Securing digital equity in Australian education

November 2024

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UTS Centre for Social Justice and Inclusion

PRF PAUL RAMSAY FOUNDATION

This report forms part of the work program supporting the Australian Network for Quality Digital Education. The Network brings together leaders from across education, industry, social purpose and philanthropic organisations, government and research, in the common purpose of ensuring that all Australian students benefit from the best educational technology (edtech), and the benefits of edtech are leveraged to tackle the persistent learning divide. Members of the Network have provided valuable engagement, input and feedback as part of the report's development, though the paper does not represent a consensus or endorsed Network view.

The Network is Chaired by Leslie Loble AM, who is Industry Professor at the UTS Centre for Social Justice and Inclusion (socialjustice.uts.edu.au).

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Note on edtech examples

This report includes snapshots that describe schools' use of edtech platforms. They do not constitute independent evaluations of efficacy or endorsement of any individual tools.

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We all acknowledge the Traditional Owners of Country throughout Australia and pay our respects to Elders past and present.

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Executive Summary

Not all children have an equal chance to succeed at school, a pattern that persists across countries and time. The impact of this inequity compounds as children get older – in Year 3 the average difference in reading between students from advantaged and disadvantaged backgrounds measures at about two years. By Year 9, that gap has increased to nearly five (Hunter and Parkinson 2024). The chance of children not meeting expectations catching up and staying caught up is only about one in five (Groves and Lu 2023).

Australian governments and school sectors have long been committed to changing this. The Alice Springs (Mparntwe) declaration (2019), built on the Melbourne declaration (2008), affirms Australian governments' vision 'for a world class education system that encourages and supports every student to be the very best they can be, no matter where they live or what kind of learning challenges they may face' (Council of Australian Governments Education Council 2019:2).

We remain a long way from realising that ambition. It is in that context that we consider educational technology (edtech), including that powered by artificial intelligence (AI) in this report. We ask:

> How does equity intersect with educational technology and AI? How is the rapidly increasing prevalence of AI-enabled edtech in Australian schools likely to impact educational equity? How could it help? How might it make things worse? What can we do to tip the balance?

Educational learning gaps sit on top of – and are exacerbated by – inequalities of other kinds. This report considers four dimensions of digital equity:

- Access equity and digital inclusion
- Data equity
- Designing for equity
- Equity and effective use.

It synthesises insights from transnational organisations such as the Organisation for Economic Cooperation and Development (OECD) and World Economic Forum, research literature and reports by Australian equity-focused organisations such as The Smith Family. It is also informed by consultations with teachers and incorporates brief snapshots of teachers and schools using edtech in ways to improve learning experiences and outcomes, particularly for students in disadvantaged contexts.

It is nearly 30 years since the term 'digital divide' was coined and significant differences continue to exist across the dimensions of digital access (and affordability), skill (digital literacy), and use (or the outcomes gained from digital interaction).[1] A national survey by The Smith Family found that just over half of parents and carers experiencing disadvantage think that their children are likely to miss out on essential digital devices needed for school because they won't be able to afford them (The Smith Family 2023). The finding that eight in ten Australian students with inadequate access to a computer had trouble finishing schoolwork illustrates the educational impact of the digital divide (WorkVentures and KPMG 2024).

1 The US National Telecommunications and Information Administration's 1995 report, *Falling Through the Net: A Survey of the 'Have Nots' in Rural and Urban America,* is often credited with popularising the term.

We speak of children and young people as 'digital natives' but quantity doesn't mean quality of use. In the most recent national assessment of computer literacy, fewer than half of the Year 10 students who took part demonstrated a proficient standard. Those with a degree-educated parent were more than twice as likely to be proficient as students with a parent whose education finished at Year 9 (ACARA 2023b). Income might be declining as a barrier to accessing cutting-edge generative AI tools, but only two-thirds of surveyed young people report checking AI output for accuracy (Denejkina 2023).

Schools should compensate for inequities at home, but often can't. Globally, private schools are more likely to use digital technologies for education, to have more digital devices for instruction in the classrooms, and to be better equipped for digital inclusion than public schools (Kim et al. 2021). In Australia, over one-fifth of students in disadvantaged schools lack digital resources compared with only two per cent in advantaged schools (Cobbold 2024).

Digital literacy is a critical foundation for teachers' effective use of digital resources, including AI-enabled edtech, in the classroom. The expectation that teachers use information and communication technologies as part of their teaching toolkit was encoded in the Australian Teaching Standards over a decade ago, but the OECD's Teaching and Learning International Survey in 2018 found that only two in five Australian teachers felt well prepared or better to use information and communication technologies for teaching (Mitchell Institute 2020).

Digital access (including digital skills) is the bedrock of digital inclusion in education, but how we approach issues of data, design, and use are equally critical vectors for equity in edtech. Pursuing data equity goes beyond safety and means attending to the representativeness of input data, the fairness of algorithmic operations, and the real-world outcomes these produce. Equitable design encompasses accessibility but pushes significantly beyond that to ensuring market forces don't constrain developers' focus to the 'mythical average learner' (Noakes 2019:6) at the expense of the true range of student learning needs and backgrounds.

All tools, however well designed and built, are only as good as their use. Unfortunately, the conditions for effective use – including individual and collective teacher efficacy, as well as school resourcing – are harder to achieve in some settings than others. Disadvantaged and non-metropolitan schools are more likely to experience insufficient or poor-quality digital resources than advantaged or metropolitan peers, not to mention a lack of teaching staff, poorly qualified staff, ill-prepared, and absent staff (Thomson 2021).

The acceleration of artificial intelligence and generative AI in particular has underscored the nexus of risk and potential in edtech. A knowledge-rich curriculum, expertly delivered, is the mainstay of strong student outcomes. As edtech is increasingly a powerful mediator of the curriculum in classroom teaching and at home, it becomes a potentially high-leverage but also high-stakes intervention in this arena.

The risks are real and increasingly documented, especially those of poor tools, overused or misused. Less attention is paid to the other risks of underuse and missed opportunity. For example, while there are over 25,000 assistive technology devices, there is a huge gap between the education potential this represents and the reality of pupils 'who needlessly struggle on a daily basis to complete routine tasks because they do not have ready access to appropriate devices and services' (Edyburn 2020:30).

The risks of AI and edtech are not borne equally by students and schools. All the risks, if realised, will amplify existing disadvantage, including and especially the risk of doing nothing to address the equity dimensions. Within education, digital equity and inclusion encompasses both the equity and inclusiveness of digital technologies themselves as well as the use of digital technologies to promote equity and inclusion in education (Gottschalk and Weise 2023). We still have a long way to go on all fronts. The recommendations below set out some useful steps.

Establish a Digital Equity Learning Guarantee for all Australian students that will:

1. **Provide free or low cost access to quality digital devices and connectivity to support disadvantaged students' learning, and additional resources to lift digital skills and AI literacy.**

2. **Expand the safe and effective use of digital teaching and learning tools, especially to improve outcomes for disadvantaged and special needs students, through**

    + **professional learning opportunities and preservice teacher education**

    + **research into what works best in using edtech learning applications, including work with disadvantaged schools to test and showcase effective integration.**

3. **Set equity and inclusion as core design expectations of edtech used in Australian schools through standards, procurement processes and co-investment by government and industry to develop and scale equity-focused design.**

4. **Ensure the highest level privacy and safety protections for children and students in the design and use of educational technologies.**

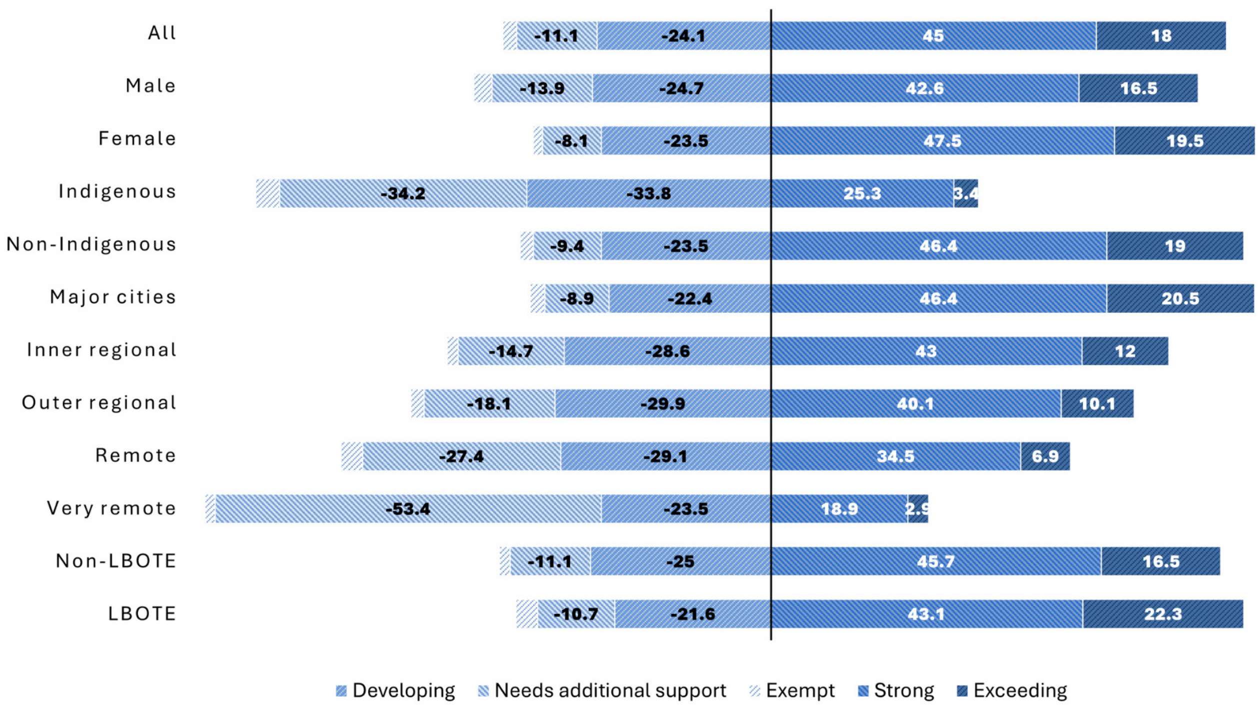
Edtech and educational disadvantage

Education is one of the biggest social policy levers to counter systemic disadvantage, yet Australian student outcomes remain persistently associated with socio-demographic characteristics.[2] The most recent NAPLAN results showed that fewer than one in ten non-Indigenous students require additional support, while approximately one in three First Nations students do. Students whose parents have a bachelor degree or higher qualification have NAPLAN average scores significantly higher across all tests in all testing years than students whose parents didn't finish school.

Students in metropolitan areas similarly outperform their regional and remote peers. Australia is not alone in this problem – globally, socioeconomic disparities in educational achievement have persisted across multiple generations and increased in many countries over the last 50 years (Dumont and Ready 2023).

Averages don't tell the whole story. Of course – importantly – there are children from all backgrounds who do well, and others from all backgrounds who need some help. Nonetheless, the data show us that not everyone has an equal chance to succeed at school.

Figure 1: Proportion of Year 9 students meeting NAPLAN Reading benchmark, by demographic characteristics



Source: ACARA (2024)

2 Australia is not alone in this persistent challenge. In a recent article, 'Using social and behavioural science to address inequality', Brummelman et al. identify achievement inequality as 'a defining challenge of our time', a global problem evident across low-, middle- and high-income countries, which has increased steadily over 60 years despite large-scale efforts to tackle it (Brummelmann et al. 2024).

Worse, the significant gaps that exist between advantaged and less advantaged students when they start school widen over time. In 2024, the difference in average NAPLAN reading scores between Year 3 students whose parents had a degree qualification and those whose parents didn't finish school was the equivalent of about two years. By Year 9 the learning gap has grown to over five years (Hunter and Parkinson 2024). Fewer than one in five of the students who are behind expectations for learning in Year 3 catch-up and stay caught up (Groves and Lu 2023).

Australian governments and school sectors have long been committed to changing this. The Alice Springs (Mparntwe) declaration (2019), built on the Melbourne declaration (2008), affirms Australian governments' vision 'for a world class education system that encourages and supports every student to be the very best they can be, no matter where they live or what kind of learning challenges they may face' (Council of Australian Governments Education Council 2019:2). We remain a long way from realising that ambition. Addressing the ongoing equity achievement gap is identified as a priority in the new Better and Fairer Schools Agreement 2025–2034 currently being negotiated between the Australian government and states and territories, which recommits to the goal of a 'high-quality, equitable and inclusive school education system', with the potential to transform lives (Australian Government Department of Education 2024:4).

It is in that context that we consider educational technology (edtech), including that powered by artificial intelligence (AI) in this report. We ask:

> How does equity intersect with educational technology and AI? How is the rapidly increasing prevalence of AI-enabled edtech in Australian schools likely to impact educational equity? How could it help? How might it make things worse? What can we do to tip the balance?

Box 1: Defining equity in education

Equity in education refers to the principle of fairness in educational opportunities, resources, and support. Pursuing equity in education is important because students do not arrive at school with equal opportunity to access and succeed in learning. Through equitable inputs, schools and systems aim to provide a platform for achieving equity in student learning growth and outcomes.

Focusing on equity in education means providing what each student specifically needs to thrive, helping to remove barriers and close achievement gaps. It recognises that some groups of students (often referred to as priority equity cohorts) are more likely to experience educational disadvantage than others. The Mparntwe Declaration and the Better and Fairer Schools Agreement identify priority equity cohorts as Aboriginal and Torres Strait Islander students, students living in regional, rural and remote locations, students with disability and students from educationally disadvantaged (including low socioeconomic status) backgrounds.

Within education, digital equity and inclusion encompasses both the equity and inclusiveness of digital technologies themselves as well as the use of digital technologies to promote equity and inclusion in education (Gottschalk and Weise 2023). The European Commission links the two in its definition of digital inclusion as ‘leveraging digital tools to widen access and enhance the quality of teaching and learning for the purpose of delivering a fair and equitable education’ (EC 2021:15). Digital equity and inclusion must be built on the non-negotiable foundation of online child safety, noting that the most vulnerable children in the playground are also often the most vulnerable online (for example, NSPCC 2022).

Why digital equity matters in education

Faced with persistent equity gaps in Australian schooling, we need to pull all the levers we can to make a difference. A knowledge-rich curriculum, expertly delivered, is key to strong student outcomes, and the *Better and Fairer Schools Agreement* commits jurisdictions to providing 'quality-assured curriculum resources that have been developed in partnership with the teaching profession' (Australian Government Department of Education 2024). As edtech is increasingly a powerful mediator of the curriculum in classroom teaching and at home, it becomes a potentially high-leverage, but also high-stakes intervention in this arena.[3] The rapid developments in AI technology only heighten this nexus of potential and risk.

Well-designed digital learning applications have features that can lend themselves to bridging the learning gap – with the potential to support standardised as well as personalised approaches to teaching and learning. As Kucirkova argues, both standardised and personalised approaches are necessary to fully support equity. Personalised approaches alone risk exacerbating inequity: 'Those who start behind are left behind with their own data – without group power to lift them up' (Kucirkova 2021). On the other hand, without knowing and attending to individual students' learning needs – for example, which concepts they have mastered, what requires more practice – it is impossible to support consistent access to grade-level curriculum and learning outcomes.

Digital resources that are comparatively simple in technological terms can support the consistent access to high-quality, content-rich curriculum resources that promote educational equity by giving teachers access to well-sequenced and well-resourced lesson banks (Jensen et al. 2023). These tools can help ensure that students' opportunity to learn is not compromised, for example, by inequitably distributed variations in teacher experience, expertise or turnover, by providing a baseline of critical knowledge and skills for students to achieve.

They can also give teachers more time to develop the knowledge of individual students that promotes appropriate, effective differentiation of learning and positive teacher-student relationships. Teacher-student relationships are known to positively impact students' sense of belonging at school, to be associated with positive engagement with learning, and to underpin effective classroom management (AERO 2023, CESE 2020a).

Augmenting curriculum access, well-designed edtech can support students with adaptive learning support that responds to individual learning gaps and points of need. While this may benefit any learner, we know that students experiencing disadvantage are more likely to have disrupted learning, contributing to lower levels of achievement (ACARA 2023a). Intelligent tutoring systems (ITS) can offer supplemental, individually paced access to the curriculum, with the opportunity to revisit content and practice skills as often as necessary to achieve mastery.

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3 In Finding 4 of its report, *Improving Outcomes for All: The Report of the Independent Expert Panel's Review to Inform a Better and Fairer Education System*, the Panel found: 'As part of the implementation of the reforms in the next Agreement, governments should focus on the potential for digital technologies and digital innovation, including generative AI, to support teaching, learning and assessment approaches to improve the learning experience of students and drive powerful learning and progress in student achievement. Governments should develop appropriate safeguards in advance to mitigate associated risks with the use of these technologies in education settings' (2023:75).

Some of the strongest studies in the emerging evidence-base for edtech point to the efficacy of intelligent tutoring systems. For example:

+ A synthesis by Escueta et al. finds adaptive learning systems offer ‘enormous promise’ (Escueta et al. 2020:914), with two-thirds of the high-quality research studies they examined demonstrating substantial and statistically significant effects.

+ A frequently cited meta-review by Kulik and Fletcher (2016) reports a mean effect size of 0.62 from their analysis of 50 controlled experimental or quasi-experimental evaluations of ITS in elementary, secondary and tertiary institutions. This is an effect size considered moderate-to-large in social sciences (Cohen 1988), and well above many other traditional education interventions.

+ A recent systematic review and meta-analysis of quasi-experimental and experimental studies published between 2010 and 2023 that evaluated the effects of educational technology interventions on the literacy outcomes of K–5 students found positive effects for decoding, language comprehension, reading comprehension and writing proficiency (Silverman et al. 2024).

+ In the Evidence for ESSA database, which provides guidance on evidence-based practices and programs for US policymakers, teachers and schools, intelligent tutoring systems in English and mathematics made up 25 per cent of the ‘strong’ programs, with evidence of higher impact for students experiencing disadvantage.

Two other aspects of well-designed edtech have particular potential for supporting students experiencing learning disadvantage – adaptive assessment and diagnostic tools. Assessment and the related practice of feedback are core components of quality teaching practice. According to education researcher and educator Lyn Sharratt ‘nothing else matters in teaching and learning as much as quality assessment, that is, data that inform and differentiate instruction for each learner’ (Sharratt 2019, in CESE 2020b). Quality screening, diagnostic assessments and progress monitoring, along with evidence-based intervention, are the pillars of the multi-tiered system of supports (MTSS) framework, which has been identified as the best way to organise support for students who are struggling (AERO 2024).

Technology-enabled tools can make regular assessment and the interpretation of assessment data easier (for example, by providing valid, reliable, objective and inclusive assessment items and built-in dashboards), leveraging teachers’ capacity to understand individual learner progress, identify misconceptions and scaffold next steps. This may be particularly helpful in supporting teachers’ capacity to provide at scale the ongoing formative assessment critical to learning.

Box 2: Enhancing the ability to monitor student progress between assessments

John Therry Catholic College is a large, median-ICSEA* secondary school in southwestern Sydney. About a fifth of the students have a language background other than English and nearly a tenth identify as Aboriginal or Torres Strait Islander. The science faculty introduced a learning platform to address inconsistent delivery of curriculum and improve teaching and learning, which is now fully integrated into the teaching program as key support for teacher instruction.

The faculty has worked with the platform vendor to customise the tool to enable adaptation of lessons and assessments for different learning needs. Considering the wide range of student ability in the school including, for many students, a significant gap in basic literacy as well as science literacy, the science teachers find they need to supplement the online curriculum tool with literacy tools and instruction to address the gaps.

The faculty particularly values the platform's provision of detailed and immediate feedback to assist them with tracking individual learner progress between assessment tasks, which they use to identify when intervention is necessary. As the lead science teacher explains:

> You can look at the marks and you can see where kids need to catch up and who's falling behind. You might think, 'oh, I thought that kid was coping', and then we can have a conversation within the faculty.

The faculty also uses the data to inform discussions with the student, parent or school leadership, and students like the immediate feedback provided by the platform's self-marking functionality. As a result of the lift in teaching and learning quality, the science leader has observed boosted student enrolment in science subjects and a slow but steady improvement in achievement. The increased student demand now allows the school to offer all NSW science curricula.

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* ICSEA – or the Index of Community Socio-educational Advantage – is a statistical measure of school-level advantage, computed using student family background data. ACARA computes an ICSEA score for every Australian school for which sufficient aggregated-level data is available.

Technologically based platforms also make adaptive assessment possible. Adaptive assessment tools direct a student's progress through a test based on their answers to each question – students answering questions correctly will be shown harder items; struggling students will be directed to sequences of easier questions. Adaptive tests more accurately measure student learning, particularly at each end of the achievement spectrum (Papanastasiou 2014). Given that students experiencing disadvantage disproportionately score lower in standardised assessments, this may be of particular support to them.

AI-enabled tools can further assist in the early identification of specific learning issues such as dyslexia or dysgraphia, by making brief but reliable assessments accessible and helping families overcome barriers of cost, location and specialist availability. Early identification of conditions that impact learning is important to effective support and remediation. In addition, AI-enabled edtech can facilitate greater accessibility to curriculum outcomes through adaptive multi-modal user interfaces (for example, text to voice, screen readers, assistance in scaffolding work). It is important to recognise that the benefits of edtech to assessment can be compromised by assessment protocols that may prevent students with disability using assistive technologies such as screen readers and speech recognition.

Box 3: Boosting diagnostic capacity

AI-enabled tools can assist in the detection of learning difficulties like dyslexia. Families in Australia often wait six to twelve months to obtain a diagnosis, which can cost up to $2,000 (Fitzsimmons 2021). Early detection can boost the success of remedial interventions (OECD 2021).

Australian company Dystech trains their machine learning algorithm on voice recordings of readers of all abilities and claims they can identify the likelihood of dyslexia in a screening participant with 90 per cent accuracy, in under ten minutes (Dystech 2022). As well as predicting the likelihood of a student having dyslexia, the tool provides a number of different reading-related measurements, such as phonetic decoding fluency, word reading fluency and average orthographic mapping speed. Discrepancies between the different measures can be instructive and help identify, for example, a student who is using a strong memory to compensate for weak decoding skills. Strengthening decoding skills before high school can help with the transition to the increased demands of the secondary curriculum.

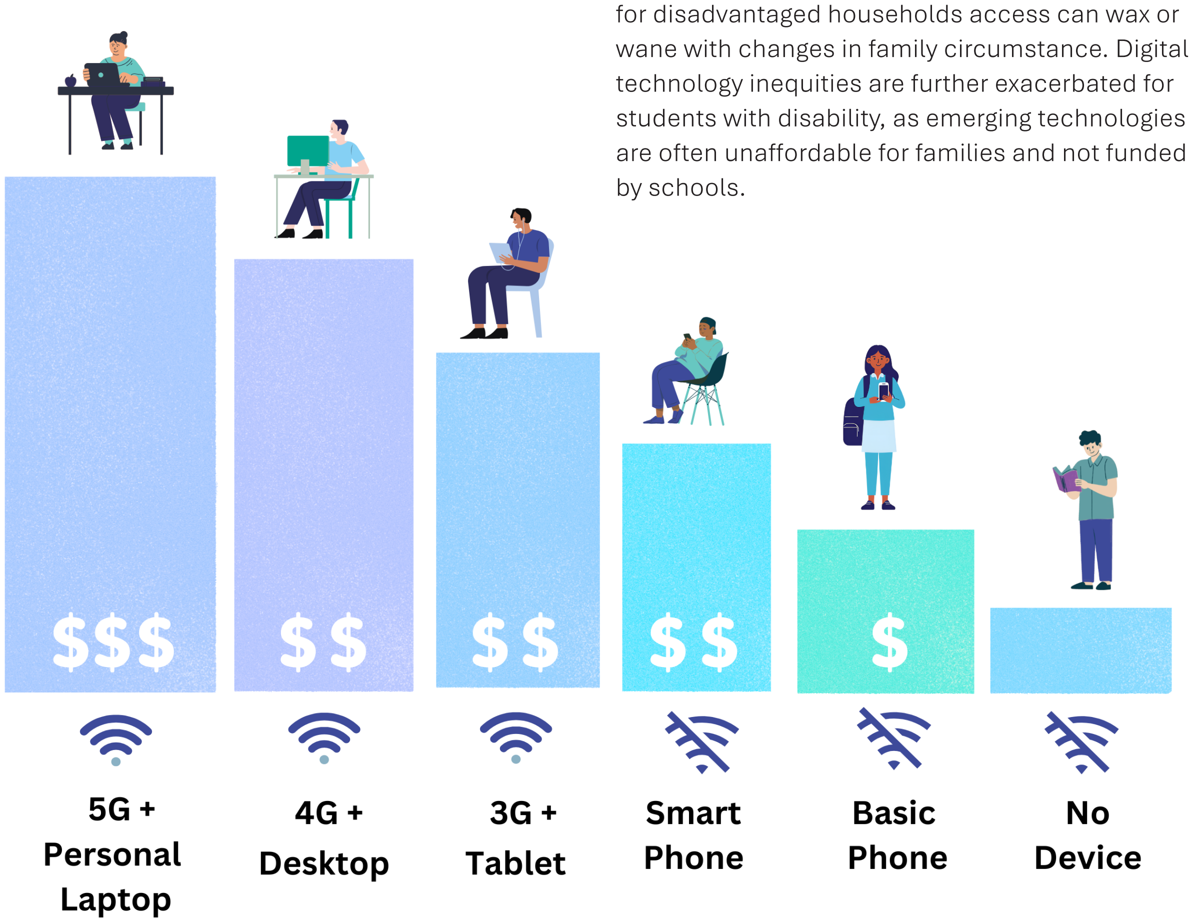
Dystech can be used regularly to support intervention. While the assessed likelihood of dyslexia will not change from the initial screening, tracking a student's learning and improvement across reading-related skills has benefits for the student, family and teacher, separate from formal diagnosis. In using tools to monitor and track learning, it is important to be clear on what skills individual tools assess and how these relate to skills assessed by standardised assessments. For example, decoding skills are important to, but not the same as, the complex inference assessed by NAPLAN.

In summary, digital equity matters because without it the advantages offered by the best of these tools will accrue to those students, families, schools and systems that have sufficient resources to acquire, assess and use them effectively. It also matters because unless we foreground equity in our considerations of edtech, it is likely that many tools will fail to deliver on their considerable promise. While developers of high-quality products may be motivated by commitment to educational outcomes, for other providers, market incentives may trump close attention to the more difficult challenges faced by education. For example, many tools are designed for the broad middle of students, rather than those with greater or more complex learning needs. If tools disproportionately favour students in the upper-middle or higher achievement levels, there is a danger that they will widen the educational divide. Poor-quality tools and poor or inappropriate use also are likely to compound disadvantage. The most vulnerable children in the playground are also the most vulnerable online and are likely at greatest risk of insecure data as well as being overlooked or misrepresented in data sets biased towards more ‘mainstream’ users. Teachers and schools serving disadvantaged communities are likely to find it harder to establish the conditions for effective use, including adequate time and resourcing for teacher professional development. If we want to address both actual dangers as well as the real risk of failure to realise potential, now is the time to shape policy, practice and the market.

Access equity and digital inclusion

It is nearly 30 years since the term 'digital divide' came into use. The concept is thus well established, with discussion typically identifying three dimensions – digital access (including affordability), skill (digital literacy), and use (or outcomes).[4] More recent commentary reconceives the divide as a spectrum (for example, Kopp 2021) and points to the interaction between the dimensions, which form a digital inclusion 'stack' (Robinson et al. 2020:2). The concept of a stack recognises that advantage (or disadvantage) compounds across the dimensions. Only if digital access is paired with digital literacy, and those skills put to productive use is digital inclusion achieved.

Figure 2: The spectrum of digital access



Source: Modelled on Kopp (2021)

Access and affordability

Access and affordability of digital infrastructure (including digital devices, internet access and software) is the foundation of digital inclusion. Hardware, software and internet connectivity are all requisites for equitable access to digital learning materials (OECD 2021), both at home and at school. Rather than a binary of 'haves' and 'have-nots', access exists on a spectrum, where 'students can move from having access to no device, to a basic phone, to a smartphone, to a tablet, to a laptop; and from having no connectivity, to SMS, to slow data, to fast but prohibitively expensive data, to fast, cheap and reliable WiFi.' The priority is then to move students up the 'access ladder' (Kopp 2021), noting that for disadvantaged households access can wax or wane with changes in family circumstance. Digital technology inequities are further exacerbated for students with disability, as emerging technologies are often unaffordable for families and not funded by schools.

4 In this paper we refer to the digital divide as it applies in the education context. For a broader picture, see the Australian Digital Inclusion Index (ADII). The ADII identifies three dimensions of digital inclusion: access (to devices and connectivity), affordability and digital ability (ADII 2024).

Access and affordability at home

In Australia, many children do not have access to digital technologies, and access and usage differs according to socioeconomic, gender and age characteristics, as well as geographic location (ARC Centre for the Digital Child 2023). Affordability is the greatest barrier to digital inclusion for low-income families with school-aged children (Kennedy et al. 2022). A national survey of over 2,200 parents and carers experiencing disadvantage by The Smith Family (2023) revealed that just over half think that their children are likely to miss out on essential digital devices needed for schoolwork because they won't be able to afford them. Where devices do exist, they may be insufficient to family needs: 'Family devices are often second hand, and broken devices may stay broken due to the costs associated with repairing them' (Dezuanni et al. 2023:4). The finding that eight in ten Australian students with inadequate access to a computer had trouble finishing class work and assignments illustrates the educational impact of inequitable access (WorkVentures and KPMG 2024).

The quality and reliability of internet access matters for adequate access to online learning platforms and can be too costly for many households. The Australian Digital Inclusion Index (ADII) finds that over a third of low-income households would need to allocate at least 10 per cent of their income to access an internet bundle enabling quality and reliable connectivity.[5] Remoteness also creates a 'double jeopardy of digital disadvantage' regarding access to infrastructure (Park 2017:405).

Access and affordability at school

In the face of inequity of digital access in families and communities, schools are critical to ensuring that all students benefit from digital technology. Research shows that the integration of information and communication technologies (ICT) in schools serves as a compensatory measure for the social inequalities of students and may contribute to the reduction of digital inequality. In fact, ICT quality of use at home has been proven to be more affected by school ICT integration than by SES (Gonzales-Betancor et al. 2021).

Unfortunately, disparities are well established across as well as within school systems globally, with private schools more likely to use digital technologies for education, to have more digital devices for instruction in classrooms, and to be better equipped for digital inclusion than public schools (Kim et al. 2021). As the PISA data in Fig 3 (next page) shows, the gap in resources related to levels of disadvantage is particularly acute when viewed from the perspective of geolocation. Fig 4 (next page) reveals that the gap in digital access between Australian students in low- and high-SES schools is the sixth largest gap in the OECD - over one-fifth of Australian students in low-SES schools lack digital resources compared to only two per cent in high-SES schools (Cobbold 2024, citing PISA 2022 data). In light of these resourcing gaps, it is not surprising that students in well-resourced schools are more likely to adopt and more quickly benefit from new technology in teaching and learning (OECD 2021a).

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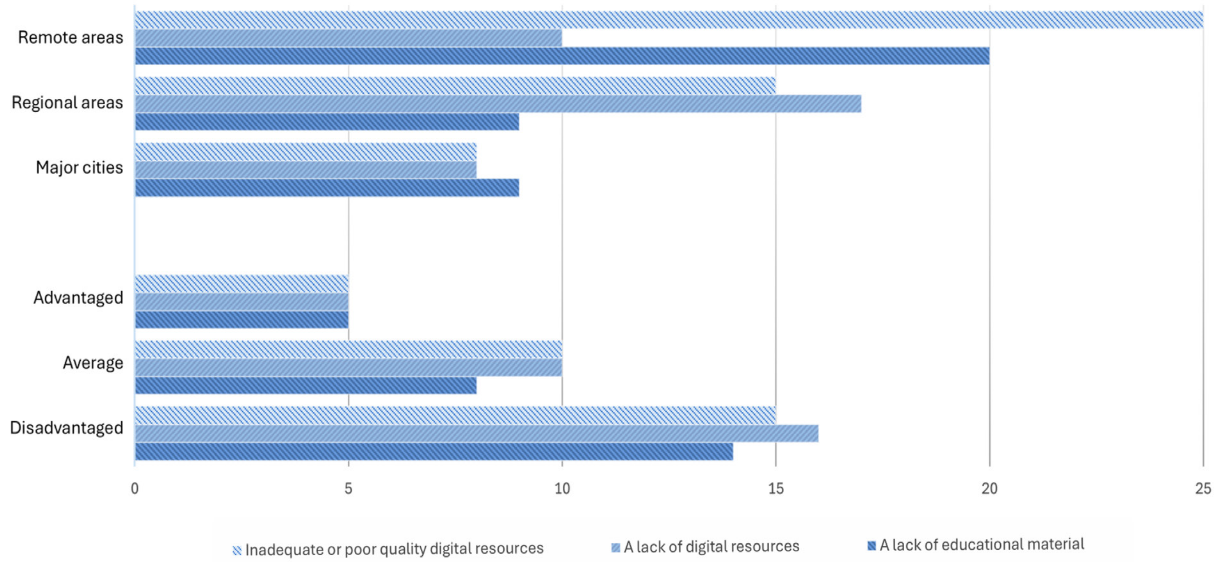
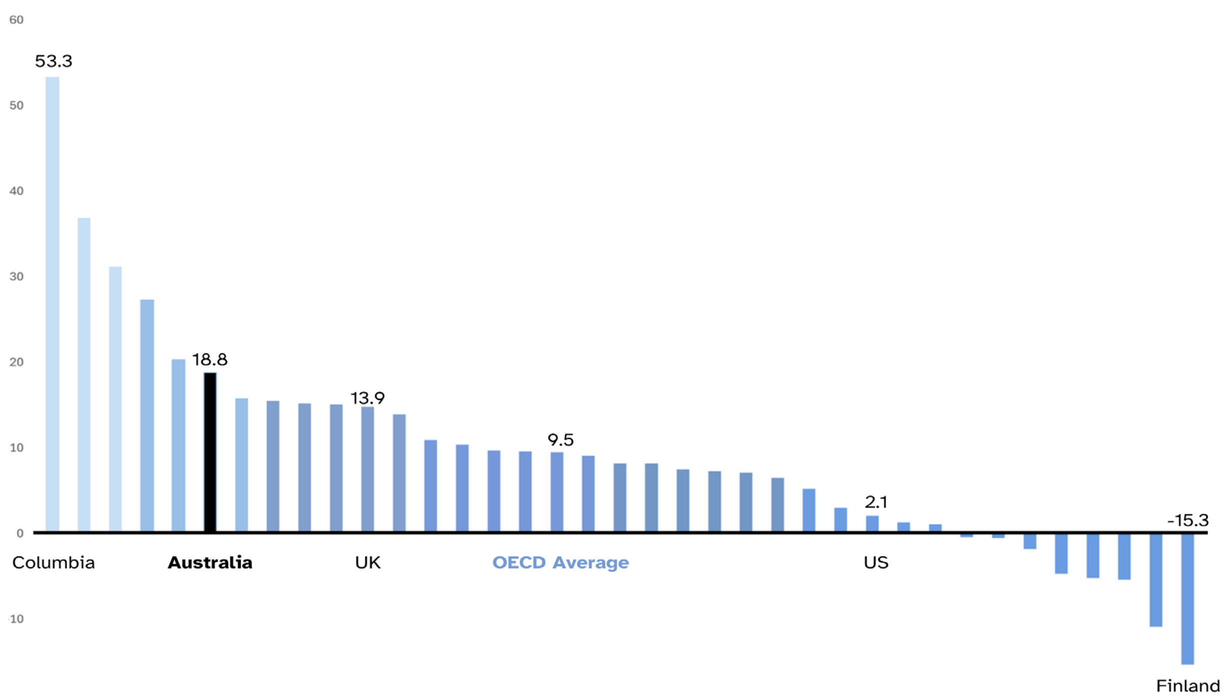
5 ADII typically defines lower income groups as those in the lowest 40 per cent of the income distribution. They provide five income ranges calculated at the household level, with each range covering approximately 20 per cent of the population. The ranges from low- to high-income are: Q1 < $33,800; Q2 $33,800-$51,999; Q3 $52,000-$90,999; Q5 $91,000-$155,999; Q5 $156,000 or more (ADII 2024).

Figure 3: Percentage of principals reporting that learning is hindered by a shortage of educational resources, by school demographic



Source: PISA 2022 data accessed via De Bortoli L and Underwood C (2024)

Figure 4: Difference between percentage of students in low and high SES schools lacking digital resources (PISA 2022)



Source: OECD (2023a) PISA 2022 Results, Table II.B1.5.19

Box 4: Access issues facing Australian teachers

We have consulted with Australian primary and high school teachers from a range of rural, urban, low-SES and above median-SES schools who shared their experiences with access to classroom digital infrastructure.

'Bring Your Own Device' programs are common, highly advantageous for integrating edtech, but impossible in some contexts. One teacher from **Beenleigh State High School**, located in a highly disadvantaged area of southeast Queensland, described how inconsistent device access affected teachers' plans for learning. Because students in Years 9 and 10 have unreliable access to devices, the school uses an online science curriculum application primarily as a teacher presentation tool alongside textbooks. On the day that science is timetabled for first period, students can reliably borrow a device from the library. On these days, they can work on the application independently. The school also finds that, typically for disadvantaged communities, students often lack digital devices at home or must use limited-data mobile phones for learning. These access constraints flow through to more complex programming decisions: the school designs their learning to happen mostly in the classroom and homework needs to be separate from the online learning application.

Not all schools serving disadvantaged communities struggle with making devices available. **Marsden Road Public School** is a large primary school situated in south-western Sydney, serving a disadvantaged community. The school serves many students who have spoken English for fewer than three years, students who have been through a refugee or refugee-like experience, and some who are the first literate generation in their family, in any language. Over half of each Kindergarten cohort has additional learning needs. Nonetheless, the students at Marsden Road are well served by four full class sets of digital devices, in a central bank, easily checked out by teachers for the relevant lesson. In addition, the school has excellent internet connectivity, which is crucial. As the principal observed - 'If you don't have good internet, … pretty much technology is useless.' (This model may be more workable for primary-aged students than their high-school colleagues, who are more likely to require 1:1 access across all subjects and most lessons. It also mitigates, but does not address, lack of access at home.)

Disparities exist between as well as within school systems. Describing COVID-imposed learning from home, a Victorian teacher observed:

> All the kids at the [non-government] school had a MacBook, they could all learn. But we have kids at the government school just down the road on an iPhone 5 trying to do [senior secondary]. You know, it was … difficult times for the government kids.

Digital literacy

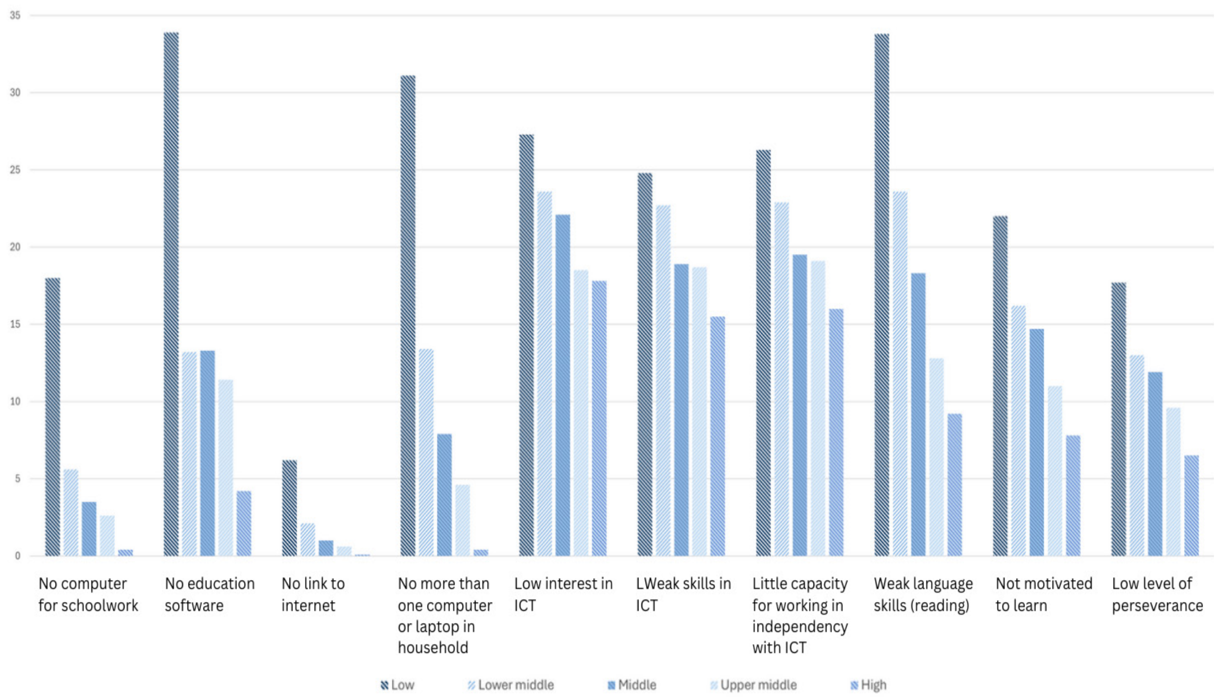
Building on a foundation of digital access, students, teachers (and parents) need sufficient digital skills, including AI literacy skills, to effectively utilise digital resources. Students need an appropriate level of digital literacy to participate in the classroom, while teachers should have adequate pedagogical skills for integrating technology into teaching activities (Kim et al. 2021). While digital literacy has always been broader than technical skills, the advent of generative AI significantly increases the range of skills necessary for digital and technological agency, spanning operational skills such as effective prompting through to critical AI literacy. Like access, digital literacy exists on a spectrum: 'even ubiquitous-access populations are riven with skill inequalities and differentiated usage' (Robinson et al. 2020:1).

Digital literacy for students

Despite the common assumption that young people are 'digital natives', evidence shows that young people often lack valuable digital skills. The report of the National Assessment Program in ICT Literacy 2022 shows that despite an increase in instruction to support digital literacy in schools since 2017, there has been no correlating increase in the number of students demonstrating adequate skill levels. Despite reporting high levels of device usage and positive attitudes to technology in the student survey, fewer than half of the Year 10 students who took part reached the assessment's proficient standard – the lowest percentage since testing began in 2005 (ACARA 18 October 2023).

Not every student has the opportunity to develop digital skills by themselves outside the classroom. Like access, digital literacy runs along established socioeconomic fault-lines of advantage. Students from low-SES families more frequently record the lowest levels of interest in ICT, the weakest skills in using ICT and the lowest levels of capacity for working independently with ICT (Mitchell Institute 2020, citing PISA 2018 results).

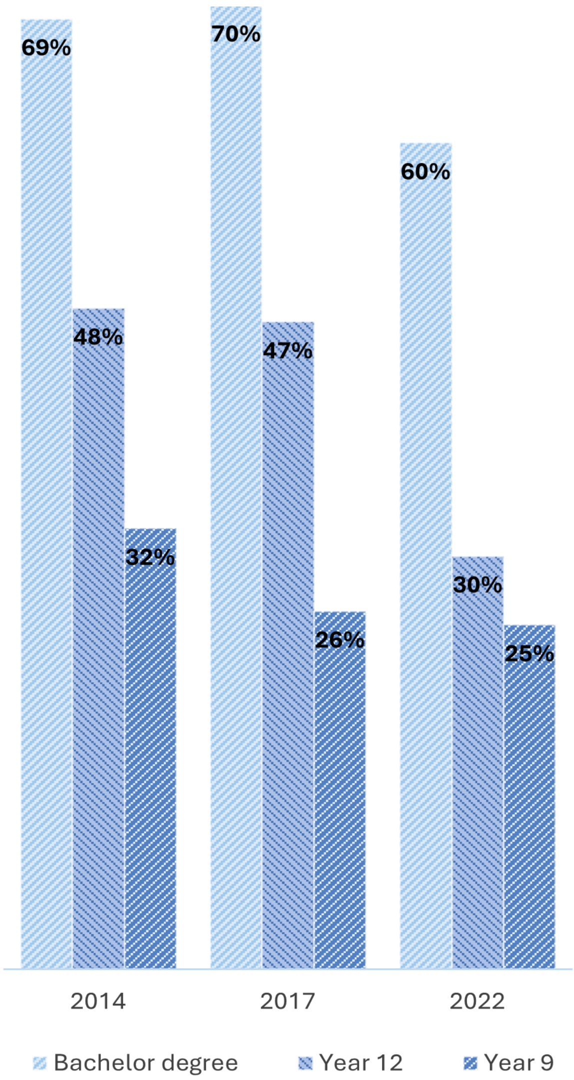
Figure 5: Digital access and skills of Year 9 students by social background (percentage)



Source: Mitchell Institute (2020), derived from PISA 2018

The NAP-ICT Literacy assessment results also reflect this: Year 10 students with managerial or professional parents scored 72 points higher than those with parents who are unskilled labourers, office, sales or service staff (ACARA 2023b). Similarly, students with a parent with a bachelor degree or above were more than twice as likely to demonstrate proficiency as students whose parent completed Year 9 as their highest education.

Figure 6: Proportion of Year 10 students achieving proficiency in NAP-ICT Literacy by parent education level



Source: ACARA (2023c)

These patterns may persist in the face of emerging technologies such as generative AI, although recent findings regarding the association between household income and children's awareness and use of ChatGPT are mixed (Picton and Clarke 2024). As free versions of some generic generative AI applications improve, the capacity to pay may diminish in significance, though new, improved (frequently more accurate) models are often made available to paid tiers of access first. This happened, for example, in September 2024 with ChatGPTo1.

Generative AI does appear to amplify the importance of knowledgeable and skilled use. In one survey, around three in five (62 per cent) of Australian Gen Zs reported that they were somewhat confident about the accuracy of information and content generated by AI tools, and 66 per cent reported that they verify the accuracy of AI-generated information. This still leaves around a third who do not, with high school students being less likely to check than tertiary students (58 per cent v 74 per cent). The same survey revealed young men had significantly higher confidence and self-reported skill levels in using generative AI than young women (Denejkina 2023). This is consistent with findings of other research, where studies consistently find males to be more confident, though this does not always translate into a performance difference when skills are independently assessed (Haddon et al. 2020).[6]

6 This pattern is observed in the Australian NAP-ICT assesment, in which females demonstrate higher levels of OCT literacy, but lower levels of confidence (ACARA 18 October 2023).

Digital literacy for parents

Research shows that parents with stronger digital skills often take a more enabling approach to their child's engagement in the digital environment, while lower skill levels can lead to a more restrictive approach (Gottschalk and Weise 2023). A study conducted during COVID-19 found that parents in low-income families are less likely than parents with higher incomes to have the digital skills required to support their children's online schooling (Kennedy et al. 2022).

Digital literacy for teachers

Digital literacy is a critical foundation for teachers' effective use of digital resources, including AI-enabled edtech, in the classroom. While teachers' use of technology to support learning is an expectation of the Australian Teaching Standards, the OECD's Teaching and Learning International Survey in 2018 found that only two in five Australian teachers felt well prepared or very well prepared to use ICT for teaching (Mitchell Institute 2020). Further discussion of teachers' digital literacy appears below, under 'Effective use for equity'.

Box 5: Digital literacy as a mirror of disadvantage

Fairfield High School is a secondary school serving a highly disadvantaged community in Western Sydney. The school hosts an Intensive English Centre (IEC) for students, over 95 per cent of whom are refugees requiring intensive support in English language acquisition to access the curriculum. Many of the Centre's students have only attended school in their home nations for two or three years and may not be literate in their first language. Many also arrive with a history of significant trauma, which can be an obstacle to school engagement and learning.

One teacher at the Centre has adopted a range of innovative approaches to teaching and learning, including using several technology-based tools, to provide highly interactive methods for improving English language mastery at the same time as developing important technological skills, within the technological and applied studies syllabus. He believes that digital literacy is critical for students' post-school success, however most students lack devices at home, as well as family members who could assist them in becoming technologically literate. This makes skill-building and access to such tools at school even more important. He explains that 'our students are missing out at home … but at school we've been able to do a lot.'

Digital use and outcomes

Successful or effective outcomes of digital technology use are not a given: research shows that even if young people do possess digital skills, they may struggle to translate them into tangible outcomes, especially in situations of socioeconomic disadvantage (Livingstone et al. 2021; Gottschalk and Weise 2023). Learners need the right resources to use their digital skills in ways that can bring about tangible beneficial outcomes, within education, work, or other areas more broadly (Livingstone et al. 2021).

The types of use of digital devices differ across levels of advantage. Research suggests that students from more advantaged backgrounds and who attend higher-SES schools tend to be more active users of technology, while students from more disadvantaged backgrounds are likely to be more passive in the digital environment (Gottschalk and Weise 2023:28). An Australian study has shown that children of parents with low education attainment, few professional skills and in lower socioeconomic households tend to have less productive use of digital media and technologies at home, compared with their peers with higher cultural capital (Graham and Sahlberg 2021).

There also appears to be a threshold for gaining benefit from technology for learning. Mathematics performance data from PISA 2022 shows that students who spent time at school learning on digital devices outperform those who don't, but excess use sees results decline. Interestingly, the association between time spent learning on digital devices and results seems stronger for Australian students than their OECD peers. For Australian students, performance improves steeply as digital learning at school increases, peaking at three to five hours per day, before a sharp downturn in results. In contrast, across the OECD, once students use a device at all, results are steady before a slower decline from the same point (Broadley 2024).

Box 6: Compounding digital disadvantage - the Matthew effect

Marsden Road Public School founds its educational provision on the explicit, systematic and sequential teaching of fundamental literacy and numeracy skills and uses three digital learning platforms to assist with this. While teachers are the main users of technology at Marsden Road, one application to develop reading and comprehension skills is available for students to use at home. Only about half of them do, however, and the principal notes that those who do have access to a device at home, parents who understand and support the value of using the app, and a significant degree of self-motivation. She called this an example of 'the Matthew effect' – the pattern of advantage compounding over time, so that the educationally rich get richer, and the equity gap grows.

Data equity

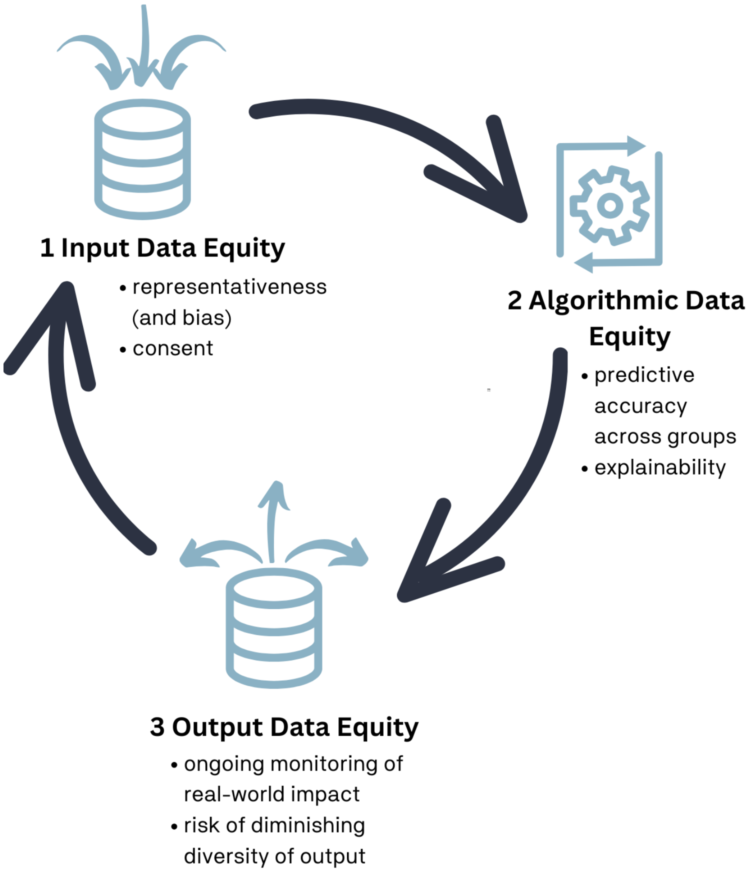
While some edtech uses the digital domain solely as a delivery mechanism, applications that support student-level learning insights or targeted learning pathways, and all applications that embed functionality based on generative AI tools, are heavily data dependent. The discussion of data equity in this report encompasses the range of data-enabled tools in which ‘AI can sit at the back end of a system as well as having user-facing applications’ (Southgate 2020:15).

Data is not neutral. Recognising this, the World Economic Forum (WEF) has established the Global Future Council on Data Equity to address ‘the societal impact of data and how emerging data ecosystems and technologies are perpetuating existing power dynamics, and creating new ones.’ A focus on data equity seeks in contrast to ‘create a world where data-based systems promote fair, just and beneficial outcomes for all individuals, groups and communities’ (WEF 2024:1).

Consideration of data and algorithmic bias in a range of high-stakes contexts such as health, justice and recruitment has increased with developments in artificial intelligence (Holstein and Doroudi 2023), both before and after the emergence of generative AI. While fairness and equity get some attention in discussions of learning analytics (Buckingham Shum and Luckin 2019; Sousa et al. 2019), the impact of data and algorithmic bias in education has not been publicly highlighted, apart from high-stakes algorithmic failures during COVID-19 such as the abandonment of computer-predicted grades for the British A-level.[7]

Given that learning data offers so much potential to improve educational outcomes, there is an urgent need to attend to data equity in the educational context. If we do not face up to the prospects of data inequity in edtech, ‘it is quite possible that [AI data analytics] will be underused due to excessive caution and misplaced fear about how it might be misused, resulting in a loss of its potential benefits’ (Kitto and Knight 2019:2857). Algorithmic systems make predictions (for example, whether a sequence of question answers means a child has ‘learned’ a concept, or the likelihood that a young person will finish Year 12) based on historical (‘training’) data. As a result, data-enabled edtech can encode and amplify bias at a number of points.[8]

Figure 7: The three points of data equity



Source: Adapted from World Economic Forum (2023)

7 The use of an algorithm to standardise A-level results during COVID, when students could not sit exams, was abandoned when it disadvantaged students in state schools, high achieving students in low-performing schools, and students in schools that were improving rapidly (BBC 2020).

8 The description of data equity in this section is heavily indebted to the framing in the World Economic Forum's briefing paper, *Data Equity: Foundational Concepts for Generative AI* (WEF 2023) as well as analysis by Kizilcec and Lee (2023), and Holstein and Doroudi (2023). While the WEF paper is explicitly focused on generative AI, the key equity points of input, algorithm, and output hold across different types of predictive AI.

Input data equity

The data that underpin a system necessarily reflect things that have already happened and therefore existing, often longstanding, social inequities and absences. This in turn affects the patterns observed and the outputs of the model or product. For example, in the early days of generative AI, a prompt asking for text about a doctor would commonly refer to a man, reflecting the scrape of the internet the models had been trained on.[9] Researchers have summarised the bias of the first wave of large language models as 'WEIRD' – 'Western, Educated, Industrialised, Rich, and Democratic' (for example, Atari et al. 2023).[10]

Leaving generative AI aside, educational training data sets have been shown to affect the accuracy of predictions for students from those groups due to explicit or implicit data sampling strategy. For example, a student 'affect detector' was more accurate for students from rural, suburban and urban regions if it was trained on a sample drawn from those areas (Kizilcec and Lee 2023).

Input data equity 'should also embrace the rights and wellbeing of data subjects' (WEF 2023:7), attending to issues such as informed consent and, importantly, negotiating the trade-off between data representativeness and the actual or perceived potential for increased surveillance of particular groups (WEF 2023:7). Within education, there is a tension between AI's potential to individualise learning experiences and the associated requirement for more student information, potentially including personal or sensitive information (US Department of Education, Office of Educational Technology 2023).

Algorithmic data equity

Algorithms are rules that interpret relationships within the input data to predict outcomes (including the production of new data, in the case of generative AI). Evaluation of an algorithm's performance is important to assess its fairness, and this must extend to the assessment of predictive accuracy for individuals from subgroups, especially if they are underrepresented in the data (Kizilcec and Lee 2023). According to the WEF, 'attaining algorithmic data equity involves including a diverse array of perspectives in its design and assessing its influence on different demographic groups' (WEF 2023:7).

Explanation is at the heart of teaching practice and if we use machine-based systems in education, we need to be able to explain why they make the decisions that they do (Southgate 2020). This is particularly challenging in the case of foundation or large language models (LLMs), which have a well-deserved reputation for being inscrutable 'black boxes'. The size and complexity

9 Explicit correction of bias in generative AI is important but can underscore other problems with the technology, such as hallucination. Attempt to address the racial bias in outputs from Google's image generation tool, Gemini, led to 'the endless parade of Indian Popes, Asian Vikings, and even, a Black woman as the King of England' (Phan 2024).
10 The acronym originated in a critique of behavioural sciences research, which is often based on WEIRD societies. The authors argue that findings from these studies are then generalised as though they apply more broadly, despite the fact that WEIRD societies represent a 'particularly thin, and rather unusual, slice of humanity' (Henrich et al. 2010).

of these products (and the fact that a single prompt will not generate the same output twice) make the objectives of transparency or explainability much harder to achieve than it may be for other AI systems. For LLMs, therefore, this underscores the importance of equitable representation in the underlying data (equally a challenging task). It also points back to the importance of AI literacy – for teachers and students – to understand the limitations and the potential of these tools.

Output (outcome) data equity

Output data equity refers to the actions and real-world outcomes of data-driven and AI-enabled systems in practice. Because these systems are increasingly complex and opaque, it has become common to stress the importance of having a 'human in the loop' to ensure fair and equitable outcomes, especially in high-stakes contexts (for example, US Department of Education, Office of Educational Technology, 2023:16). It is important to remember, however, that humans also exhibit bias and blind spots. In monitoring and interacting with these tools, we need to validate with clear eyes and remain open to having our own assumptions challenged.

Monitoring the real-world impact of these tools needs to be ongoing. AI systems can be dynamic, both shaping learner and teacher behaviours and being shaped by them. In this circumstance, results can be challenging to anticipate (Holstein and Doroudi 2023). This may be particularly pronounced with generative AI systems, in which the reuse of generated output may magnify bias over time (WEF 2023). Commentators and researchers have also raised the possibility of 'model collapse'. A recent study documented in *Nature* found that 'training artificial intelligence models on AI-generated text quickly leads to the models churning out nonsense'. More subtly, but with important equity implications, the study found that learning from AI-derived texts caused models to forget the information mentioned least frequently in their data sets as their outputs became more homogeneous (Gibney 2024:18).

Box 7: Data (in)equity in practice

The three data equity points of input, algorithm and outcome are intertwined. For example, students from disadvantaged backgrounds are, on average, less likely to complete Year 12, but this reflects significant differences in the learning opportunities, experiences and resources available to them, not something intrinsic to the students themselves. Nonetheless, a predictive model is likely to identify future students from this group as having a reduced chance of school completion. Whether this makes the system inequitable may depend on whether that prediction results in further support for students (beneficial), or the recommendation that they pursue alternative pathways (potentially discriminatory). In engaging with data-driven edtech, systems, schools and teachers need the skills to access and understand what the data is telling them, what the evidence tells them will be effective in response, and the capacity to deliver that.

Box 8: Indigenous data sovereignty in action - Living First Language Platform

Indigenous data sovereignty is critical to data equity.

Data sovereignty refers to the right of a nation to control and manage its own data, regardless of where that data originated and [is] stored (Australian Senate Economics References Committee 2023).

Maiam nayri Wingara is an Aboriginal and Torres Strait Islander Data Sovereignty Group, associated with the Global Indigenous Data Alliance and parallel groups in New Zealand and the US. According to the Maiam nayri Wingara Indigenous Data Sovereignty Principles, '"Indigenous Data Sovereignty" refers to the right of Indigenous people to exercise ownership over Indigenous Data. Ownership of data can be expressed through the creation, collection, access, analysis, interpretation, management, dissemination and reuse of Indigenous Data.'

Indigenous data sovereignty and the related right of Indigenous data governance are key to Indigenous people being empowered to accurately reflect their stories; identify what works, what doesn't, and why; and to make decisions that support communities and First Nations in ways that meet development needs and aspirations (Maiam nayri Wingara 2018).

The Living First Language Platform – Australian Literacy and Numeracy Foundation (ALNF) and the Living First Language Platform Company (LFLP Co)

The Living First Language Platform is an Application Programming Interface (API)-equipped database along with an interactive, web-based application that Indigenous communities use to support community-led language and literacy documentation, with the goals of (i) increasing the accessibility and use of First Languages; (ii) supporting language and literacy development in both First Language and English, particularly for children; and (iii) increasing skills, awareness and confidence of community members, parents and caregivers.

While the ALNF/LFLP Co may own the software code for the LFLP, each Language community has full control and authority over their Digital Language Space. Respected, representative Community Organisations host each Digital Language Space and have governance over all the Language content therein. The Community has accessible tools to manage the collection, curation, recording and sharing of their content for the benefit for the community. Other practices supporting data sovereignty include community-determined permissions structures, facility for data import and export, non-cloud solutions and pathways for communities to innovate upon their curated data (for example, API integrations).

Designing for equity

Edtech is increasingly big business. The global education market was estimated at USD $142 billion in 2023. In the same year, the Australian edtech peak group EduGrowth sized the local market at 700 companies, more than 40 per cent of which were early-stage start-ups, with a revenue of AUD $3.2 billion (EduGrowth 2023). Market size, however, doesn't necessarily equate to product quality, and market considerations may even get in the way of equitable product design.

Conversely, school education is a complex ecosystem, with many requirements and expectations, in which it can be difficult for companies to isolate and solve a problem with sufficient value attached, meaning that many fail (for example, Shulman 2017).

Equity in edtech design is often considered through the lens of accessibility, though this is only the first step towards inclusive design, which means also that products cater to the full range of students, in terms of both educational need and cultural background. Analysts have noted that edtech has significant potential to help teachers effectively scaffold learning for students at different levels of knowledge and skill, but without other incentives, the profit motive may push edtech companies to design for 'a mythical average learner' (Noakes 2019:6).

Digital materials and technologies are accessible when students with and without disabilities can use them in an equally integrated and effective manner, and with substantially equivalent ease of use (Jones and Fox 2018). The Web Content Accessibility Guidelines (WCAG) establish an important baseline (W3C Web Accessibility Initiative 2024), and edtech that includes significant user interface features enabling users to adjust the tool to meet their needs (for example, font size, verbal function, dictation) can support equitable opportunities to learn. The United Nations' position that 'States parties should promote technological innovations that meet the requirements of children with different types of disabilities and ensure that digital products and services are designed so that they can be used by all children without exception and without the need for adaptation' is a higher bar (United Nations 2021:par.91).

This type of adaptive support may be considered to be at one end of a spectrum – facilitating access to the curriculum and typical classroom learning activities – and there is an ongoing need for it. While there are over 25,000 assistive technology devices (Edyburn 2020), 'there is [nonetheless] a huge gap between the potential of AT (assistive technology) and the reality of pupils with special educational needs and disabilities who needlessly struggle on a daily basis to complete routine tasks because they do not have ready access to appropriate AT devices and services' (Edyburn 2020:30).

At the other end of the spectrum, there are technologies that are specifically 'designed to address and provide support for issues related to the child's disability' (Good 2021:125). While there are some encouraging examples of edtech providing important diagnostic support for students with learning difficulties such as dyslexia or dyscalculia, targeted support for students with disability overall may be an example of market failure: 'although adaptive educational technologies and inclusion, in the broadest sense, are two key considerations in the current educational landscape, they intersect more seldom than one would expect' (Good 2021:123). Some researchers claim that 'more often than not, untested special education technology ends up in the hands of practitioners and students with disabilities' (Thomas et al. 2019:297).

Students with disability are not the only important and under-served cohort. In an inventory of edtech products compiled by Loble and Hawcroft (2022), few developers suggested how their applications would be particularly useful to disadvantaged students, students with learning disabilities, or those from non-English speaking backgrounds.

School and home contexts as well as student needs should be considered. Given the difference in resources among school and home environments, designing edtech with a view to usability across multiple platforms and in lower-resource settings is important. For example, low or slow bandwidth can have significant implications for application design, requiring designers to prioritise performance, optimise data usage, and consider the implications for user experience and accessibility. From the time-poor teacher or parent perspective, simplicity is key. This is particularly true when resources for professional learning are tight.

Quality educational content relevant to students' needs also must be part of digital access and inclusion (Kim et al. 2021). As described above, students experiencing disadvantage are more likely to have low literacy levels and can become frustrated or disengaged if they cannot access the content. While technology's multi-modal nature may seem intuitively well suited to helping in this situation, schools can invest considerable effort adapting online curriculum offerings to meet the literacy needs of their students (though they appreciate vendors' flexibility in facilitating this adjustment). As one teacher described:

> you can take out sentences in a big paragraph and just summarise it down a little bit more, highlight the keywords for kids who really need it … It makes a big difference in their learning.

Positively, our consultations have found that some edtech providers are willing to adapt their tools to school needs, which can include the needs of students who require adjustments for learning disability. One teacher we spoke with advised their edtech provider that the platform's content was too challenging for students with special needs; as a result, the provider is collaborating with the school's Special Education and Individual Curriculum Plan teachers to adapt the tool.

Researchers have identified 'the social distance between developers and those they seek to serve' as a factor that may contribute to inequities in AI-supported education (Reich and Ito 2017, in Holstein and Doroudi 2023:155). Currently, edtech design is likely impacted by 'early-adopter iteration bias'; that is, participants at the earliest stages of design tend to represent a relatively privileged and influential subpopulation. This can skew the design of new technologies, so that they fail 'to reflect the needs of marginalised, underserved, and otherwise risk-averse populations' (Holstein and Doroudi 2023:157). While edtech developers may prioritise time-to-market and thus design (initially at least) for the middle, it is more cost-effective to centre universal design from the outset. Retro-fitting increases costs substantially.

Designing products with reference to and input from students and teachers in a wide range of settings is key to improving edtech's equity and a number of organisations recommend more participatory approaches. For example, the US Office of Education Technology (n.d.) recommends that developers hire individuals with disabilities and engage with the disability community to contribute to the design process and test tool compliance.

This principle also holds for building tools that meet the needs of students and educators from diverse backgrounds, with a particular responsibility to engage authentically and respectfully with First Nations communities. The importance of co-design more broadly to ensure education provision meets the needs of Aboriginal and Torres Strait Islander students is enshrined in the Heads of Agreement for the Better and Fairer Schools Agreement 2025–2034, which commits the Parties 'to work in partnership with Aboriginal and Torres Strait Islander peoples to design and deliver reforms to increase education equity for Aboriginal and Torres Strait Islander students' (Australian Government Department of Education 2024).

Box 9: Bringing community expertise and technology together to support teachers in delivering First Nations curriculum content – Indigital

Indigital is an Indigenous owned profit-for-purpose company seeking to create a culturally diverse and inclusive digital future. To do this, they use digital technologies – like AI, augmented or mixed realities – as a pathway to learning Indigenous heritage, and use First Nations' culture to teach digital skills as a pathway to the future of work.

Indigital Schools is an Indigenous-designed teacher professional development training program for primary and secondary schools. It enables teachers to connect with and learn from Elders about cultural knowledge, history and language, while learning digital skills in metaverse-bridging technologies. Teachers are then supported to implement this program in their classrooms via Indigital Classrooms, building digital skills and understanding of First Nation knowledge and culture for students.

A further strategy to support equity in edtech design is to ensure that tools have a strong basis in the research on how students learn. Understanding of learning science has strengthened significantly over recent decades, and prioritises:

+ The deliberate development of students' self-regulated learning
+ Planning and sequencing learning to support changes in students' long-term memory
+ Teaching in ways that manage cognitive load for learners (explicit teaching)
+ Gradual handover of learning responsibility to students as they develop mastery, supporting application of knowledge and development of higher-order skills such as critical and creative thinking (AERO 2023b).

Equity and effective use

Any technology is only as good as its use. Skilful integration with school and teacher classroom practice is key to effective use of edtech to improve student learning engagement, experiences and outcomes — so much so that research assessing the impact of policies that facilitate investments in ICT for schools or students generally cannot disentangle ICT access from use, and 'teachers' pedagogical practices and teaching strategies with ICT largely determine the extent to which their use in the classroom will result in improved cognitive achievement' (OECD 2023b).

Teacher knowledge and skill, as well as school resourcing, are critical enablers, but these are much harder to achieve in some schools than others. Disadvantaged schools tend to have the highest rates of beginning teachers, out-of-field teachers, and teacher turnover (Hunter et al. 2022). In the 2018 PISA principal survey, principals of disadvantaged schools were much more likely to report that their capacity to provide instruction was hindered by lack of teaching staff (34 per cent compared with 3 per cent in advantaged schools), inadequate or poorly qualified teaching staff (21 per cent v 0.3 per cent), teacher absenteeism (28 per cent v 5 per cent), and teachers not being well prepared (18 per cent v 5 per cent) (Thomson 2021).

Teacher efficacy and edtech

It is not surprising then, that schools serving disadvantaged communities can struggle for high levels of individual and collective teacher efficacy. Teacher self-efficacy reflects a teacher's estimation of their ability to achieve the engagement and learning goals they have for their students, even for students who may be less motivated or more challenging. Teachers with high levels of self-efficacy are more likely to challenge students, try new methods, be innovative in teaching and work longer with students who are struggling (Tschannen-Moran and Hoy 2001). Research suggests one of the drivers of teacher self-efficacy is a teacher's level of mastery experience in the classroom (Hoy and Woolfolk 1993).

Collective teacher efficacy (CTE) reflects a shared confidence of the ability of a school or group of teachers to make a real and positive difference to students' lives and education outcomes, regardless of their backgrounds (Hoogsteen 2020). Collective teacher efficacy is central to school improvement. Educational researcher John Hattie found collective teacher efficacy to have the largest impact on student attainment out of 252 researched influences (Hattie 2018).

Research into the drivers of CTE suggests that while it also depends on past mastery experiences, it is impacted by contextual variables, including socioeconomic status and school level (primary or secondary) (Pongratz 2024). This doesn't mean that disadvantaged high schools (in particular) can't or don't foster CTE, but they may face greater challenges to do so. Protective factors can include communities of teachers with high, attainable goals (Hoy and Woolfolk 1993) and strong relationships between teachers (Pongratz 2024).

Teacher beliefs, efficacy, and collegial collaboration are also important when implementing ICT in the classroom, which depends on individual and school readiness (Petko et al. 2018). For teachers, self-efficacy for using ICT in their teaching practice is associated with general ICT self-efficacy (Hatlevik and Hatlevik 2018) as well as their underlying beliefs about the value of educational technology for teaching and learning (for instance, Petko et al. 2018) and school support for technology integration (Kim et al. 2021).

Teachers' technological knowledge is intertwined with subject content knowledge, pedagogical knowledge, and knowledge of their teaching context, as encoded in the TPACK model.[11] In Australia, focus area 2.6 of the Professional Standards for Teachers describes the expectations that teachers use effective strategies to integrate ICT into teaching and learning programs (AITSL 2022). The professional standards were developed to support the 2008 Melbourne Declaration. Released in 2011 and updated in 2018, they predate the significant growth of AI in education and the Australian Framework for Generative AI in Schools.

The complex interrelationship between teacher knowledge domains was demonstrated during COVID-19 when even highly skilled teachers experienced a decline in teacher self-efficacy with the move to online education (Brianza et al. 2024).

Even in more usual circumstances, Australian teacher skills in using digital technologies for teaching are uneven. The OECD's Teaching and Learning International Survey in 2018 found only two in five Australian teachers felt well prepared or very well prepared to use ICT for teaching (Mitchell Institute 2020).

Like students, teachers need time to learn, practise and embed new skills. Teachers in resource-rich schools engage more frequently with other teachers in professional development and may have school structures (including technical support and specified expert teachers to guide effective practice using technology) and timetables that better support teachers' use of ICT for teaching and learning (Kim et al. 2021).

In consultations, teachers have described wanting time 'to play' with new technology to build their confidence and understanding of the potential and limitations of tools, including with colleagues from their own and other settings. With respect to generative AI, one teacher commented that 'just seeing what other teachers are doing … how they're using tech opens up so many different ideas and conversations.' This aligns with studies that have found teachers prefer an informal approach to learning how to use ICT and want to learn with other teachers (Hatlevik and Hatlevik 2018). The opportunity to experiment, however, is unevenly distributed. One consulted teacher explained: 'The other equity [issue] that we're now facing is. … Some schools just cannot get people here or have people come in and explain how to do it.'

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11 TPACK (the Technology, Pedagogy and Content Knowledge Model [Mishra and Kohler 2006]) is a model for thinking about the different types of knowledge that teachers need and leverage in their practice.

Edtech as a support for collective teacher efficacy

The good news is that the thoughtful use of edtech can provide a platform for the development or strengthening of collective efficacy. Our consultations suggest that edtech learning platforms can support consistent faculty- or school-wide implementation and shared understandings about effective curriculum delivery and teaching strategies to close identified gaps. Lessons can become a shared faculty resource and responsibility, while teaching them becomes a shared experience. This can make it easier for teachers to reflect collectively on what is working in teaching particular aspects of the curriculum and what isn't. And it can promote better benchmarking and moderation of student engagement and work across classes. Working from a shared base makes continuous refinement of curriculum and teaching practice more sustainable and means that students can benefit from the accruing expertise of teachers past and present.

Box 10: Building collective efficacy using a digital curriculum platform

Narrabeen Sports High School is an above-median SES school in the northern suburbs of Sydney. Over the past decade, the school has grown significantly, with enrolments almost doubling to nearly 1,000 students. The school, which caters to many student athletes as well as inevitable transfer students, recognised the need to better support student learning during transitions from other schools and between academic years. This was the impetus for the science faculty's implementation of an online learning platform in 2022 to support consistent and sustainable curriculum planning and delivery.

The faculty has worked with the vendor to customise platform content according to their priorities. This has included shaping lesson formats to align with their explicit teaching approach, with content delivery up front, followed by more time for class discussions and questions, which they have found suits their students well.

Through this use of a collective and tailored tool, the faculty has seen benefits in professional conversation and collegiality. Resource consistency has allowed the faculty teachers to 'all speak the same language of the resource' and standardised assessment results reflect faculty-wide strengths and areas for improvement, which the faculty can celebrate and address collaboratively:

> It's a faculty that wants to work together because we're all sharing the success, and we all share the challenges. … It's a team sport.

The school's science faculty has become a faculty of choice in the area, attracting and retaining high-calibre staff within the competitive market for science teachers. Teachers appreciate feeling part of a team and having time to pursue leadership and other opportunities. The faculty head attributes the sustainability and professional satisfaction within the science staff in significant part to the consistent use of a curriculum-based digital platform.

This foregrounding of faculty professionalism may be particularly important in schools or faculties that have significant numbers of early career teachers, or substantial turnover of teaching staff. One teacher we consulted recalled an early career moment, in a remote location, 'staring at a blank A4 page with "Program" written on it.' While schools may adopt new digital platforms at any time, moments of curriculum change can provide an opportunity to connect adoption with building understanding of syllabus change.

Counter to the common call for technology to 'disrupt' education, evidence shows that technology implementation is most effective when it supplements or augments teacher practice and expertise. The Education Endowment Foundation's guidance report (2019) (based on a systematic literature review by Lewin et al. [2019]) emphasises that the pedagogic rationale must come first: to be effective, technology must address an identified need, with clarity also on how this application will improve learning.

The report identifies three key ways in which digital technology can contribute to improved student learning:

+ By improving the quality of explanations and modelling
+ By improving the quality and quantity of practice that students undertake
+ By playing a role in improving assessment and feedback (EEF 2019).

As indicated by this evidence synthesis, quality use means grounding technology in its educational context and amplifying teacher professionalism. Far from being a potential replacement for teachers, edtech depends on teacher expertise for its effectiveness. For example, applications that support differentiation by providing fine-grained diagnostic insights require teachers with the capability to understand the data and translate the information into appropriate teaching strategies.

Box 11: Teacher skill as crucial for edtech effectiveness

Marsden Road Primary School uses an online assessment platform as an integral part of its explicit teaching of literacy. The platform provides short (one-minute) fluency measures that can detect risk and monitor the development of early literacy and reading skills. It has helped the school to streamline and improve the accuracy and consistency of formative assessment of literacy skills, specifically phonological awareness, phonics, fluency, and aspects of comprehension. It has given teachers additional information about the knowledge and skills of early and struggling readers. With two full years of data, the school reports improvements in phonics in Kindergarten-Year 1, as well as improvement in fluency across most years.

The principal emphasises that teacher skill has been critical to this impact on student outcomes. While the platform provides important data on student progress quickly and reliably, it is the teacher who differentiates their instruction to meet student needs, not the technology. This means knowing what the data is telling them, what the evidence tells them will be effective in response and the capacity to deliver that in their classroom setting. While the data from the assessment tool is powerful:

> If we don't understand the science of learning, then you're not really going to be able to understand what this assessment is for and what information it's giving you. So I think the teaching has to be there first before you start using this tool.

The teacher remains essential, even in the case of individual tutoring applications, to provide point-in-time responses to queries and clarifications of understanding, or to conduct regular, in-depth interviews with students to monitor and support progress. Consultation indicated that if there is a large spread of student ability, with students working across many year levels, edtech can require a depth of content knowledge and pedagogical flexibility in the teacher (compare Inder 2019).

Box 12: Edtech reinforces the need for teacher subject mastery and assists with extension

Cohuna Secondary College is a small, lower-SES school in regional Victoria. The school serves its local country town and adjacent communities, with almost half of students falling into the bottom quarter of socioeconomic advantage and another third in the next lowest quarter.

The maths faculty adopted an Australian-designed adaptive maths learning platform in response to staff departures and teacher supply pressures, to assist with workload management and providing more targeted instruction for students. The learning platform is the faculty's primary curriculum resource, providing classroom resources, as well as adaptive student tutoring and instruction capabilities, including biweekly formative assessments to gauge each student's understanding and adjust content accordingly.

Students typically work independently with the platform during maths lessons, with teachers providing additional help, clarification or instruction. The demand for expert assistance is high, with teachers being called on by a student 'every five minutes or so'. This reinforces the importance and necessary depth of teacher subject knowledge, needing to identify where students have missed a critical step or forgotten an underpinning concept from earlier lessons:

> [The platform] does have annotated examples and solutions, but at the same time the kids are going: What does this mean? And then you have to break it apart for them. You have to know your maths. You have to know it inside out and if you don't, the kids will find you out soon enough ....

The school credits this combination of student, platform and teacher with helping to enhance student outcomes, having observed an improvement in student results and in students showing greater preparedness for the Victorian Certificate of Education (VCE). By way of example, three Year 10 students were able to accelerate their learning using the platform and recently sat the Year 12 VCE Maths exam with outstanding results: one performed in the top eight per cent of the State and another in the top 15 per cent: 'So they finish Year 9 and then next year they're top of the Year 12.'

Edtech and student engagement

The ultimate objective of educational change is to improve student learning outcomes, but engagement with learning is a critical intermediate step. We still need to understand much more about the conditions for positive student engagement with edtech. Technologically enabled education is often assumed to be more engaging for students and many forms of technology have been reported to improve student engagement in learning (AITSL 2024a).

The relationship between technology, motivation and student achievement is complex, however (EEF 2019). In some cases, pupils may be motivated to use technology, but this motivation may not translate to engagement that leads to learning. In some cases, technology may pull students away from learning, and indeed the Growing Up Digital study found that 84 per cent of Australian teachers and principals believed that digital technologies were a growing distraction in the learning environment (Graham and Sahlberg 2021).

Conversely, there may be thresholds to edtech's appeal, with implications for equity. Some of the teachers we consulted suggested that gamified learning did not create enduring interest for all students; it was human interaction that often was a key support to students' ongoing engagement with learning platforms.

For example, a randomised control trial in disadvantaged New York and Chicago public schools evaluated the ability to scale an established small group tuition program by adding in the use of an online learning application. The study found that by replacing some in-person sessions with work on the application, the program could reach twice as many students while maintaining its significant learning impact. Still, the tutors were found to be critical to student engagement, on the learning platform as well as off it. On average, students used the application for about two-thirds of the designed dosage and when COVID-19 closed schools, engagement with the online application dried up.

Importantly, usage was positively correlated with indicators of comparative advantage – higher baseline achievement, better attendance, less misconduct – even in this highly structured setting and the authors call out the equity implications of this (Bhatt et al. 2024). These findings align with the assessment that more motivated students may be better placed to take advantage of online learning platforms than their peers (Lewin et al. 2019).

Box 13: Bringing engagement and outcomes together for highly disadvantaged students using generative AI

In **Fairfield High School's Intensive English Centre**, students have the benefit of a teacher with particular interest and expertise in emerging technologies. This interest has driven him to find innovative ways to incorporate technological tools into classroom instruction. He describes how he uses the text-to-image function of a common application to help students acquire and practice English language in the context of the technological and applied studies syllabus. Students find the tool's quick and easy interactivity highly engaging. Entering a prompt, the image generated either looks as they intended, or not, providing students with a result allowing for rapid, engaging feedback. Through the process of amending and reiterating prompts, students can expand vocabulary, grammatical understanding and fluency, in pursuit of realising the image in their head.

> A lot of it for students was being able to immediately see 'Oh, I used the wrong colour. I used the wrong word. I used the wrong pronoun. What happens if I structure this differently? What happens if I write a paragraph or I take a paragraph from the story I wrote in English? What will that look like?' And seeing that, and saying, 'Oh, that's not what I had in mind. How can I change it?'

Introducing the AI-enabled edtech tool has had a profound impact on student engagement, effort and commitment to the learning process. The capacity to connect their new language of English to the universal and language-agnostic power of an image has proven to be a powerful motivator with significant impact:

> Students [are] coming to the classes excited and prepared, students who have never done homework for me in their lives. Students who will have a detention every second day for not doing anything in class were coming to that class prepared, having written down things that they wanted to try out and pictures they wanted me to print.

In the view of this teacher, the students' engagement and intrinsic motivation to practice language exceeds anything previous. Even students who did not always engage very well were moving out of the comfort zone of their first language into using a lot of English, with increasing sophistication. They were 'able to construct not just sentences, but paragraphs, describing things.'

Conclusion – The inequitable risk of a missed opportunity

Neither edtech nor AI is a silver bullet for education. Digital tools are just that – tools – and are only as good as their design and use. Positive studies notwithstanding, we still find ourselves speaking frequently about potential rather than demonstrated power, when it comes to edtech. Benefit clarity for policy makers and practitioners can be illusive or missing.

There are documented downsides. Across all edtech's equity dimensions – of access, data, design and use – we can already see the amplification of disadvantage, as well as future risk to mitigate. The evidence-base struggles to separate educational use from screen time overall, and concerns about over-use and its implications for wellbeing are voiced. There is evidence that ICT can create more harm than good where classroom technologies are poorly integrated (EC 2021) and generative AI reminds us to foreground pedagogical intent, with unsound use by students and teachers a real risk.

The risks of overuse and misuse can easily skew towards reinforcing existing disadvantage. For example, a study of US teachers' definitions of successful edtech implementation found that teachers overall were more likely to define success in terms of outcomes (for example, improved student outcomes or engagement) rather than conditions (for example, sufficient technology access and support). However, definitions varied by context. Notably, the larger the percentage of students identifying as Black or Hispanic, the more likely teachers were to define success in terms of quantity rather than quality of use (Kohler et al. 2022).[12]

If there are risks of overuse and misuse, there is also the risk of underuse and missed opportunities.[13] For example, the UN Convention on the Rights of Persons with Disabilities (2006) has afforded assistive technology the status of a human right (Edyburn 2020), but there is much to do to make this a reality in education.

The risk of missed opportunities will also likely be borne by those who already miss out. Recognising this, the expert panel to inform the Better and Fairer Schools Agreement found that 'Governments, school systems and approved authorities need to support the digital inclusion of students from disadvantaged backgrounds to prevent the use of digital technology in education settings from further entrenching inequality' (Improving Outcomes for All 2023:74). Similarly, the Inquiry into the Use of Generative Artificial Intelligence in the Australian Education System found that generative AI could exacerbate the digital divide and that there's a relationship between funding and the adequacy of tools used

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12 The percentage of Black or Hispanic students was highly correlated with the percentage of students qualifying for a free or reduced-price lunch (an indicator of socioeconomic disadvantage).
13 This framing draws on Kitto and Knight (2019): 'AI can be used to foster human nature and its potentialities, thus creating opportunities; underused, thus creating opportunity costs; or overused and misused, thus creating risks' (Kitto and Knight 2019:690).

in schools, particularly for disadvantaged students (Australian House of Representatives Standing Committee on Employment, Education and Training 2024).

There are green shoots to nurture. The Living First Language Platform and Indigital offer examples of edtech initiatives that profoundly address Aboriginal community priorities and honour principles of data sovereignty. We also have seen schools using digital platforms in intentional, creative and sustained ways to support improved learning experiences for students experiencing disadvantage.

There is much more work to be done – to understand and codify good product design and what skilful teaching with technology looks like; to resource these efforts; to scale; to address the digital divide in the first place. In the face of ongoing educational inequity we have a responsibility to students not to 'leave learning on the table' (Stephens 2024) and high quality edtech, skilfully used, should be part of the resource package to narrow Australia's learning gaps. The recommendations that follow describe some important steps.

Recommendations – A digital equity learning guarantee

Establish a Digital Equity Learning Guarantee for all Australian students that will:

1. Provide free or low cost access to quality digital devices and connectivity to support disadvantaged students' learning, and additional resources to lift digital skills and AI literacy.

2. Expand the safe and effective use of digital teaching and learning tools, especially to improve outcomes for disadvantaged and special needs students, through:

   + professional learning opportunities and preservice teacher education

   + research into what works best in using edtech learning applications, including work with disadvantaged schools to test and showcase effective integration.

3. Set equity and inclusion as core design expectations of edtech used in Australian schools through standards, procurement processes and co-investment by government and industry to develop and scale equity-focused design.

4. Ensure the highest level privacy and safety protections for children and students in the design and use of educational technologies.

Appendix – Snapshots of school practice

Beenleigh State High School

QLD | Low-SES secondary school | Stile*

* These snapshots describe schools' use of edtech platforms. They do not constitute independent evaluations of efficacy or endorsement of any individual tools.

Located in southeast Queensland in an area with high concentrations of disadvantage, Beenleigh State High School has a diverse community and culture that includes students with language backgrounds other than English, First Nations students and students with special needs. Many students require an Individual Curriculum Plan (ICP) to ensure access to the curriculum and tailored support.

The school has historically welcomed excluded students and is committed to providing them a second chance with dedicated support programs. Beenleigh State High School also runs a special education department and organises smaller support classes of 10-15 students led by teachers with specialist expertise.

The school started considering the possibility of using education technology platforms to lessen teacher workload, enhance teaching and learning differentiation, and support early career teachers. In 2020, the science faculty began using Stile, a science education technology platform.

Technology

Stile is designed to provide a comprehensive, year-long structure for science and STEM education in the middle years of schooling (Years 5-10). It aligns with Australian, New Zealand, United States, NSW and Victorian curricula. The focus is on teacher support, with lesson plans and a range of resources such as interactive simulations, videos and suggested science experiments and collaborative activities. The platform also includes formative and summative assessments. To accompany the instructional materials, Stile includes lab guides, a student revision notebook, and professional development resources for educators. For Years 7-10 students, Stile also offers 'Squiz,' an adaptive homework application that helps students engage with key concepts outside the classroom.

Use

Stile's integration into the school's teaching program varies by year level, depending on device availability.

For Years 7 and 8, Stile is accessed on iPads. Teachers take students through part of a Stile lesson then monitor independent student use of the platform's question-and-answer and poll functionalities, providing learning support where needed. They often use Stile's real-time data to gauge student progress and address learning needs.

The school's head of science sees this 'real time' capability to enhance instruction as particularly useful:

> This way you can actually look through answers, find one ... This is a good answer. Talk about what's good about it ... How could we improve it? All that is straight there in front of the kids, they get to see their peer's work and focus on how they can fix [their own].

For Years 9 and 10, who lack consistent device access, the school uses Stile as a teacher presentation tool alongside textbooks. Once a week, when students have access to the school's loan laptops, they work on Stile independently.

The school occasionally administers assessments through Stile. The teachers typically design their own assessments, which may draw upon the Stile resources, and then use the platform so that there is uniform access across classes. Students can complete the assessments in school or at home, depending on teacher requirements or whether students have access to appropriate devices.

Impact

Beenleigh State High School science faculty has found the platform to be especially useful in supporting teachers with quality materials and streamlining lesson planning, assessments and marking. Stile's quality of resources, and especially the capacity to tailor them to particular teaching and learning needs, has been a key factor. Overall, the use of Stile has delivered substantial workload relief.

The platform also has enhanced consistency of curriculum access and continuity of learning across classes. The lessons are diverse and flexible but situated within a reliable, curriculum-aligned resource structure and library. This has been especially valuable for early career and casual teachers. Relatedly, the platform has helped improve marking moderation as teachers can see student work across classes and set consistent benchmarks.

One of the key impacts of using the tool has been to support greater differentiation of teaching and learning within the school's highly diverse student population. There is capacity to personalise content and level of learning challenge. Teachers can extend learners through extra lessons or more difficult content or adjust to a lesser difficulty level for others. A bonus is the anonymity; teachers can make these adjustments without exposing students to potentially challenging dynamics between students in the classroom.

> One of the things with your high achieving students is they can get resentful: 'I got the work done, so why should I have to do more work?' But with Stile, you can set them an extra lesson and they don't know that they've got one more lesson than the person next to them.

There has been some variable degree of student engagement with the tool at Beenleigh State High School and some students have preferred not to use it. On the other hand, teachers have found the range of resources and multimedia capabilities have allowed for more engaging instruction. Taken together, this highlights the importance of teacher decision-making about when and how to use technology.

A key benefit has been the professional growth conversation amongst the science faculty. Part of this has been due to the ongoing engagement of Stile and how it shares effective practices across participating schools.

> I think the biggest thing to getting the most out of a platform like Stile is [having an] ongoing conversation with the users about how we use it. Because quite frankly, you could use it like a textbook and you would not get anywhere near the value from it that we currently have because we share ideas around using it.

Barriers and enablers

The school has a limited number of laptops available for students and only Years 7 and 8 access iPads. Typically for many disadvantaged communities, students also often have no digital devices at home or must use limited-data, mobile phones for learning. These access constraints flow through to programming decisions: the learning must be designed to happen mostly in the classroom and homework needs to be separate from Stile.

As a school serving a highly disadvantaged community, the financial impost of edtech platforms, including Stile, are a key consideration. The school reports that learning app subscriptions often end up costing more than textbooks so some tough choices must be made. Stile's progressive pricing scheme and reduced per-student rate for disadvantaged schools has helped considerably; also crucial was the positive impact it has had and very strong support from teachers.

A key enabler has been Stile's responsiveness and support for the school's implementation through in-person and virtual connection, and by addressing the school's customisation requests. For example, in response to the school finding some of Stile's content too challenging for special needs students, Stile now is working with the school's Special Education and Individual Curriculum Plan teachers to understand how they can improve the platform for differentiation within the school.

Cohuna Secondary College

VIC | Lower-SES outer regional secondary school | Maths Pathway

Cohuna Secondary College is a small school in a northern Victoria country town. Nearly half the students are in the bottom quarter of socio-education advantage and another third in the next lowest quarter. The school draws students from its regional town and adjacent communities, though students also choose to attend independent or Catholic schools in a nearby larger town. Class sizes are small, typically 15 students. The school holds high expectations for their students and founds its teaching and learning approach on student agency, effective teaching strategies and a student support system rooted in local community networks. With several staff departures and teacher supply pressures, Cohuna Secondary College adopted the Australian-designed Maths Pathway (MP) platform to assist the maths faculty with workload management and to ensure students would have access to maths education targeted to their needs.

Technology

Maths Pathway is an adaptive learning platform designed for students in Years 5-10. The platform includes a range of classroom resources such as lesson plans, instructional videos, assessments, and exercises. A key element of Maths Pathway is its adaptive student tutoring and instruction capabilities, including biweekly formative assessments to gauge each student's understanding and adjustment of content to match their learning levels. The system generates data on student performance that allows teachers to track progress against learning objectives, provide individual feedback, group students with similar learning needs, and address specific issues.

Use

Maths Pathway was initially introduced alongside maths textbooks. However, to avoid student confusion and streamline instruction, the faculty shifted to an 'all-in' strategy, making Maths Pathway the primary curriculum resource.

Students typically work independently with the platform during maths lessons. Teachers provide additional help, clarification or instruction. One teacher said this occurs fairly frequently, sometimes 'every five minutes or so', as students request content clarification or help with problem solving. In fact, the maths teachers at Cohuna Secondary College see this interaction between platform, student and teacher as crucial.

> Maths Pathway does have annotated examples and solutions, but at the same time the kids are going: 'What does this mean?' And then you have to break it apart for them. You have to know your maths. You have to know it inside out and if you don't, the kids will find you out soon enough …

Because the range of student capability is quite wide, teachers have used varying strategies to ensure student understanding and progress. The centrepiece is regular one-on-one tutoring sessions focusing on areas of individual difficulty with students at risk of falling behind. The Maths Pathway program supports this targeted instruction.

The school also values Maths Pathway's responsiveness to teacher requests for assistance with the platform, and support to tailor the platform to the school's needs. With Maths Pathway's support, the school has customised the tool to enable clearer communication with students and their parents through detailed, personalised reports based on Maths Pathway's student performance database and its curriculum grid mapping feature, which tracks progress across different year levels. These reports guide discussions during parent interviews.

Impact

The school reports that Maths Pathway facilitates differentiated teaching, saves teachers valuable time, reinforces the depth and importance of teacher subject knowledge and enhances student outcomes. They have observed an improvement in student results and in students showing greater preparedness for the VCE. By way of example, three Year 10 students were able to extend their learning using the platform and recently sat the Year 12 VCE maths exam with outstanding results: one performed in the top eight per cent of the State and another in the top 15 per cent. 'So they finish Year 9 and then next year they're top of the Year 12 class.'

At Cohuna Secondary College, Maths Pathway has helped teachers meet the needs of a wider range of students within their classes, including at both ends of the achievement spectrum. The previous practice of pitching lessons at the expected year level, plus or minus a year reportedly left many students outside the teaching range. Maths Pathway helps them to engage significantly more at point of learning need:

> I find that Maths Pathway has filled in a fair few more gaps for students because when I first started teaching, you might have only been hitting 30-40 per cent of the kids at best.

The school emphasises that technology platforms, including Maths Pathway, are no substitute for teachers. The tool can explain concepts and help with knowledge and skill acquisition, but students may miss a critical step or have forgotten an underpinning concept from earlier lessons. The expertise of teachers to guide, instruct and support students has been crucial, especially as student engagement with Maths Pathway lessons can be variable. The combination of student, platform and teacher can be quite powerful:

> Now the kids have their own little journey. They're hearing a different voice compared to mine … they've got mine and the computer as well now, to help them out.

Barriers/enablers

A cohesive 'all-in' approach from teachers has been crucial to implementation success. Parent support is also important. Parents initially were sceptical about their children using education technology and Maths Pathway. A key concern was the extent of digital device usage. By involving parents in the process and sharing more and detailed insights to their child's progress through the platform's capabilities, the school has gained parent support.

A key enabler has been Cohuna Secondary College's smaller class sizes which allow for greater student and teacher interaction. As maths often can be a challenging subject for students, and depends on cumulative knowledge, the capacity for teachers to fill in gaps has been important.

Since 2018, the school has had a 'bring your own device' (BYOD) approach that has allowed whole-class access to Maths Pathway during lessons. For families unable to purchase a BYOD device, the school has 120 laptops and 40 calculators which can be borrowed out each day.

Fairfield High School Intensive English Centre

NSW | Low-ICSEA secondary school | Generative AI

Fairfield High School serves a highly disadvantaged community in Western Sydney. The school hosts an Intensive English Centre (IEC) for students, over 95 per cent of whom are refugees requiring intensive assistance in English language acquisition to be able to access the curriculum. Many of the centre's students have attended school in their home nations for only two or three years and may not be literate in their first language. Many also arrive with a history of significant trauma, which can be an obstacle to school engagement and learning. In the IEC, students spend about half their time studying English, with science, mathematics and history as additional priorities. Students spend a maximum of five terms in the IEC before transitioning to the mainstream high school classes – 'it's a long time, but at the same time, it's not a long time to learn a new language.'

Given the very significant literacy and English language challenges, one IEC teacher with technological interests and skills has adopted a range of innovative approaches to teaching and learning. These include using several technology-based tools to provide highly interactive methods for improving English language mastery.

Technology

Adobe Express is a key tech tool adopted by this teacher, providing AI-enabled text-based functions to create new images, alter existing images (for example, using a text prompt to change style or appearance) and produce templates (such as presentations, videos, web pages, posters). Through the NSW Department of Education, a Premium K-12 version of Adobe Express is freely available to all NSW department staff and students, who can access the application through their student or staff portal on the department's platform. The premium version offers additional features and more generative AI tools.

Additionally, this teacher has used 3D printers and laser engravers, and explored the potential of alternative generative AI platforms like ChatGPT, to bring a more dynamic methodology to English language learning.

Use

The text-to-image function of Adobe Express, with its quick and easy interactivity, is used in computer classes to help students acquire and practice the often-complex English language in the context of the technological and applied studies syllabus. Students enter a prompt, and the image that is generated as a result provides rapid, engaging feedback – either resulting in what the student intended, or not. Through the process of amending and reiterating prompts, students can expand vocabulary, grammatical understanding and fluency, in pursuit of realising the image in their head:

> A lot of it for students was being able to immediately see 'Oh, I used the wrong colour. I used the wrong word. I used the wrong pronoun. What happens if I structure this differently? What happens if I write a paragraph or I take a paragraph from the story I wrote in English? What will that look like?' And seeing that, and saying, 'Oh, that's not what I had in mind. How can I change it?'

3D printers and laser engravers are used in similar ways, allowing students to build and practice language skills by providing text descriptions to produce or engrave a desired output.

Generative AI is used by the teacher in the classroom to provide quick translation into multiple languages at once, as is often necessary in the context of an IEC. This teacher has also considered whether generative AI might be useful in other ways, for example, potentially by enabling students to engage in simulated English language conversations:

> In English [it would be] literally the perfect tool. It's something that they could open on their phone. If I could get our students for 10 minutes every night talking to [a generative chatbot], giving it a prompt that says, 'Hey, I'm learning English, can you have a conversation with me and correct any mistakes I might make?' There's no judgement there. It could be over in 5-10 minutes, but it would be such a fantastic opportunity for them to practice language in a safe environment, to experiment with language in a safe environment.

Impact

Introducing these AI-enabled edtech tools has had a profound impact on student engagement, effort and commitment to the learning process. The capacity to connect their new language of English to the universal and language-agnostic power of an image has proven to be a powerful motivator with significant impact:

> Students [are] coming to the classes excited and prepared, students who have never done homework for me in their lives. Students who will have a detention every second day for not doing anything in class were coming to that class prepared, having written down things that they wanted to try out and pictures they wanted me to print.

In the view of this teacher, the engagement and intrinsic motivation to practice language exceeds anything previous:

> I'm really excited about it. I struggle to explain just how huge it was, compared to anything else I've done … I'm pretty on top of the tech that's out there. We've done coding, we've made games, we've done a lot of things, nothing has ever come close.

Increased engagement underpins increased learning. Even students who did not always engage very well were moving out of the comfort zone of their first language into using a lot of English, with increasing sophistication. They were 'able to construct not just sentences, but paragraphs, describing things.'

The increased motivation and learning confidence are closely connected to the interactivity of the tools and the safe environment they offer for experimentation. The immediacy of technology becomes a key motivator; the feedback is quick and direct. It is also, importantly, non-judgmental, and doesn't rely on the teacher to offer a correction: 'You can be as non-judgmental as you like. As a teacher, there will still be students who are embarrassed or scared to get something wrong.'

Generative AI has also supported differentiation within a very complex classroom. In an Intensive English Centre, students are grouped according to their level of English proficiency. While similar in this way, they may differ significantly in others. For example, a student who has never been to school will need to learn single-digit addition in maths, while another international student may be working at the Year 11 level. A generative chat bot can help straddle this range, particularly by providing explanations of higher-level mathematics in a student's first language. Requesting the explanation in English as well as other languages allows the teacher to check first that the explanation is accurate before spending targeted time with the students building foundational skills.

Barriers/enablers

One of the biggest challenges has been teacher confidence and skill in understanding AI tools and how they could be used effectively for teaching and learning. This is compounded by significant workload and time constraints, and the challenge of teacher shortages which make it difficult to find the time and resources to train teachers in using technology. Adopting these tools not only relies on professional learning but sufficient time and opportunity to experiment with them and share learnings with fellow educators.

For students, the biggest barrier has been the lack of access to devices at home. Very few households have personal computers, which limits learning time to the classroom, in contrast to other students who benefit from technology at both school and home. Access also is only part of the challenge; the majority of these students do not have family members who can assist them in becoming technologically literate. This makes access at school all the more important. The teacher explains that 'our students are missing out at home … but at school we've been able to do a lot.'

A critical enabler has been this teacher's intrinsic motivation to find innovative and creative ways to boost English language learning, reinforced by the positive student response. At root is a sense of social purpose. This teacher underscores for students how engaging with technology, and building AI literacy, will be critical for their future education and employment. Access to these opportunities shouldn't be dependent on advantage.

John Therry Catholic College

NSW | Median-SES secondary school | Stile

John Therry Catholic College is a large, median-ICSEA secondary school in southwestern Sydney with a diverse student population. About a fifth of the students have a language background other than English and nearly a tenth identify as Aboriginal or Torres Strait Islander. Within science, as across the school, students are working at varying literacy levels, with several classes working below year-level expectations while some students exceed these. The school's leadership changed in 2017, which led to significant changes in whole-school culture and expectations (both academic and behavioural) and prompted a comprehensive review of teaching practice. With these changes, the school also invested in a number of education technology applications to support teaching and learning and student achievement.

Technology

Teachers and students across the school are using or trialing several learning applications, including:

+ Stile – a science platform for Years 5-10, with comprehensive, integrated teaching resources and opportunities for interactive student use (see the Beenleigh High School snapshot for more detailed description)
+ Edrolo – a multi-curriculum platform primarily for senior secondary students (up to 21 NSW HSC subjects) that provides teaching resources, student learning and practice, and assessment and data insights
+ Atomi – a platform with wide curriculum and year level range (62 subjects in NSW across all year levels from 7 to 12), with teacher resources, student tutorial and revision, assessments and data feedback.

Use

John Therry Catholic College initially introduced Stile to address inconsistent delivery of curriculum across the science faculty and improve teaching and learning. The school's leader of science learning recalls that:

> The science faculty was sort of a bit fractured; it wasn't a well-oiled machine and the programs weren't very well written. Everybody was just off doing their own thing.

Now fully integrated into the science teaching program, Stile resources have become a key support for teacher-led instruction, for tracking student progress between assessment tasks and for signalling to students particular content areas for focus. The faculty also can use an anonymised student answer as a basis for whole-class discussion and the quick data feedback allows them to identify students who are struggling with particular concepts or skills. The suggested science experiments also can be very useful, especially when Stile has undertaken risk assessments and provides equipment guides and materials.

Customisation has been an important feature of implementation, enabling adaptation of lessons and assessments for different learning needs. There is a wide range of student ability in the school including, for many students, a significant gap in basic literacy as well as science literacy. The science teachers find they need to supplement Stile with literacy tools and instruction to address the gaps.

Edrolo is used as a revision tool across faculties to support senior secondary students preparing for Year 12 exams and Atomi is currently in trial status.

Impact

The school credits Stile with significantly helping reduce time-wasting activities and teacher workload through easy access to quality, customisable materials, suggestions, resources and data. Teachers have simultaneously been able to establish greater consistency across the faculty while also enabling greater differentiation across students with varying knowledge and skill levels. The whole-faculty access to a shared bank of tested resources and real time insight to student progress has been critical.

A key helpful element is the more detailed and immediate feedback that data-based tools provide. As the lead science teacher explains:

> You can look at the marks and you can see where kids need to catch up and who's falling behind. You might think, "oh, I thought that kid was coping" and then we can have a conversation within the faculty.

The data also informs discussions with the student, parent or school leadership and students like the immediate feedback provided by the platform's self-marking functionality.

The lift in teaching and learning quality also seems to have boosted student enrolment in science subjects and delivered a slow but steady improvement in achievement. The school now offers all NSW science curricula due to student demand. Even challenging subjects like chemistry have attracted enrolments and some courses, for example earth sciences, are now being offered after an eight-year hiatus.

Barriers/enablers

The broader whole-school culture change at John Therry Catholic College provided a crucial opportunity to review programming and teaching approaches. While the use of edtech tools has been a contributor to embedding quality teaching, all of the tools require teacher skill and agency in deciding how and when to use them, with which students and in what ways, and how to act upon the data feedback.

The sometimes-mixed student engagement with the tools highlights the teacher's central role:

> We're finding that if you just leave the kids to do it on their own, they get sick of it. We don't want this. This is boring. We can't do it. … But if you sit there and engage with them and show them that you're following along, you're interested in what they have to say, have a class discussion about each of the questions … then the kids don't have to feel like they're on their own and they do engage with it.

The faculty credits Stile's willingness to provide professional learning and to work with them to ensure the tool is fit for purpose for their school.

Marsden Road Public School

NSW | Low-SES primary school | DIBELS (also Literacy Pro and PR1ME Mathematics)

Marsden Road Public School is a large primary school in south-western Sydney. Marsden Road Public School is proud of its cultural diversity, with over 40 cultural backgrounds represented. Many students have been speaking English for less than three years (some have never heard or spoken English before), nearly one in five have been through a refugee or refugee-like experience, and some students are the first literate generation in their family, in any language. Over half of each Kindergarten cohort have additional learning needs. The school holds high expectations for all students and founds its educational provision on the explicit, systematic and sequential teaching of fundamental literacy and numeracy skills.

Technology

DIBELS (Dynamic Indicators of Basic Early Literacy Skills) is a set of procedures and measures for assessing the acquisition of literacy skills. It comprises short (one minute) fluency measures that can detect risk and monitor the development of early literacy and early reading skills from Kindergarten to Year 8. DIBELS assessments can be accessed and implemented offline, but the online DIBELS Data System streamlines this process and offers additional functionality for conducting assessments and analysing results, including tools to monitor individual student progress and identify groups of students with very similar learning needs.

DIBELS was developed in its current form by the University of Oregon, which continues to conduct research on the tool. DIBELS is based on another tool developed through the Institute for Research and Learning Disabilities at the University of Minnesota. In April 2023, DIBELS released materials adapted for Australasian users.

Marsden Road Public School also uses Literacy Pro and PR1ME Mathematics. Literacy Pro is a student-facing and teacher-facing resource that allows students to see their current reading level, identify books matched to their level and interests, and set targets for improvement. PR1ME Mathematics is a comprehensive primary mathematics program based on the teaching practices of Singapore, South Korea and Hong Kong, which combines an offline student textbook with an online professional learning resource for educators. The latter is a digital library of videos that demonstrate the teaching of mathematics concepts following the PR1ME Mathematics instructional approach.

Use

Marsden Road Public School prioritises the use of applications with substantial research backing, such as DIBELS. The school focuses on technology that supports and enhances teacher practice, rather than student-facing technology, with the Literacy Pro application being an exception.

> We use technology, and we use it quite widely, but we don’t use it as the medium of teaching, rather it is something that supports the teaching.

Marsden Road Public School uses DIBELS to assess students’ reading skills at the beginning, middle and end of the year. Following an initial trial with a small group of students, the school rolled it out across all years. While the school sometimes uses the suggested teaching interventions for groups of students based on their results, they often develop their own targeted approaches. It is the fine-grained assessment data that DIBELS produces that is the key to the school's use of the platform.

Literacy Pro is used by students at school and optionally at home. Students undertake short literacy assessments based on authentic texts to determine their lexile reading level, identify appropriate books of interest and track their progress.

> This is one area where students can definitely monitor and set their targets and actually see and assess themselves.

PR1ME Mathematics has been implemented across the school, to bring the same level of consistency to the teaching of mathematics as was already in place for reading. While the resource includes interactive whiteboard lessons, Marsden Road Public School uses these less frequently.

Impact

DIBELS has streamlined and improved the accuracy and consistency of formative assessment of literacy skills, specifically phonological awareness, phonics, fluency, and a part of comprehension. It has given Marsden Road teachers additional information about the knowledge and skills of early and struggling readers, allowing for more targeted teaching. The school now has two full years of data and reports improvements in phonics in Kindergarten-Year 1, as well as improvement in fluency across most years.

> This programme actually gives us much more detailed and accurate information of what a child can actually do when it comes to reading, so it gave us information on their fluency, their phonemic awareness, their phonics … it was a little bit more accurate than a human can be.

The online platform also saves teachers considerable time:

> The downside [of the paper-based version] is you need to do all the paper-based assessment and then put it all into spreadsheets which they provide for you. But the time is too much. We have 760 kids now. It's just far too much to expect, whereas the teachers can sit with the device. As the students do it, you just touch the screen for errors and that's all you need to do. It's a minute, each little assessment as well.

The speed of assessment makes it unobtrusive for the students, 'not like a running record where you sometimes sit there for 15-20 minutes reading, asking questions.'

The school credits their use of PR1ME Mathematics with creating consistency in the metalanguage and teaching of mathematics from Year 1 to Year 6. In addition, the school has observed substantial improvement in NAPLAN numeracy over the past two years, with an increase in the proportion of students meeting proficient standard from 3 to 29 per cent. The school's students have demonstrated learning growth and achievement above that of similar students across NAPLAN domains.

Barriers / enablers

Devices and connectivity are the first enablers. Students at Marsden Road Public School have access to a bank of 120 laptops in a hub; the teachers check class sets in and out. The school also has strong Internet access: 'If you don't have good Internet, … pretty much technology is useless.'

Access at school is important because students' access at home varies greatly. Only about half the students use Literacy Pro at home. The school describes this as an example of 'the Matthew effect' of compounding advantage, noting that those students not only have technological access, but also likely parents who understand and support the value of using the application, and a significant degree of self-motivation.

Teacher skill is key. Data from the assessment tools is powerful, but

> If we don't understand the science of learning, then you're not really going to be able to understand what this assessment is for and what information it's giving you. So I think the teaching has to be there first before you start using this tool.

Following assessment, it is the teacher who differentiates rather than the technology.

In the end, the technology itself is both an enabler and potential barrier to effective teaching and learning. According to the principal of Marsden Road Public School, there's an ever-present risk of over-dependence: 'If you use it wisely, it's a great tool, but if you don't know how to use it wisely, it's the worst thing that can happen in a classroom.'

Narrabeen Sports High School

NSW | Above-median SES secondary school | Education Perfect

Narrabeen Sports High School is a moderately advantaged comprehensive public high school, in the northern suburbs of Sydney. School enrolments have almost doubled over the last decade and the school now has nearly 1,000 students. Around one in five students have a language background other than English. While the school has experienced some recent teacher turnover, the science faculty is very stable.

In 2016, a Year 8 student turned up at Narrabeen Sports High School half-way through the year, due to a change in family circumstances. Mid-year transitions can always be disruptive, but in this case, the student had already studied the science topics about to be covered at Narrabeen (biology and chemistry) and had no knowledge of the subjects their Narrabeen peers had completed (physics and earth sciences).

The fact that one teacher was already delivering his course through Google classrooms made it viable for the new student to work independently alongside his classmates so that everyone finished the year having covered the syllabus, but the case of the mid-year enrolment prompted the science faculty to consider the benefits of a consistent approach to curriculum planning and delivery, for the faculty and more broadly.

Technology

The science faculty began the process of developing a comprehensive online curriculum using the generic platform of Google Docs and freely available Academy of Science (Science by Doing) resources:

> For the next two years, myself and another teacher basically spent every holiday going through their resources, converting them to Word, adding/removing what we wanted, adding questions, turning their PDFs into Google Docs.

While the Google Docs approach was effective for the development of a consistent lesson bank and content delivery, it was cumbersome for analysing data and providing quick feedback.

In 2022 the faculty implemented Education Perfect as the foundation for consistent and sustainable curriculum planning and delivery. Education Perfect is a learning, assessment and analytics platform. It offers lessons across many key subjects from K-12, aligned to the Australian Curriculum and state syllabi. Assessment functions include the ability to set pre- and post-tests and the automated provision of feedback. Analytic functions allow for the monitoring of student engagement with lessons and growth against specific learning outcomes. The platform can recommend further lessons to individuals or groups of students.

Use

The whole faculty uses Education Perfect for Years 7 to 10. When they switched to the new platform, they used the application straight out of the box for 6 months, simply selecting lessons. Over the last couple of years, however, the faculty has worked closely with Education Perfect to customise the platform for their needs. This has included shaping the lessons to suit the faculty's specific approach to learning design: explicit instruction of key ideas.

> We brought all the content to the front of the lesson and had explicit delivery. And then we had the first set of questions after it as recall and basic level questions. And then the last section was the application questions.

This lesson format means that students spend less time reading information within the application and allows more time for class discussion and questions, which the faculty has found suits their students well.

Narrabeen's implementation of Education Perfect also leaves scope for teachers to bring their individual teaching styles to the lessons. Some are natural storytellers, some prefer a demonstration, but all are clear on the baseline learning outcomes and success criteria for each lesson. Teaching style aside, it is common for teachers to now teach from the back, rather than the front, of the room. This gives visibility over student's screens and has enabled teachers to nip in the bud any temptation to engage in non-educational online activities. The technological set-up of the platform also helps with this.

Education Perfect's ability to recommend additional lessons to particular students is mainly used by Narrabeen's science faculty to support independent student revision and the modification of the teaching programs from year to year. Differentiation of content to meet student needs occurs within the teacher's classroom delivery and discussion:

> We could take the content and say 'OK, here's a key idea. And for this student I have to break it down into these parts. And this student I have to use this kind of analogy to connect them to it. And this kind of student, I need to take them and extend them. … A lot of the students, their extension is through conversation and questioning and developing a response to a high level, including different terminology. And when you look at the band descriptors in HSC, it's what they look for.

Narrabeen High School supplements the use of Education Perfect with an investigation/skills workbook to deliver the working scientifically outcomes in a directed and explicit manner. The faculty has also implemented handwritten summary notes for each lesson to increase variety.

Impact

Results for the NSW VALID science assessment in Years 8 and 10 have improved. The school achieves above the average for all schools and schools with similar demographics, exceeding its performance in literacy and numeracy (measured via NAPLAN). The positive results led to faculty members working for a period with the NSW Department of Education's VALID assessment team, 'because they were stoked with how we were going, and we wanted to work out how to do better.'

Use of a consistent curriculum platform has reduced within-faculty variation of content delivery, enhancing consistency in science-specific terminology and understanding. In addition, it has significantly reduced the time teachers need to spend revising at the start of each year or module of work to make sure that all students have the same foundational knowledge.

The value of feedback to student learning is well known and the functionality of the digital platform has allowed the school to move away from 'point assessment at the end of a topic' to a more continuous assessment model. Having regular, instant quantitative feedback on their understanding has helped boost student engagement. Parent confidence in the school's science faculty has strengthened, as they know what their children are studying in science and that they're being challenged.

Having planned lessons readily available has increased teachers' capacity to respond to individual student needs, including differentiation in the classroom:

> The beauty of doing this stuff, is it actually places true value in what the teacher brings which is the communication, the connection and all those things that you actually can't write on paper. ... The real differentiation does happen in a classroom. When you've got the time and the headspace to think about it, you get to actually know your students. You know, because you're not up to 10:00 o'clock or 9:00 or 11:00 o'clock at night making a worksheet.

The faculty has seen real benefits in professional conversation and collegiality. Everyone teaching the same lessons means that 'we all speak the same language of the resource' and standardised assessment results reflect faculty-wide strengths and areas for improvement, which the faculty can celebrate and address collaboratively: 'It's a faculty that wants to work together because we're all sharing the success, and we all share the challenges. ... It's a team sport.' Narrabeen's science faculty has become a faculty of choice in the local area for teachers, who variously appreciate feeling part of a team, having time to pursue leadership opportunities, and having time to continue sports training at semi-elite level.

Barriers / enablers

Teacher confidence and commitment are critical. To realise the benefits of consistency for students, curricular cohesion, and workload benefits, everyone needs to be on board. In the beginning, some people needed convincing:

> They said, 'oh, it works for new teachers. I don't need to do it.' Or 'it works for teachers who aren't so good. But I don't need to do it.'

Even once a platform is in place, teachers need to embrace it so that students will. Teacher confidence also needs to be maintained, and enhancements to a platform need to be approached with this in mind. Unless managed carefully, changes can throw people off.

Faculty-wide implementations require people to take a risk, which can be difficult because no one likes to fail. Narrabeen found it requires a champion to take responsibility for the outcome, to bring others along. Subscription models can add to this risk, as investments can be vulnerable to budget and personnel changes. When a product has been customised to a particular school context and circumstances change, initial work may need to be redone.

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