Submission to the Better and Fairer Education System Review

Leslie Loble AM
Industry Professor, University of Technology Sydney

Thank you for the opportunity to make a submission to the Review to Inform a Better and Fairer Education System. The principles of equity and excellence rightly provide the foundation and guiding values to the Mparntwe Education Declaration, as they have to previous national education declarations and as they continue to do for the present review.

Equity and excellence – a double and intensifying challenge

Educational excellence and equity are experiencing challenges in Australia and internationally. NAPLAN results show some improvement in primary years from 2008 to 2022, but stagnation or decline in secondary schooling, and international assessments reveal increasing proportions of low achievers. Students from priority cohorts remain, on average, less likely to achieve as highly as their peers on key performance measures, and the achievement gap increases as students get older.

The load carried by schools in supporting learning for their students is unevenly distributed. The recent results from the PIRLS international assessment of reading at Year 4 show that "65% of Australian Year 4 students were in classrooms in which reading instruction was limited some by students not being ready for learning due to hunger, tiredness, lack of prior learning or other related factors. 6% of students were in classrooms where instruction was limited a lot by these factors" (Hillman, O'Grady, Rodrigues, Schmid and Thomson 2023). The challenges presented by teacher supply issues – including lack of teacher continuity, out-of-field teaching, and challenges accessing professional learning because of cost and difficulty finding a relief teacher – are similarly inequitably spread across school communities.

Tackling this learning divide requires multiple, coordinate reforms and this Review will provide welcome advice and insight. The purpose of this submission is to draw attention to one increasingly important aspect of teaching and learning that can help lift outcomes when integrated within a suite of evidence-backed interventions: education technology, particularly adaptive learning applications. These tools are becoming powerful assets for enhancing student outcomes, teacher professional expertise and research insights, amongst other benefits, but they also need to be carefully managed.

Effective reforms to lift outcomes and equity must start first with quality teaching and learning and related school and system supports. Technology is no silver bullet and works best when aligned with good education practice. But the evidence is growing that, when designed well and used by teachers in effective ways, edtech tools can deliver significant positive learning impact. Importantly, however, they also are poised to become the next frontier of the digital – and learning – divide as better-off schools, teachers and students are able to access and master these learning applications, thus enhancing an already-significant education advantage. The rapid scaling and impact of generative AI systems further highlights this equity dynamic.

The benefits and risks of AI-enabled edtech are significant, as we find in other domains like health. These tools can help amplify and support schooling reforms but also deserve specific attention to ensure they align with Australian priorities, rest on evidence and demonstrated outcomes, support teacher-led instruction and agency, are safe, well-governed and equitably available and used. Some practical and achievable steps toward these goals could become part of the Better and Fairer Education System Review and reform agenda (outlined below).

[While this submission highlights some of the opportunities and issues currently facing Australian schooling when it comes to edtech, outcomes and equity, my report Shaping AI and edtech to tackle Australia's learning divide, provides further evidence and detail.]

Education technology is a powerful lever for improvement, but also a potential educational divide

Edtech has the potential to support both improved student learning and teacher experience, providing that it is high quality, designed with reference to the evidence base on how students learn, and in service of, not seeking to replace, the teacher as the learning professional with a holistic understanding of the young people in their class. At the same time, there is a real risk that technology will exacerbate divisions between more and less advantaged students and schools. World-wide, COVID was a powerful indicator of this (CIRES & Mitchell Institute 2020, Sonneman & Goss 2020). During the pandemic, disadvantaged students were 40 times more likely to lack a computer than their better-off peers (Shergold, Broadbent, Marshall & Varghese 2022). This meant that some systems and schools disproportionately confronted the challenge of providing even entry-level hardware and internet access so that students could maintain basic connection to learning. Other schools relatively seamlessly transitioned their full face-to-face provision online.

Access to physical infrastructure for edtech (now critically including fast and reliable wifi) is only the first step. Schools used to be approached frequently by textbook company reps; now these have been replaced by providers of online curriculum applications, which often come with associated assessment and data analytic tools. It can be difficult for schools to evaluate the educational basis and benefits of these tools, and they can have steep price tags.

Within the rapidly developing field of generative AI tools (both multi-purpose and education-specific), you get more powerful education support if you're in a position to pay. For example, you can sign up to ChatGPT for free, but a ChatGPT Plus subscription costs US $240 per year, or nearly a quarter of a million dollars annually in a thousand-student school – roughly equivalent to three new teachers just for one app. Benefits of the paid version include: guaranteed access during peak time; faster response times; and greater content (you can enter longer and more specific prompts, and get longer answers). Significantly, only the paid subscription gives you access to specialist software packages that make ChatGPT work better. Some 750 'plug ins' already are available, including many specialist education support tools like EducationCo-Pilot (school lesson plans and materials), MetaMentor (help in structuring personalised learning goals), or GigaTutor (tutoring and support), just to name a few ChatGPT education plug-ins. [Note: the examples here and elsewhere are illustrative, not endorsements. ChatGPT access for students remains blocked for some public school

systems, though this may change as the education sector adjusts to this latest technological disruption.]

While resourcing is one determinant of who gets what value from edtech, AI literacy is another. Understanding how AI works and the limitations this imposes on its output – e.g. the potential for 'hallucination' and bias – is only the beginning. Knowing how to use AI, safely and to good effect is crucial, and students, teachers and parents need systematic advice on what works best.

Adaptive education technologies, including those using generative AI, offer potentially greater personalisation and learning support, but these applications also may worsen our educational divide if they and the capability to use them well are not equitably distributed across Australian schools.

Harnessing edtech to support learning success, especially for disadvantaged and students with special needs should be integrated with the next round of national reform

The intent of the next national reform agreement is to establish the conditions for educational success in Australia, which means improved student outcomes overall, as well as a reduction in the impact of students' personal circumstances on their access to, experience of, and achievement in learning. The digital environment is integral to contemporary teaching and learning and needs to be considered as part of this four-year reform program. The next national reform agreement presents an opportunity to bend the curve of digitally enabled education towards lifting outcomes and equity, taking advantage of edtech's potential to amplify existing investments by government, and ensuring we do not see another version of educational 'haves' and 'have-nots'. This will require care, a deliberate rather than ad-hoc approach at both state and Commonwealth levels, appropriate governance, incentives, and well targeted investment.

Australia currently lags other countries in key factors that affect the quality of educational technology offerings:

- Developing edtech strategically and linking it to learning goals
- Evaluating its effectiveness
- Understanding what factors really matter for teachers when using it
- Directing it towards high-priority students and students experiencing disadvantage
- Making sure it is accessible to all, safe and ethical.

Singapore stands out amongst countries in elevating education (personalised learning) to one of five 'high value' project areas in its *Smart Nation: National AI Strategy*. Long an international leader in educational achievement, Singapore sees advanced education technology as key to its shift towards developing increased student agency, higher-order skills (like critical thinking), collaborative learning, and responsiveness to student interests.

The UK Government's EdTech Strategy of 2019 has familiar aims of improving student outcomes, addressing the achievement gap, and alleviating pressures on teacher time. It is

notable, however, in its highlighted focus on developing better technology for students with disability and other special needs.

The U.S. has a dedicated, high-level office focussed on education technology, providing advice for schools and teachers, supporting research and policy development and stimulating mechanisms to improve edtech market transparency. But perhaps one of the most influential steps was when the national education funding legislation – Every Student Succeeds Act (ESSA) – incorporated clear standards for evidence and proven impact to underpin all education interventions, including technology-based.

Student-, teacher- and system-oriented technology can all support improved educational equity

It is important to anchor education technology in evidence-based teaching and learning. Three types of edtech are particularly effective in lifting outcomes and improving educational equity.

(1) Student-oriented applications

Evidence shows that student-oriented applications, such as adaptive and personalised learning tools and intelligent tutoring systems, can create learning paths for students that adapt as they progress and encourage them to reflect on their learning.

Tutoring (small-group and especially 1:1) is known to be effective in remediating learning for students that need additional help. While teachers strive to provide appropriately differentiated learning for all students in their class, this is increasingly challenging in the context of growing diversity and complexity of student needs and curriculum requirements. We know that students experiencing disadvantage are more likely to experience slower learning growth and lower levels of achievement. 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.

The best of these tools incorporate known effective learning design such as cognitive load theory and direct instruction. While the evidence-base for edtech is still developing, some of the strongest studies, with statistically significant results, point to the efficacy of student-oriented applications, especially intelligent tutoring systems. For example:

- A recent synthesis by Escueta et al. (2020) finds adaptive learning systems offer ‘enormous promise,’ with two-thirds of the high-quality research studies they examined demonstrating substantial and statistically significant effects.
- A frequently cited meta-review by Kulik & 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.
- Hattie (2017) attributes an overall effect size of 0.48 to ITS, and 0.57 for technology supporting students with disability, in a ranking of meta-analyses across 252 teaching and learning approaches. These two types of advanced edtech sit above the defined

average effect size or ‘hinge point’, where interventions deliver greater positive impact. (By contrast, the Hattie effect size for whole language reading instruction is 0.06; and 0.05 for teacher performance pay.)

- 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% of the ‘strong’ programs, with evidence of higher impact for students experiencing disadvantage.

Equity watch-points

Intelligent tutoring systems should not replace teacher professional judgement and holistic attention to the needs of individual students, nor a whole-school plan for the consistent delivery of quality teaching. The use of intelligent tutoring systems may not always be appropriate for the students in greatest learning need, but targeted well could help free up extra teacher-time for those students and could be a potentially useful supplement to small group tutoring.

Effective integration with teacher classroom practice is key to success. This is likely to be harder to achieve in schools serving disadvantaged communities. Disadvantaged schools tend to have the highest rates of beginning teachers, out-of-field teachers, and teacher turnover (Hunter, Haywood and Parkinson 2022). In the 2018 PISA principal survey, principals of disadvantaged schools were much more likely to report their capacity to provide instruction being hindered by lack of teaching staff (34% compared with 3% in advantaged schools), inadequate or poorly qualified teaching staff (21% v 0.3%), teacher absenteeism (28% v 5%), and teachers not being well prepared (18% v 5%) (Thomson 2021). A whole-school approach to embedding quality student-oriented applications as part of the suite of instructional resources will be an important support for effective implementation.

(2) Teacher-oriented applications

Teacher-oriented applications, such as teaching support platforms and curriculum tools, can provide significant time-savings and deliver ‘proven in practice’ resources to teachers for lesson planning; diagnostic tools can support early detection and remediation of additional needs; and adaptive assessment systems respond to individual student learning.

The curriculum is the foundation for the purposeful and well sequenced learning that leads to content mastery and student achievement. When schools (and school systems) don’t have a high-quality, content-rich curriculum then inequality increases (Jensen 2023). The Australian curriculum (and the state-based syllabuses that elaborate it) provide the overarching structure for this, and most states provide a range of curriculum support materials. Nonetheless, teachers spend considerable time making the detailed plans and identifying the high-quality resources that bring this learning journey to life. Some schools approach this systematically, heavily scaffolding teachers new to the profession or the subject, but many time-poor teachers must do this alone. Unfortunately, “the research is clear that when teachers pick and choose from large and varied banks of resources the critical connections and sequencing of content are often lost” (Jensen 2023).

A recent Grattan Institute survey of 5,442 Australian teachers and school leaders found that more than 90% of teachers do not have enough time to prepare effectively for classroom

teaching, and 86% ‘always or frequently’ do not get enough time to do high-quality lesson planning (Hunter, Sonneman & Joiner 2022). In another study Grattan Institute found Australian teachers use ‘difficult to quality assure’ social media sites at least once every two weeks to find resources, including 64% turning to YouTube, 49% to Teachers Pay Teachers, 19% to Pinterest and 12% to Instagram (Hunter, Haywood & Parkinson 2022). The rapid rise of generative AI tools (including general chatbots as well as education-specific applications) will only increase this reliance on untested sources.

Once again, the situation is compounded in schools serving disadvantaged communities. In addition to the disproportionate rates of ‘teacher churn’, less experienced and out-of-field teachers, survey data has indicated that teachers in disadvantaged schools are less likely to have access to a whole-school curriculum plan (Hunter, Haywood & Parkinson 2022). At the same time, Australian analysis has shown that around 20% of students in low-SES schools are hindered by the lack of high-quality textbooks and instructional material, compared with only 1% of students in high-SES schools (Cobbold 2020). Similarly, a US-based RAND study found that teachers in disadvantaged schools reported searching for material online at higher rates than teachers overall (Opfer, Kaufman & Thompson 2016).

Two additional aspects of teacher-oriented applications are especially relevant for students experiencing learning disadvantage – adaptive assessment and diagnostic tools. Assessment and the related practice of feedback are core components of quality teaching practice. Prominent education researcher and educator Lyn Sharratt has claimed that “nothing else matters in teaching and learning as much as quality assessment, that is, data that inform and differentiate instruction for each learner in a never-ending cycle of inquiry to discover what works best” (Sharratt 2019, in CESE 2020). Similarly, feedback, provided regularly and well (with specificity, focused on tasks, learning processes and student self-regulation) significantly improves student achievement. One meta-analysis found that the average effective size of feedback was comparable to students’ prior cognitive achievement, enhancing students’ feelings of self-efficacy, motivation and engagement (CESE 2020).

Technology-enabled tools make regular assessment and the interpretation of assessment data much easier (e.g. 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. Technologically based platforms make adaptive assessment possible. Adaptive assessment tools direct a student’s progress through an assessment based on their answers to each question – students correctly answering questions will be directed to harder test items; struggling students will be directed to sequences of easier test items. Adaptive tests more accurately measure student learning, particularly at each end of the achievement spectrum. Given that students experiencing disadvantage disproportionately achieve at the lower ends of the scale, this is of particular support to those groups. Adaptive assessments have also been shown to positively impact student motivation in assessments, again enhancing the accuracy of the results and the impact on learners.

AI-enabled tools can also assist in the identification of particular learning issues such as dyslexia or dysgraphia. Using brief, accessible assessments, digital learning tools can help identify specific writing or reading dynamics that can hinder students’ learning progress.

Early identification of learning difficulties is important to effective remediation, and these tools can help families overcome accessibility issues of cost, geolocation, and specialist availability. AI-enabled edtech also open up greater accessibility to curriculum outcomes through more adaptive versions of, for example, text to voice (and vice versa); screen readers; translation of images to text; assistance in scaffolding work and setting routines; and study guidance and revision aids. Teachers also can use technology like generative AI to evaluate their learning materials to ensure they are accessible and inclusive.

Equity watch-points

The positive impact of educational technology on student outcomes has always been heavily dependent on teacher confidence and skill in implementation. Today's advanced tech is no exception. Yet less than 40% of Australian teachers describe themselves as well or very well prepared to use ICT in teaching and learning (Thomson and Hillman 2019). While the evidence for what best practice implementation of advanced learning tools looks like is comparatively thin (and needs to become an Australian research priority), a slowly growing body of research identifies the following key components:

- Intentional integration into teacher planning and programming
- Teacher professional development
- Keeping the use of edtech in proportion.

Professional development, in particular, can be harder for teachers working in more complex environments. An analysis of professional learning in rural, regional and remote areas by AITSL revealed that the majority of surveyed teachers in these areas found it difficult to access external professional learning opportunities, due to cost, distance and, significantly, access to casual/relief teachers. If a casual/relief teacher is not available, it places a burden on other teachers within the school to cover classes, take extra students, in their classes, or combine classes, ultimately making it impractical for the teacher to attend professional learning (AITSL 2019). While these findings relate specifically to teachers in non-metropolitan areas, the challenges can be extrapolated to other hard-to-staff schools that similarly struggle to provision teacher relief.

(3) System-oriented applications

System-oriented applications, such as diagnostic systems informed by machine learning, can support early intervention by identifying and directing support to students at risk of disengagement or compromised progress. Similarly, applications that generate insights and analyse trends can improve problem diagnosis, program and policy design.

Machine learning techniques have opened up new worlds of insights across many domains, including health. Increased computing power enables the analysis of vast amounts of data across numerous data sets, quickly and with precision, enabling more timely and nuanced diagnostics and intervention. While education has been slower to adopt these approaches, there is emerging evidence that 'early warning systems' developed for educational purposes can achieve accuracy in excess of 80-90% (OECD 2021). At a system level, the Chicago 'on-track' database has been important in helping identify risk patterns, target interventions

and risk graduation rates from 52.4% in 1998 to 94% by 2019 (Allensworth et al 2016, Issa 2019).

Equity watch-points

Data sets are historic and record the impacts of enduring systemic inequity. The risks of this have been highlighted in fields from recruitment to judicial sentencing. To take one example from health, an algorithm used on more than 200 million people in US hospitals to predict which patients should receive additional medical care was found to favour white patients over Black patients twice as often as should be the case. This happened because the algorithm used health costs as a proxy for heath needs, thereby incorporating real-world bias (Solomon and Davis 2023). In education, 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). To avoid unintended consequences such as these, Australian education must ensure that AI-based edtech has strong privacy, data and ethical protections and requirements for 'explainable' systems. In addition, to ensure that systemic diagnostic and early warning systems benefit the students who most need help, systems and schools must connect insights firmly to action. 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.

Establishing the conditions for positive impact, and edtech for good

Edtech has significant potential to improve student outcomes, help reduce educational disadvantage, amplify teacher expertise, and lessen workload. In addition, it can help systems better understand problems and develop targeted interventions.

Recommendations to realise the opportunities, while managing the risks

When we consider when and how to use educational technology, the fundamentals of good teaching and learning must come first, and edtech second. We need to share and use this technology to align with what works best in learning. Standards, oversight and investments will help ensure it serves to lift education outcomes, especially for those at risk, and to support effective teaching and learning, not weaken or undermine it. The Education Ministers' commitment to an AI framework is a welcome and important first step. Some additional recommendations follow.

Recommendations

<u>Quality design and impact</u>

- Include standards for evidence to underpin education interventions, including edtech, in the National School Reform Agreement, along the lines of the U.S. Every Student Succeeds Act (ESSA) federal funding guidelines
- Accelerate high quality, independent research and evaluation of AI tools to investigate impact on learning progress for students and to identify features that amplify positive outcomes, including implementation factors

- Catalyse a world-leading Australian social benefit edtech sector by investing in promising systems that meet high standards for evidence, efficacy, ethics and equity. Novel forms of capital could be considered, such as impact investing, social enterprises, leveraging or partnering with venture capital funds and industry, as well as direct public funding. Particular attention should be paid to fostering the development of applications for priority cohorts

Best practice use

- Work with teachers and schools to test, develop and showcase best practice integration of teaching and learning technology tools, including for students experiencing disadvantage and students with special learning needs
- Provide extra resources to schools serving disadvantaged communities to access high quality edtech learning tools, with linked implementation support and professional development, alongside investment for equitable access to essential technological infrastructure and digital skills
- Commission the Australian Education Research Organisation (AERO), working with ACARA, AITSL and ESA, to provide expertise and advice on what works best when using edtech to support teachers and improve student outcomes
- Build cross-government agency and public-private partnerships to safely share de-identified data for better traction on solving education challenges using modern data techniques

Governance

- Create an accessible repository of trustworthy information on the quality and safety of available edtech tools so that schools, education systems and parents can make more informed choices
- Develop education-specific standards, incorporated into procurement and (potentially new) public oversight systems, covering product design, data use, and life cycle governance and accountability. These standards should reflect: education evidence and learning science; privacy and other requirements to protect students and educators; transparent, explainable information about how the tool works, what data are collected and how data are used; and obligations to evaluate effectiveness and demonstrate impact on outcomes
- Establish an expert advisory body reflecting education, industry, social benefit, legal and other expertise to provide early insights and strategic solutions to help anticipate, develop and deliver safe, effective AI-based edtech

Australian students deserve the highest quality edtech, proven to deliver learning progress, aligned to curriculum, ethical and legal standards, and that meets or exceeds expectations for both learning outcomes and equity. Australia can become a global leader in shaping that direction for AI in education and the next quadrennial funding agreement provides an excellent springboard for delivering on this ambition.

References

Allensworth, E, Healey, K, Gwynne, J & Crespin, R (2016), *High school graduation rates through two decades of district change: The influence of policies, data records, and demographic shifts*, University of Chicago Consortium on School Research, Chicago, accessed 24 August 2022, from <https://consortium.uchicage.edu/publications/high-school-graduation-rates-through-two-decades-district-change-influence-policies>.

Australian Institute for Teaching and School Leadership (2021), *Teaching Futures: Background Paper*, ESA. https://www.aitsl.edu.au/docs/default-source/research-evidence/ait1793_teaching-futures_fa(web-interactive).pdf?sfvrsn=d6f5d93c_4. Accessed 27 July 2023.

Australian Institute for Teaching and School Leadership (2019), *Spotlight: Professional Learning for Rural, Regional and Remote Teachers*, accessed 27 July 2023, from https://www.aitsl.edu.au/docs/default-source/research-evidence/spotlight/professional-learning-for-rural-regional-and-remote-teachers.pdf

BBC News (2020), 'A-levels and GCSEs: How did the exam algorithm work?' accessed 27 July 2023, from A-levels and GCSEs: How did the exam algorithm work? - BBC News

Centre for Education Statistics and Evaluation (2020), *What Works Best: 2020 update*, NSW Department of Education, accessed 27 July 2023, from <https://education.nsw.gov.au/about-us/education-data-and-research/cese/publications/research-reports/what-works-best-2020-update>.

CIRES & Mitchell Institute (2020), *Impact of learning from home on educational outcomes for disadvantaged children*, Victoria University, accessed 24 August 2022, from <http://www.vu.ediu.au/sites/default.files/impact-of-learning-from-home-federal-government-brief-mitchell-institute.pdf>.

Cobbold, T (2020), *Low SES Schools Have Far Less Resorces than High SES Schools*, Save our Schools, accessed 24 August 2022, from <https://saveourschools.com.au/equity-in-education/low-ses-schools-have-far-less-resources-than-high-ses-schools/>.

Cohen, J (1998), *Statistical power analysis for the behavioural sciences*, 2nd edn, Erlbaum, Hillsdale, N.J.

Escueta, M, Nickow, A, Oreopoulos, P & Quan V (2020), 'Upgrading Education with Technology: Insights from Experimental Research,' *Journal of Economic Literature*, vol. 58, no. 4, pp. 897-996.

Hattie, J (2017), 'Hattie Ranking: 252 Influences and Effect Sizes Related to Student Achievement,' *VISIBLE LEARNING*, accessed 5 April 2022, from <https://visible-learning.org/hattie-ranking-influences-effect-sizes-learning-achievement/>.

Hillman, K, O'Grady, E, Rodrigues, S, Schmid, M & Thomson, S (2023), *Progress in International Reading Literacy Study: Australia's results from PIRLS 2021,* Australian

Council for Educational Research, accessed 27 July 2023, from https://doi.org/10.37517/978-1-74286-693-2.

Hunter, J, Haywood, A & Parkinson, N (2022), *Ending the lesson lottery: How to improve curriculum planning in schools*, Grattan Institute, Melbourne, accessed 20 October 2022, from <http://grattan.edu.au/wp-content/uploads/2022/10/Ending-the-lesson-lottery-Grattan-Report.pdf>.

Hunter, J, Sonneman, J & Joiner, R (2022), *Making time for great teaching: How better government policy can help*, Grattan Institute, Melbourne, accessed 5 April 2022, from <https:grattan.edu.au./repot/making-time-for-great-teaching-how-better-government-policy-can-help/>.

Issa, N (2019), 'Chicage high school dropout rate hits all-time low,' *Chicago Sun Times*, accessed 24 August 2022, from <https://chicago.suntimes.com/2019/8./22/20828653/cps-chicago-public-schools-dropout-rate>.

Jenson, B (2023), 'Curriculum research shows that when schools don't have a high-quality, content-rich curriculum, inequality increases in exactly the way that it has in Australia,' *The Australian*, 29 July 2023.

Kulik, J & Fletcher, J (2016), 'Effectiveness of Intelligent Tutoring Systems,' *Review of Educational Research*, vol. 86, no. 1, pp. 42-78.

OECD (2021), *OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots*, OECD Publishing.

Opfer, D, Kaufman, J & Thomson, L (2016), *Implementation of K-12 State Standards for Mathematics and English Language Arts and Literacy: Findings from the American Teacher Panel*, RAND Corporation, Santa Monica.

Sharratt, L (2019), *Clarity – What matters most in learning, teaching and leading*, Corwin, Thousand Oaks.

Shergold, P, Broadbent J, Marshall, I & Varghese, P (2022), *Fault Lines: An independent review into Australia's response to COVID-19,* accessed 7 November 2022, from <https://independentcovidreview.com/wp-content/uploads/2022/10/FAULT-LINES-1.pdf>.

Solomon, L & Davis, N (2023), *The State of AI Governance in Australia*, Human Technology Institute, The University of Technology Sydney.

Sonneman, J & Goss, P (2020), *COVID catch-up: helping disadvantaged students close the equity gap*, Grattan Institute, accessed 30 July 2023 from <https://grattan.edu.au/wp-content/uploads/2020/06/COVID-Catch-up-Grattan-School-Education-Report.pdf>.

Thomson, S (2021), *Australia: PISA Australia—Excellence and Equity?* Springer, accessed 26 July 2023 from <https://doi.org/10.1007/978-3-030-59031-4>.

Thomson, S & Hillman, K (2019), *The Teaching and Learning International Survey 2018. Australian Report Volume 1: Teachers and School Leaders as Lifelong Learners*, Australian Council for Education Research, accessed 27 July 2023 from <https://research.acer.edu.au/cgi/viewcontent.cgi?article=1006&context=talis>.