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The science of learning – working memory training



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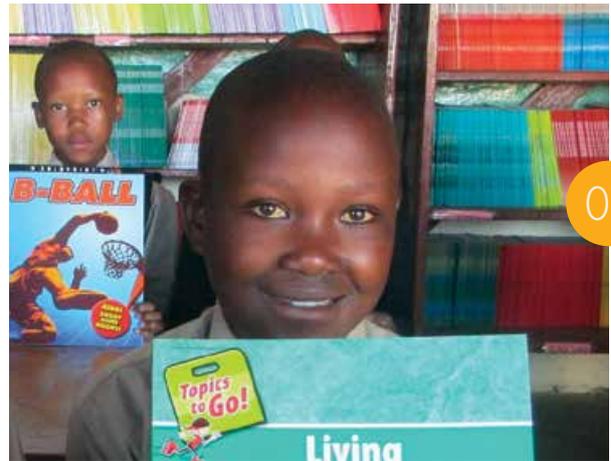
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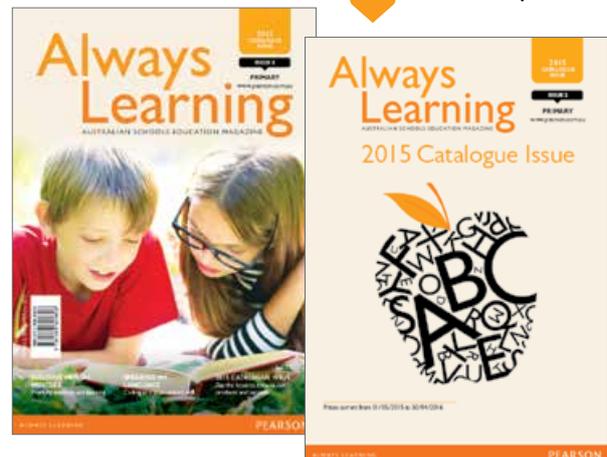
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Working memory and its relationship to learning

Managing and improving working memory

Author: Mimma Mason

Do you have students who fail to make academic progress, despite working hard?

Their behaviour is inattentive, restless, distracted, disorganised. While it appears as though they are deliberately not listening or not trying hard enough, it may be that they are unable to hold onto the information available to them in the classroom. Around 15% of school-age children have working memory difficulties that may explain this behaviour.

WHAT IS WORKING MEMORY AND WHY IS IT IMPORTANT?

Humans have the quite special ability to represent ideas in mind. It is what allows us to think, plan and manage complexity. Our working memory is that capacity to hold and manipulate visual and verbal information, keeping it active in our minds for long enough to use it in our thinking and complete a task. Most of us can hold onto around four bits of information. But it is a limited capacity - we lose information when we are overloaded with too much data and too many distractions. For a few students in every class however, working memory capacity is so low that they frequently miss instructions or omit a key step. Over time, these missed learning opportunities amount to slow educational progress.

Academic learning requires a number of parallel psychological processes. Working memory is one that is especially critical to acquiring basic reading skills, reading and listening comprehension, mathematics calculations and problem solving, written language and oral expression.¹ The acquisition of literacy and numeracy is a gradual process of building both skills and knowledge. Poor working memory disrupts the rate of skill acquisition.

Students with poor working memory make characteristic errors in their classroom work, fail to keep track of their place in demanding and complex activities and make mistakes, particularly in writing and counting. More than 80% of children with poor working memory fail to achieve expected levels of attainment in either reading or maths, typically both.² Numerous studies show that working memory capacity is a useful predictor of academic performance, explaining more of the differences in academic performance than IQ does.³ Even really bright kids can have relatively poor working memory that slows their progress.

The goal for educators is to build both knowledge and learning skills. Students need to know their letters and numbers, but they also need the thinking skills to make best use of that knowledge.



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“STUDENTS NEED TO KNOW THEIR LETTERS AND NUMBERS, BUT THEY ALSO NEED THE THINKING SKILLS TO MAKE BEST USE OF THAT KNOWLEDGE.”

WHAT CAN WE DO TO MANAGE WORKING MEMORY?

There is a lot we can do in the environment of the classroom to minimise the chance that a student will miss a learning opportunity because of working memory failure. We can structure activities to lighten the working memory load: simplifying instructions, building in lots of repetition, minimising noise and other distractions, coordinating rich visual and verbal cues to reinforce new information. We can also teach children strategies to cope with poor working memory, using memory aids and mnemonics, building routines and sticking closely to what is familiar. The more information they have already mastered, the less they have to hold in mind. When asked what we can do to manage working memory constraints, leading academics Joni Holmes, Susan Gathercole & Darren Dunning (2010) add a third option beyond managing the environment and teaching strategies - intensive training on working memory tasks to strengthen working memory capacity.

CAN WORKING MEMORY BE IMPROVED?

Cognitive neuroscience research in the last decade has shed new light on the plasticity of working memory and executive functions. Until relatively recently, working memory was considered a fixed capacity and the teacher's job was to help students cope. There is a strong body of evidence today that suggests working memory can be significantly improved with specific and intensive training, and that those gains do have a sustained effect on learning skills.⁴ These are skills we can deliver in the learning environment.

In a 2013 study of children in the UK, students who completed Cogmed Working Memory Training not only improved their performance on working memory tasks, they made significantly greater progress across the academic year in English (speaking,

listening, reading and writing skills) and maths than matched untrained pupils as measured by their scores on National Curriculum assessments. The data suggest that Working Memory training has the potential to transfer to educationally relevant measures of academic ability.

The mechanism for change is the same as for all successful physical and cognitive strength-building programs, involving repeated practice of specific tasks at increasingly challenging levels. Unlike the myriad of brain games you can find on the Internet, good cognitive training is distinguished by the close management of challenge and reward for each student, the focus on tasks that are specific to the skills we want to improve, lots of practice and lots of support. Just like going to the gym, successful training is hard work and a highly structured program with the close personal support of a coach makes a difference. When a training program is personalised, monitored and intrinsically rewarding, a student is more likely to complete the training at the dose and intensity that makes a difference.

Read more about how Cogmed Working Memory Training can support your students with the extended version of this article, available at blogs.pearson.com.au/schools/newsroom. You can also find out more and enquire about Cogmed Working Memory Training at www.cogmed.com.au/schools.

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Coding: the language of the 21st century

Author: Rachel Davis

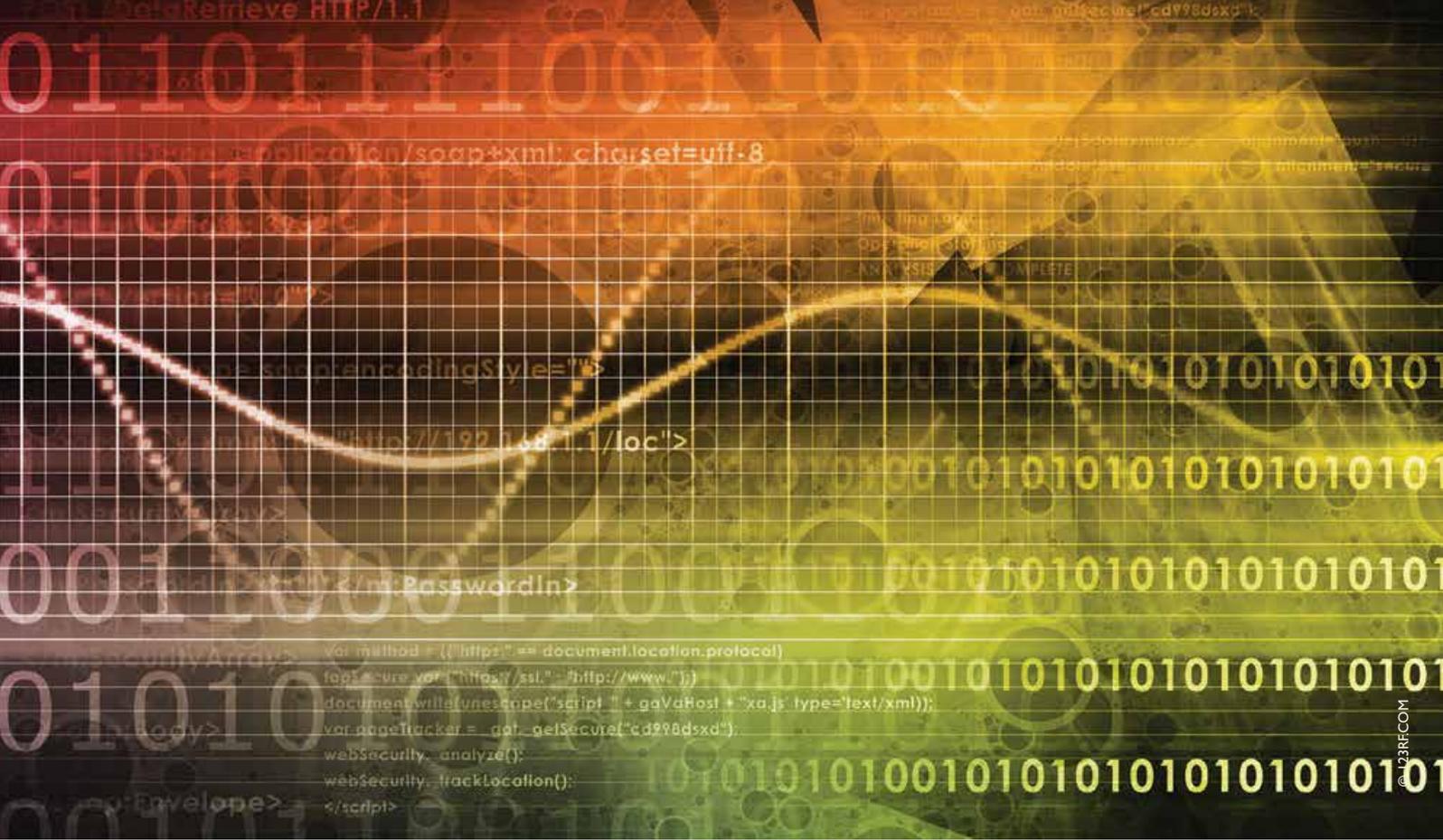
As Australia shifts towards an information-based knowledge economy, more than ever before, education must be more than just the “3 Rs”. Educators need to equip learners with all the crucial skills to survive and thrive in the 21st century: collaborative problem solving, critical thinking, creativity, communication, flexibility and a thorough understanding of information technology. But what do these 21st-century complex skills actually look like in a classroom context? What skills, resources and programs do learners need to effectively develop these skills? And what skills do educators themselves need to be able to facilitate student learning?

To many people, including policy-makers in the US and Britain, a key component of 21st-century learning starts with “coding” and “computational thinking” – the skills once limited to computer programmers, but now increasingly important for many aspects of 21st-century work. Until recently, most computer programming skills were only self-taught or acquired through tertiary study, but coding is now officially an integral part of primary and secondary curriculum in the UK, as well as in parts of the US.

Although coding is taught in some Australian schools and is a key component of ACARA’s Digital Technologies,¹ there is still nowhere near the political or institutional support for coding in Australia as there is in the US, Britain and elsewhere. However, the Australian Computer Society and StartupAus are among 10 industry groups currently petitioning the government for compulsory coding skills to be taught from a young age across all Australian schools.²

This call to teach coding and other computational thinking skills is echoed by many Australian industry and business organisations frustrated with skills shortages. Sami Malia, CEO of payday lender Nimble, has had to recruit from Asia, Eastern Europe and the US because “data scientists...are in desperately short supply in Australia”.³ According to Sally-Ann Williams, Google Australia’s Engineering Community and Outreach Manager, Australia has “seen a 41 per cent drop in the number of IT graduates since 2001”.⁴ More and more, it seems clear that we need to integrate coding more deeply and earlier into the curriculum, to give learners the best possible skills to thrive in the 21st century and Australia its best chance to transform from a resources economy to a knowledge economy.

What can we learn from the experiences of other countries about how to integrate this 21st-century learning into real classrooms? It is tempting to treat coding as an “extra” topic, to be included as part of ICT classes or as an elective. However, in places such as the US, educators now see coding as a fundamental skill – something not to be taught in a stand-alone way, but rather to be integrated within other subjects and used as a broad tool for exploration and further learning.⁵

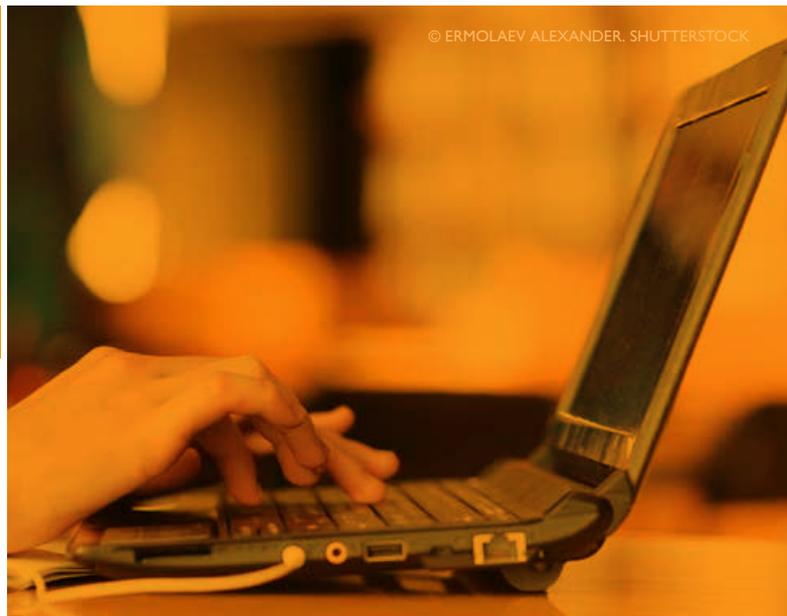


“TO UNDERSTAND THE FUNDAMENTALS OF HOW YOU WRITE CODE...IS AS IMPORTANT AS UNDERSTANDING THE FUNDAMENTALS OF MATHS OR BEING ABLE TO READ AND WRITE.” John Fallon, Pearson CEO

Even if many teachers do not yet have the skills or experience to allow a full cross-disciplinary exploration and use of coding, recent examples show that coding can still be successfully taught alongside and within other subjects. For example, in 2013, Beaver Country Day Schools in Massachusetts integrated coding into their core curriculum via mathematics classes, using a 1:1 laptop environment.⁶ The level of understanding and skills that developed eventually saw students able to build and program their own robot – an impressive feat, by anyone’s standards!

The progress needed to go from basic coding to building a robot might seem overwhelming at first. But coding, like any other skill, begins with small steps. For example, the not-for-profit Code.org® (launched in 2013) is devoted to increasing the availability of computer science in schools. Its hugely successful “Hour of Code” campaign has encouraged over 98 million people of all ages to delve into coding for an hour, learning basic principles of coding in a fun environment and providing links to further learning. Here at Pearson, people across all departments completed almost 4000 hours of coding as part of the “Hour of Code”. And during Computer Science Education Week in December 2014 there were more than 600 events planned in Australia.⁴

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Pearson Labs: <http://labs.pearson.com/>

Can Kano save the world?

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“WE NEED TO INTEGRATE CODING MORE DEEPLY AND EARLIER INTO THE CURRICULUM.”

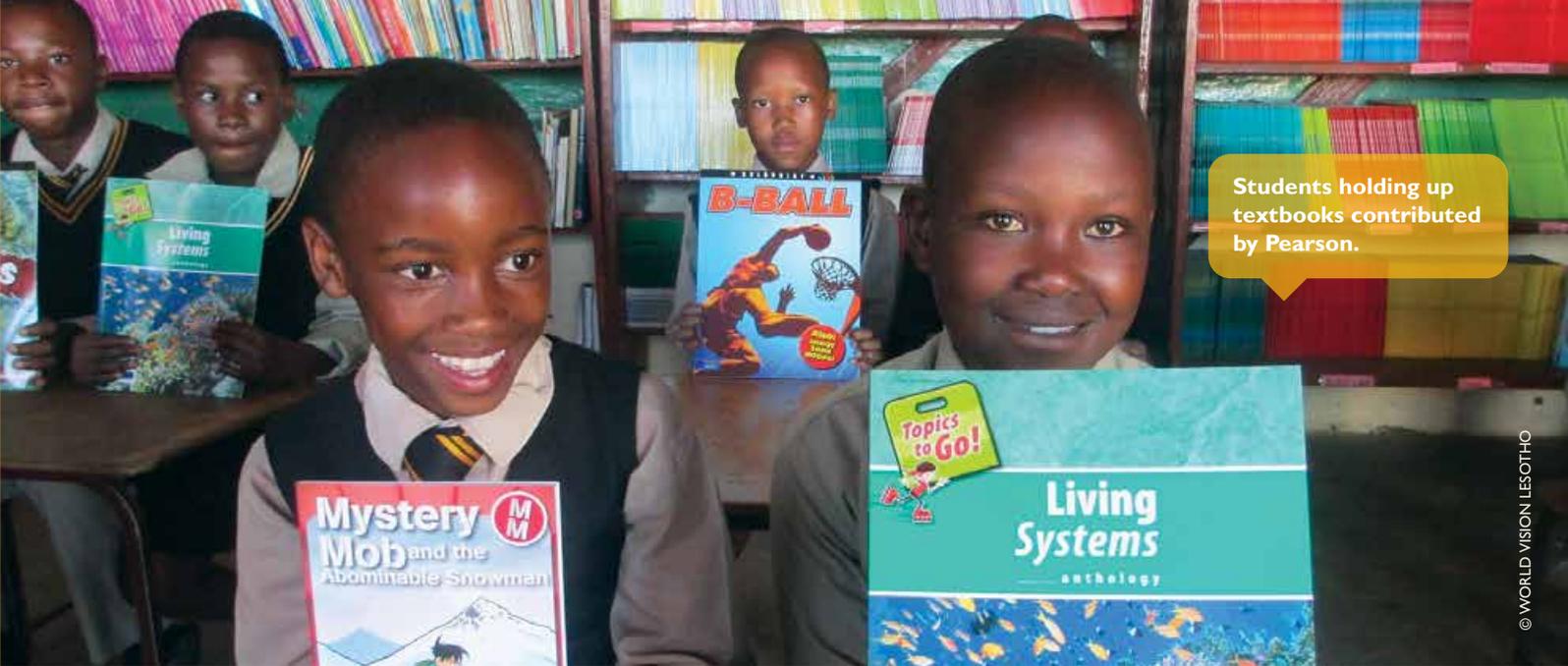
Following first steps like the “Hour of Code”, learners need pathways to further develop their skills, but the educators who support them also need development pathways. In Britain, Pearson has teamed up with tech startup Kano and NAACE (the National Association for the Advancement of Computer Education) to roll out a training course to help primary teachers develop skills required to implement the curriculum’s new coding and programming requirements.⁷ Kano produces a computer that you can build yourself, as simply as playing with Lego, and this sort of from-the-ground-up computing has proven a great way to teach essential 21st-century skills. It is solutions and services like these that we will need in Australia, if (or more likely when) coding becomes a core component of the curriculum.

With 24 million computers sold around the world this year⁸ and counting, the world is going to need a lot of coders to keep up with demand. The story told in the viral YouTube video “What Most Schools Don’t Teach” (Code.org®) is that coders can and should start to learn coding as early as possible. Britain, the US and others are seizing the opportunity to put coding opportunities in front of every student, rather than leaving only the most dedicated students to seek it out for themselves. Australia seems certain, sooner or later, to embrace this educational coding trend too.



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Students holding up textbooks contributed by Pearson.

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Donated textbooks inspire students to take studies further

A primary school in rural Lesotho had a problem: 900 students, and near-empty library shelves. The school sits in an area of the country assisted by World Vision Australia supporters, and teachers were able to engage with World Vision staff to highlight the shortfall and work to turn things around.

What books the school did have were outdated, and there simply weren't enough to cater for full classes, let alone the entire school. Books provided by Pearson in 2014 changed all that: 9633 books were supplied to the school, focusing on maths, science and English language instruction.

Elizabeth, the school's principal, told World Vision staff that Pearson's contribution was the first time the school had received well-illustrated, clear-cut textbooks that were relevant to the curriculum.

'Maths and science have both been a burden to students at our school and countrywide. Eloquence in English speaking has also drastically declined amongst students,' she said. 'With this highly advanced donation, we feel very blessed, and are quite optimistic that we'll achieve things in the best interests of our students.'

One month on from the implementation of Pearson's textbooks, the reading culture of the students has already turned around. Students have proactively established English reading groups to share skills and learning. Teachers were also reaping the benefits – with so much reading material available, they're able to plan around the certainty that all children have access to books.

Over the past two decades, Lesotho has made great strides in education: the country has the best gender equality rating in African education, literacy rates are high, and the future looks bright. One of the main challenges to keep this trend heading in the right direction is access to resources, and contributions like Pearson's ensure that students are equipped for the best possible education.

In 2014, Pearson's partnership with World Vision Australia provided 78,809 textbooks to developing communities in Swaziland, Burundi, Lesotho and Rwanda. Tens of thousands of children throughout Africa now have access to quality educational resources. The World Vision Australia Program Resources team and Pearson look forward to working together again in 2015.

 Find out more about World Vision and how you can help at worldvision.com.au

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Your thoughts on education

Five insights from the 2014 Pearson National School Educators Survey

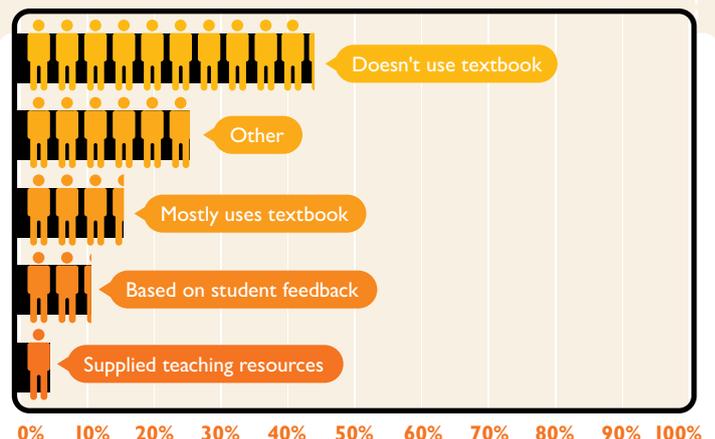
Last year Pearson surveyed educators across Australia to gather opinions on a range of topics such as technology, recognition, working hours and more. It's part of our ongoing effort to better understand and meet the needs of Australian educators.

We've picked out a few responses that help show what's important to teachers today.

Register to receive the full report at www.pearson.com.au/secondary/surveyresults.

Teachers are flexible

Less than **5%** of respondents said they rely solely on supplied teaching resources to teach with, indicating that the majority are developing their own approach to teaching topics in the classroom. Only **15%** used a textbook in most classes, while **44%** said they don't often use a textbook in class at all, preferring to plan more active lessons. This may also imply more schools adopting a flipped classroom model where textbooks would be used more actively by the student at home.



Teachers have the tech, but not the training

Almost all (**95%**) respondents feel that they are being encouraged to use more technology in their teaching, but only half (**52%**) feel they are being given adequate support and training to make this adjustment. Despite this gap, **92%** are using technology in the classroom several times per week or more.

Technology usage **95%**



Technology support **52%**

2

Teachers' favourite thought leaders

Social media platforms allow thought leaders in the field of education to connect with teachers all over the world. Here are the **most popular** individuals and groups that Australian educators are following on social media.



3

Teachers work hard

One of the most significant issues preventing teachers from achieving their workplace goals was not having enough time to do everything, with **89%** of respondents selecting this response. The time crunch spills over into non-term time too, with the majority of respondents working between **20%** and **50%** of the school holidays.

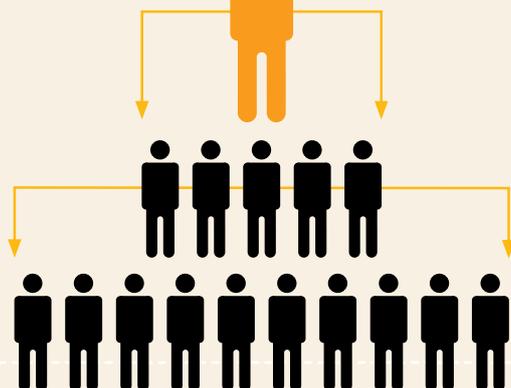
89% don't have enough time to do everything



4

Teachers are connected

78% of respondents currently use social media, with Facebook being the most popular platform, far outstripping other popular social media platforms. Three-quarters of respondents check their social media at least once a day, though less than one in six regularly post or update.



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