004; Ball, Junemann, & Santori, 2017; Lingard & Sellar, 2013). I return to these ideas below.

LAYING THE FOUNDATIONS FOR GREATER SUCCESS: BUILDING THE CASE FOR CODING AS NATIONAL POLICY

In the months following the *Budget Reply* Speech to the House of Representatives, coding in schools made a common appearance in the Hansard and official media

releases, with over 80 distinct appearances in the archive in the second half of 2015. The majority of these were initially from members of the Australian Labor Party (ALP), who were keen to exploit differences in their position from that of the government. ALP Senator Chris Ketter leveraged these distinctions:

> [U]nfortunately, in contrast, the government continues to be stuck in the past. I noted that, in response to Labor's initiatives with respect to coding in schools, this year in question time the Prime Minister [Tony Abbott]—when he says "he" he is referring to the Opposition Leader [Bill Shorten]—said:
>
> *He says that he wants primary school kids to be taught coding so that they can get the jobs of the future. Does he want to send them all out to work at the age of 11? Is that what he wants to do?*
>
> That is an infantile response to a legitimate issue which has been not only raised by Labor but supported by the Chief Scientist.
>
> As our economy responds to technological change, it is vital that all Australians are skilled to be able to participate and secure jobs today and well into the future. Digital proficiency will be a foundation skill as important as reading and numeracy. It will increasingly be the determinant of employment prospects and opportunity. (20 August 2015, 5993)

And second, comparing the Australian policy context to that of international competitors:

> European countries are investigating this issue and over 12 of them already have computer programming and coding as part of their curriculum and a further seven are in the process of introducing it. Countries, including New Zealand and Singapore, are in the process of including coding in the curriculum. Computer programming and coding is already part of the primary curriculum in England, Belgium, Finland, Estonia, the Netherlands, Italy and Greece (20 August 2015, 5994).

The comments, announced at the launch of "National Science Week" not only solidified the federal opposition's commitment to coding in schools as a policy platform, but also sought to crystallize Labor's policy as indicative of global efforts to advance computational thinking in schools. These specific comments garnered little by way of initial response from the government, and through the second half of 2015, there were no direct mentions of a coding in schools policy by the federal Liberal Party. However, with a leadership spill in September 2015, the appointment of a new Prime Minister, Malcolm Turnbull, and mounting pressure across a number of policy areas, the government began to push a narrative focused on "innovation." In a series of doorstop media events late in 2015, the Prime Minister lauded the importance of STEM and. in particular, coding programs in schools:

> [I]t's obviously never been a more exciting time than to be at school here today. The enthusiasm and the imagination of the kids doing their coding, working with computers, demystifying machine languages, it's very exciting. There's $84 million in our innovation package that is going to promote STEM and coding in schools. It's a very important part of our innovation agenda . . . right here, these young boys and girls they are the inventors, the creators, the scientists, the investors, the managers of the industries of the future, the businesses of the future. What they're learning today, the technology skills they're learning, the coding skills, the imagination that is being unleashed, that's being encouraged by those very inspiring teachers, what all that's doing is laying the foundations for greater success and stronger prosperity, more secure and prosperous Australia in the years ahead (Turnbull, 2015).

Early in the new year in parliamentary question time, the Prime Minister reinforced his message:

> [Investment & innovation] is a key platform, a key pillar, of our approach to ensuring that we benefit from this growing global economy as we transition from an economy that was, in large part, led by a mining construction boom which has now toned down. In addition to that, as I said earlier today, we have a $1.1 billion national innovation and science agenda that is driving the jobs and the investment, the commercialization and the research upon which our children's and grandchildren's futures depend. It is supporting STEM in schools. It is supporting teachers teaching computer coding right across the country—the literacy of the 21st Century (22 February 2016, 1605).

Here, the transition from coding in schools as a fringe idea to government policy is clear. Where Shorten's initial announcement was mocked as "sending them all out to work at the age of 11" by his predecessor, the Prime Minister's December comments move beyond a core focus on coding as a "literacy" to that of the "innovation agenda" unlocking "enthusiasm and imagination"—the latter a term he returned to multiple times across the end of 2015 and into the extended election campaign of 2016.

Notably, the language of coding in schools is reinforced in national level discourse in ways that connect it to broader ideas about innovation, the emergence of new networked industries, and shifting demands in the labour market. This operates across the examples above as a computational rationality; one that is underpinned, as I considered above, by both a future present, in which coding has ascended to a dominant literacy through which "we" collectively engage with the world and each other, and a present future where, as Turnbull states: "these young boys and girls, they are the inventors, the creators, the scientists, the investors, the managers of the industries of the future, the businesses of the future."

CODING IN SCHOOLS AS POLICY COMMONSENSE

One year from Bill Shorten's *Budget Reply Speech*, coding in schools as a policy orientation had bipartisan support, with both sides of government agreeing on the need, if not the exact policy configuration, for coding in schools to be implemented nationally in schools. In some ways, as Vivian and Falkner's (2015) earlier analysis shows, preceded by significant support from the education community, global scholarship, and hard-fought battles in designing the Australian Curriculum by educators. Yet, despite these moves, there is significance in tracing the move of coding from a relatively fringe issue, to one of central importance. Specific policies around the embedding of networked technologies in more and more aspects of contemporary life matter less than how and where they emerge, what they are "plugged into," and how they sediment in popular and policy discourse.

It makes sense that governments are attempting to respond to the embedding of networked technologies across work and life, and particularly in relation to young people who bear both the opportunities and risks of the future. However, as I have argued above, an interrogation of the common sense(s) that underpin the network of choices, preferences, and logics that emerge in policy discussions is critical for understanding how they come to operate in particular ways, in particular spaces. What we can see here, then, is an embedding of anxiety for the future(s), and how those capabilities and capacities are technologized through the taking up of technical practices and programs in the present. What is significant is the ways in which the future is imagined in and through these policy orientations as one that will involve more demanding forms of human-computer interface, on the one hand and, most pointedly,

an educational system that prepares successful entrepreneurs to interact with it on the other hand.

At the core of this debate, it is less significant whether or not coding and, indeed, a STEM focus is the driving factor in the future of labour market activity on a national or global scale but, rather, how computational rationalities are deployed across systems in such a way that they serve as truths in place of evidence to support or discredit them. There will be, no doubt, significant STEM and digital focused labour market opportunities in the future, however, there will also be a similar proportion of those positions displaced within the digital economy as "the promise of the new" mobilizes within the next tech environment. This work is incomplete, and many questions remain. Conceptually, there is a need for a broader comparative examination of the proliferation of coding in schools initiatives globally. Here, understanding the interplay between nationally-mandated curriculum programs and their informal counterparts would serve as an important contribution. A network analysis approach is particularly useful here in examining—as Ball, et al. (2017) attempts to do with regard to edu-business—the transnational flows of soft and hard policy, its commodification, and network effects. Methodologically, the use of Hansard records and their reading alongside print and broadcast media remains relatively underutilized in educational policy research. As is well established within education policy research, policy is made from above and below, formally and informally, but is also reinforced through the repetition of significant statements over time. These statements are, in a sense, democracy in-process, rather than in-action. How particular messages circulate in the Houses of Parliament, Subcommittees and "doorstops" serves as an important way that political allies and rivals—as well as the broader public—interact with policy as it emerges and solidifies around particular principles.

Beyond the case of coding in schools, this article has drawn upon a network analysis approach as a means of considering how the promise of the new is animated in educational policy debates within this historical present. Analysing the movement of a proprietary program from the US into Australian political discourse is not accidental here. As I suggested above, drawing on the work of Hogan et al. (2015), there are an increasing number of organizations engaged in actively coordinated efforts to influence government policy in ways that are favourable to their vision. This is not to suggest that organizations, such as code.org, harbour nefarious intent but rather to signal the very powerful ways that significant players in the global tech industry seek to have influence in discussions about pedagogy, curriculum, and assessment on an increasingly global scale. Returning to the theme of this Special Issue, how these movements are taken up directly and indirectly by governments is of key concern for any discussion around democracy and education.

Finally, what this kind of analysis makes possible is an examination of how this substantiation of "the future" is realized in and through its articulation in broader debates around policy making and policy alignment within and between national borders. While this article is focused on the interface of digital technologies and educational policy at a federal level, this approach also resonates with similar intersections of public and private interests in fields such as development and innovation, public infrastructure, population-level health, and international trade.

REFERENCES

Adam, B. (2010). Future matters: Challenge for social theory and social inquiry. *Cultura e comunicazione, 1*, 47–55.

Adams, P. (2016) Education policy: Explaining, framing and forming. *Journal of Education Policy, 31*(3), 290–307. doi: 10.1080/02680939.2015.1084387

Amsler, S., & Facer, K. (2017). Contesting anticipatory regimes in education: Exploring alternative educational orientations to the future. *Futures, 94*(November), 6–14.

Au, W. W. (2008). Between education and the economy: High-stakes testing and the contradictory location of the new middle class. *Journal of Education Policy, 23*(5), 501–513. doi: 10.1080/02680930802148941

Au, W. W., & Ferrare, J. J. (2015). *Mapping corporate education reform: Power and policy networks in the neoliberal state*. New York: Routledge.

Balanskat, A., & Engelhardt, K. (2015). *Computing our future: Computer programming and coding*. Priorities, school curricula and initiatives across Europe, (November), 1–87. Retrieved from: http://fcl.eun.org/documents/10180/14689/Computing+ our+future_final.pdf/746e36b1-e1a6-4bf1-8105-ea27c0d2 bbe0

Ball, S. J. (2004). Education for sale! The commodification of everything. *King´s Annual Education Lecture 2004* (pp. 1–29). Retrieved from http://sys.glotta.ntua.gr/Dialogos/Politics/CERU-0410-253-OWI.pdf

Ball, S. J. (2016). Following policy: Networks, education policy mobilities and globalisation. *Journal of Education Policy*, *0939*(July), 1–17. doi: 10.1080/02680939.2015.1122232

Ball, S. J. & Junemann, C. (2012). *Networks, new governance,e and education*. Bristol, UK: The Policy Press.

Ball, S. J., Junemann, C., & Santori, D. (2017). *Edu. net: Globalization and education policy mobility*. Routledge.

Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. New Haven: Yale University Press. doi: 10.1177/0894439307301373.

Biddle, N. (2013). Necessary but not sufficient? Youth responses to localised returns to education in Australia. *Education Economics, 21*(1), 92–104. doi: 10.1080/09645292.2010.511843

Boyd, danah M. (2007). Social network sites: Public, private, or what? *Knowledge tree*, 1–7. doi: 10.4018/jantti.2010040104

Buchanan, R. et al. (2012). Basic literacy or new literacies? Examining the contradictions of Australia's education revolution. *Australian Journal of Teacher Education, 37*(6), 97–110. doi: 10.14221/ajte.2012v37n6.8

COAG. (2009). *National partnerhsip agreement on youth attainment and transitions*. Canberra, ACT.

Code.org. (2013). *What most schools don't teach*.

Corneliussen, H. G., & Prøitz, L. (2016). Kids code in a rural village in Norway: Could code clubs be a new arena for increasing girls' digital interest and competence? *Information, Communication & Society, 19*(1), 95–110. doi: 10.1080/1369118X.2015.1093529

DiSalvo, B., Reid, C., & Khanipour Roshan, P. (2014). They can't find us: The search for informal CS education. In ACM *Technical Symposium on Computer Science Education (SIGCSE)* (pp. 487–492). Georgia, Atlanta.

Doherty, C. (2017). Edufare for the future precariat: The moral agenda in Australia's "earning or learning" policy. *Journal of Education Policy, 32*(1), 34–47. doi: 10.1080/02680939.2016.1215534

Duggan, S. (2013). To an audience of "I": A discussion of the digital, narrativity and performance in internet blog research. *Qualitative Research Journal*, *13*(1), 25–32. https://doi.org/10.1108/14439881311314513

Duggan, S. (2017). Understanding temporality and future orientation for young women in the senior year. *Discourse: Studies in the cultural politics of education*. https://doi.org/10.1080/01596306.2016.1173650

Duggan, S. (2018). Willfulness and aspirations for young women in Australian high stakes curriculum. *Critical Questions in Education, 8*(4), 495–513. https://doi.org/10.1080/07256860410001687036

Falkner, K., & Vivian, R. (2015). A review of computer science resources for learning and teaching with K-12 computing curricula: An Australian case study. *Computer Science Education, 25*(4), 390–429. doi: 10.1080/08993408.2016.1140410

Gerrard, J., Savage, G. C., & O'Connor, K. (2017). Searching for the public: School funding and shifting meanings of "the public" in Australian education. *Journal of Education Policy*, *32*(4), 503–519. doi: 10.1080/02680939.2016.1274787

Gulson, K. N., & Webb, P. T. (2017). Mapping an emergent field of "computational education policy": Policy rationalities, prediction, and data in the age of Artificial Intelligence. *Research in Education, 98*(1), 14–26. doi: 10.1177/0034523717723385

Hogan, A., Sellar, S., & Lingard, B. (2015). Commercialising comparison: Pearson puts the TLC in soft capitalism. *Journal of Education Policy*, *0939*(December), 1–16. doi: 10.1080/02680939.2015.1112922

Lingard, B. (2010). Policy borrowing, policy learning: Testing times in Australian schooling. *Critical Studies in Education*, *51*(March 2015), 129–147. doi: 10.1080/17508481003731026

Lingard, B., & Keddie, A. (2013). Redistribution, recognition, and representation: Working against pedagogies of indifference. *Pedagogy, Culture & Society*, *21*(3). doi: 10.1080/14681366.2013.809373

Lingard, B., & Sellar, S. (2013) Globalization, edu-business, and network governance: The policy sociology of Stephen J. Ball and rethinking education policy

analysis. *London Review of Education*, *11*(3). doi: 10.1080/14748460.2013.840986

Lynch, M. (2018). Coding as a literacy for the 21st Century, *Education Week*, (January). Retrieved from: http://blogs.edweek.org/edweek/education_futures/2018/01/coding_as_a_literacy_for_the_21st_century.html

McLeod, J., & Wright, K. (2012). The promise of the new: Genealogies of youth, nation and educational reform in Australia. *Journal of Educational Administration & History, 44*(4), 283–293. doi: 10.1080/00220620.2012.713926

OECD. (2016). *Innovating education and educating for innovation: The power of digital technologies and skills*. doi: /10.1787/9789264265097-en

Papert, S. (1972). A computer laboratory for elementary schools. *Computers and Automation, 21*(6), 19–23.

Parliamentary Debates, Senate, vol. 3658, 20 August 2015, 5993, http://parlinfo.aph.gov.au/chamber/hansards/8752d1f8-2048-47d5-92f9-caede3f25bbd/0000

Parliamentary Debates, House of Representatives, vol. 4096, 22 February 2016, 1605, http://parlinfo.aph.gov.au/chamber/hansardr/02525cdf-c0a5-4a3a-a1f4-9e9219e30bf6/0000

Rizvi, F. (2013). Equity and marketisation: A brief commentary, *Discourse, 34*(2), 274–278. doi: 10.1080/01596306.2013.770252

Robins, A. (2015). The ongoing challenges of computer science education research. *Computer Science Education*, *25*(2), 115–119. doi: 10.1080/08993408.2015.1034350

Sáez-López, J.-M., Román-González, M., & Vázquez-Cano, E. (2016). Visual programming languages integrated across the curriculum in elementary school: A two-year case study using "Scratch" in five schools. *Computers & Education*, *97*, 129–141. doi: 10.1016/j.compedu.2016.03.003

Schmidt, J. P., Resnick, M., & Ito, J. (2016). Creative learning and the future of work. In D. Nordfors, V. Cerf, & M. Senges (Eds.), *Disrupting unemployment* (pp. 147–155). CreateSpace Independent Publishing Platform,

Scholz, T. (2013). *Digital labor: The Internet as playground and factory*. New York: Routledge. doi: 10.1080/09518398.2013.816888

Selwyn, N. (2015). Minding our language: Why education and technology is full of bullshit . . . and what might be done about it. *Digital Innovation, Creativity & Knowledge in Education Conference*, *41*(3), 437–443. doi: 10.1080/17439884.2015.1012523

Selwyn, N. (2016). *Is technology good for education?* Cambridge, MA: Polity Press.

Shorten, B. (2015, May 15). *Budget Reply Speech 2015*, Parliament of Australia. Canberra, ACT. Retrieved from http://www.billshorten.com.au/budget-reply-2015.

Srnicek, N. (2017). *Platform capitalism*. Cambridge: Polity Press.

Turnbull, M. (2015, 9 December). *Doorstop Interview, Landsdale, Western Australia*. Canberra, ACT: Parliament of Australia.

Vee, A. (2013). Understanding computer programming as a literacy. *Literacy in Composition Studies, 1*(2), 42–64. doi: 10.21623%2F1.1.2.4

Vivian, R., Falkner, K., & Falkner, N. (2014). Addressing the challenges of a new digital technologies curriculum: MOOCs as a scalable solution for teacher professional development. *Research in Learning Technology, 22*(September 2017). doi: 10.3402/rlt.v22.24691

Walsh, L. (2016). *Educating generation Nnext: Young people, teacher,s and schooling in transition*. Basingstoke: Palgrave MacMillan.

Williamson, B. (2016). Political computational thinking: Policy networks, digital governance and "learning to code". *Critical Policy Studies*, *10*(1), 39–58. doi: 10.1080/19460171.2015.1052003