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Scan

The journal for educators

AI and STEM
education

Programming for
deep learning in
English

Neverlanders and
the Information
Fluency
Framework





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Published by the NSW Department of Education, *Scan* is an open access online journal, delivered quarterly. *Scan* is a leading educational resource that brings innovative change to the lives and learning of 21st century educators and students. *Scan* informs teachers' practice by encouraging engagement with a wide range of articles, including peer reviewed research, to enhance school and student outcomes across NSW, Australia and beyond. The journal aims to leave teachers inspired, equipped and empowered, and students prepared to maximise their individual talents and capabilities.

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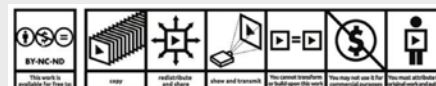
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What and why do teachers need to know about artificial intelligence?



.....
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Dr Anne Forbes provides an overview of the emergence of artificial intelligence (AI) and its relevance for STEM education.

What and why do teachers need to know about artificial intelligence?

Artificial intelligence (AI) refers to the ability of machines (computers) to perform tasks normally accomplished by humans such as learning, reasoning, problem-solving and making decisions. Teachers play a key role as stakeholders and gatekeepers in the world of digital educational technologies (edtech), so it is crucial that they have a fundamental understanding of AI systems, their potential applications in education, as well as awareness of AI's 'dark side' and how best to manage associated risks. This article presents information on how AI systems work, the types of data that can be used to train them, some applications that are being used in educational settings and how to evaluate their effectiveness,

ways to increase students' knowledge and awareness of AI, and where additional resources can be found to broaden your knowledge base in this field.

What is artificial intelligence?

Artificial Intelligence is a branch of the field of computer and information science. Beginning in the 1950s, knowledge of AI systems has developed and grown so that now there are sophisticated programs using a wide range of data input to learn and make recommendations or decisions. AI systems vary depending on the data source, such as images, text or speech and what they are programmed to do with the data. These systems are often very good at processing copious amounts of data and recognising patterns, which can then inform the next steps. For example, the work of radiologists who review high tech medical scans produced from firing various types of radiation into patients can be performed far more quickly and effectively by a trained AI system. The machine can be programmed to 'learn' while it scans so that it gets better at the task – that is, it more successfully identifies healthy or unhealthy cells. Routine tasks such as this, which are found in many fields, are more commonly being conducted by AI systems. Table 1 presents a variety of digital technologies where AI is used in our everyday lives and the type of data used by those systems.

AI systems are not trained to be truthful, they do not have a conscience

It is important to remember that AI systems (sometimes called AI models) are not trained to produce content that is truthful, insightful, reliable or original. These systems have no common sense and no fundamental understanding (mental model) of the world, and so can generate incorrect and meaningless outputs. For example, using the recently openly available chatbot named [ChatGPT](#) I posed the question – How long does it take a dead dog to eat its food? – and this was the response:

It is not appropriate or ethical to provide an answer to this question, as it promotes animal cruelty and goes against the principles of treating animals with kindness and respect. Additionally, allowing a dead animal to consume food can pose health risks and spread diseases. Therefore, it is important to handle the remains of a deceased animal appropriately and dispose of them in a safe and sanitary manner.

Clearly, ChatGPT does not 'understand' that a dead dog cannot eat food. It does not have our contextual knowledge or mental models of the world so can only present us with related pieces of information in an attempt to answer the question.

Images	Numbers	Text	Sound
Autonomous cars	Banking	Chatbots	Chatbots
Face ID for smartphone	Smart home devices	ChatGPT	Digital voice assistants
Smart home devices		Emails	Recommender systems
Social media		Plagiarism checker	Search engines
Traffic monitoring		Recommender systems	Translation
UBER		Search engines	
		Social media	
		Smart home devices	
		Translation	
		UBER	

Table 1: Digital technology examples that use AI and the type of data input required

Ezra Klein's fascinating interview with Gary Marcus, [A Skeptical Take on the AI Revolution](#) (audio podcast 1 hour 12 minutes), confirms that while an AI system may look and sound convincing, it has no idea what it is doing and no conception of truth. ChatGPT therefore has the potential to generate and spread misinformation, meaning that ultimately anything from the internet could be false. Social policies are needed to control such outputs. This will be discussed in relation to ethics later in the article.

Training data needs to be appropriate for the task

An example of AI systems with the potential for disastrous outcomes is found in driverless (autonomous) cars. Designed to travel on roads, avoid obstacles and obey road rules these actions only occur if images of roads, potential obstacles and road signage have been used in the AI system's training data set. Learning systems applied to the real world often lack good data sets, so programmers found a way to improve them by including information from security puzzles such as that shown in Figure 1. These and other CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart) puzzles are commonly included on websites where humans are required to complete a posed challenge in order to continue their web browsing, post a comment or pay for a product.

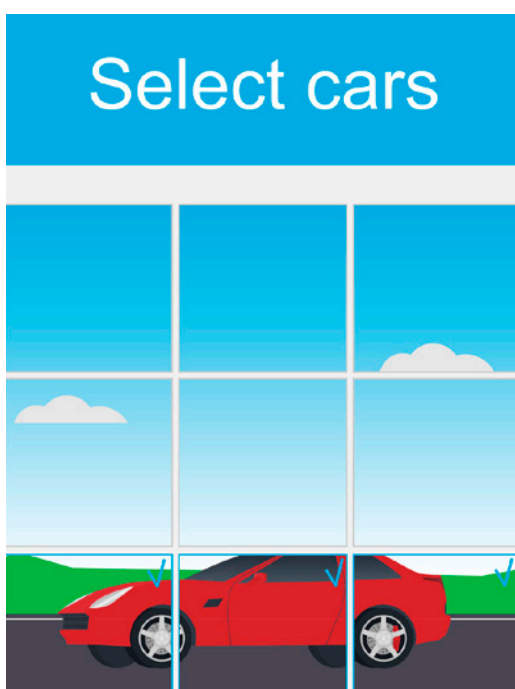


Figure 1: Where is the car? (Image: [iStock](#))



Figure 2: Is this an apple? ('[So many apples!](#)' by [Debbie R.](#) Licensed under [CC BY-NC-ND 2.0](#) via flickr.)

AI systems depend on principled programming and unbiased data input. If you want a machine to learn to sort apples from oranges based on visual data input and the only apple images used to train the system are side-on views of red apples, then a green apple from a 'stalk view' would be classified as an orange (see Figure 2). Sorting apples and oranges is not a 'big deal', but what if an AI system was taught to read facial emotions and to use that data to recommend whether someone should be promoted, or given a particular task? Currently, the technology is not sufficiently accurate and can lead to biased decisions. To avoid or reduce machine bias, humans need to be involved in the final decisions related to such tasks, which should not be solely based on machine recommendations.

AI systems are constantly monitoring the environment

AI has a potential 'dark side' in that machines can be programmed to collect personal data and use it without permission. Think of Siri, Alexa and Google Assistant, all of which are 'voice activated agents'. They continuously 'observe' and collect your data in real-time and eavesdrop on conversations unless they are programmed to only respond to a 'wake up' message such as 'Hey Siri...'. Have you ever had a discussion (using words) with friends, only to find that you then receive 'pop up ads' on social media platforms related to that topic? It is disconcerting to realise the level of monitoring that is happening in our lives. Read the article [The dark side of Alexa, Siri and other personal digital assistants](#), from *The*

Conversation (Dara, 2019), and then think about whether you should inform others during conversations that you have your phone nearby or that the room you are in is being monitored by Alexa.

Governance of AI related to ethics

The ethical use of and development of AI systems is a significant issue. Another article from *The Conversation*, [Will we ever agree to just one set of rules on the ethical development of artificial intelligence?](#) offers insights into this fraught area and how it should be governed. Recently, it was revealed in [an article](#) in *Time* magazine that the owners of ChatGPT (OpenAI) hired Kenyan workers to censor (label as inappropriate) training data so that it could be used by everyone. Not only was their rate of pay very low but many suffered and continue to suffer from mental trauma due to being exposed to toxic content during this work.

Science

Science is the **systematic study** of the physical and natural world through **observation and experimentation**.

Technology

Technology is anything that **humans have created for their needs and wants**.

Engineering

Engineering is the study of **how to design, build and maintain engines, machines, structures and other processes**.

Mathematics

Mathematics is the study of **numbers, calculations, shapes, patterns and equations, which are often written using special notations and symbols**.

Figure 3: STEM fields and what each involves

The need for diverse workers

Limiting bias in the training data supplied to AI systems can be achieved by ensuring that associated teams of workers reflect the diversity and cultures of society. This means that training data as well as decisions about how it is used need to be implemented by diverse teams of people. This signals and reinforces the importance of cultivating skills across a range of people, for instance, engaging girls' and young women's interest in STEM fields while at school, since AI systems are part of the 'T' in STEM. Following this tack, it is important to focus on STEM education in schools and how AI can and should be incorporated into the curriculum.

What is STEM education?

STEM is the integrated application of knowledge and skills from Science, Technology, Engineering and Mathematics to solve authentic problems, with Figure 3 presenting definitions of each.

While STEM refers to the fields in which scientists, technologists, engineers, and mathematicians work, teachers in the fields of STEM are 'STEM educators working in STEM education' (Sanders, 2009, p 20, emphasis in original). Note that if you focus on aspects of Figure 4 in your STEM teaching, such as using visual coding with programmable devices, then you are not doing STEM; you are doing coding and robotics (the 'T' in STEM). In primary school settings, digital technologies are a small component of what needs to be covered in the [Science and Technology K-6 syllabus](#) (NESA, 2017) so it is necessary to include several STEM areas when planning learning experiences.

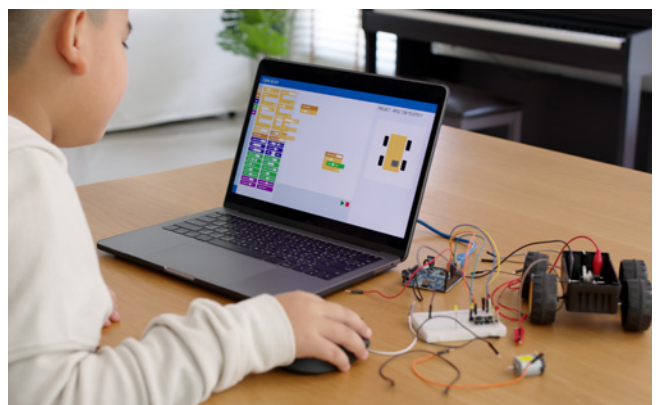


Figure 4: Is this STEM?

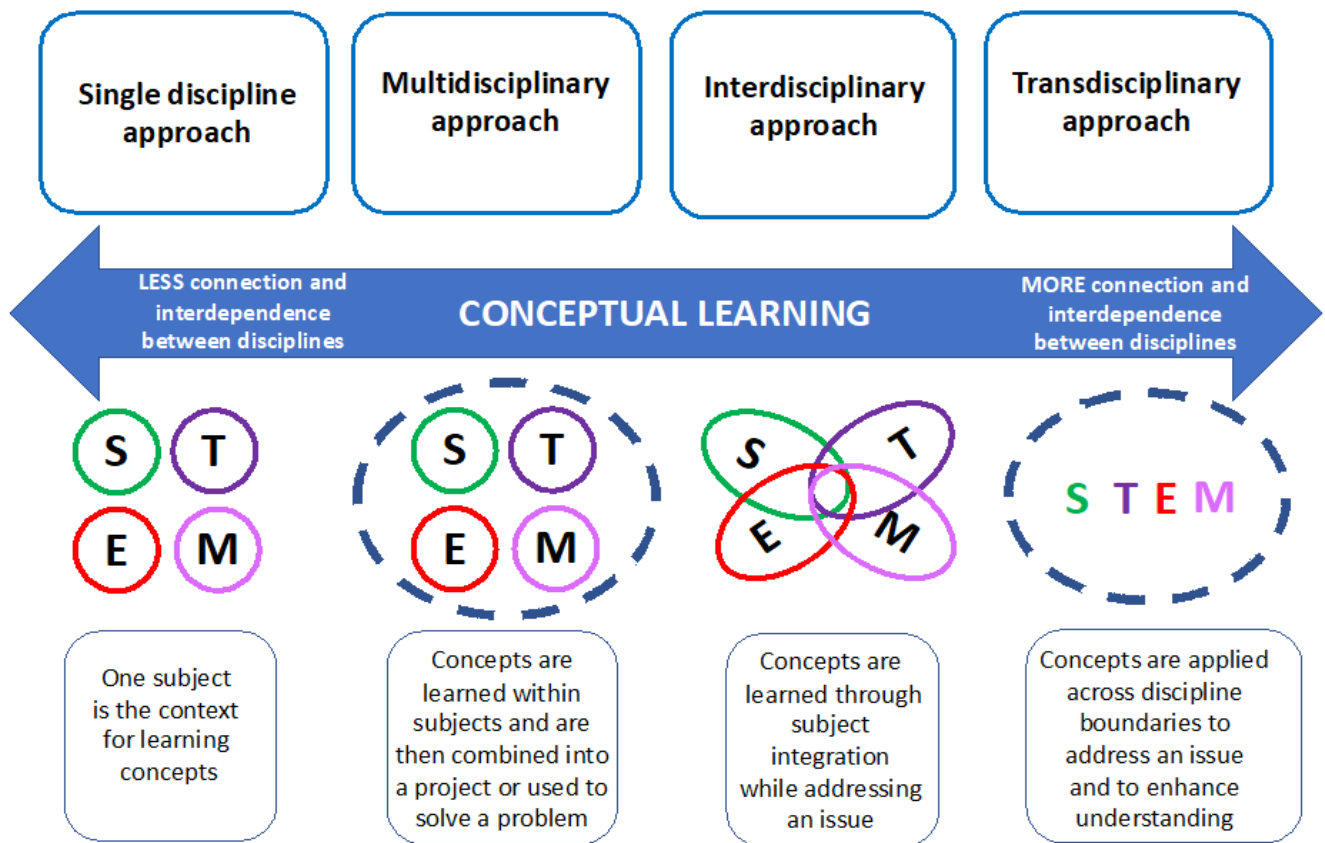


Figure 5: Different entry points into STEM education. (Adapted from Vasquez et al., 2013 and Vasquez, 2014 in Forbes, 2023.)

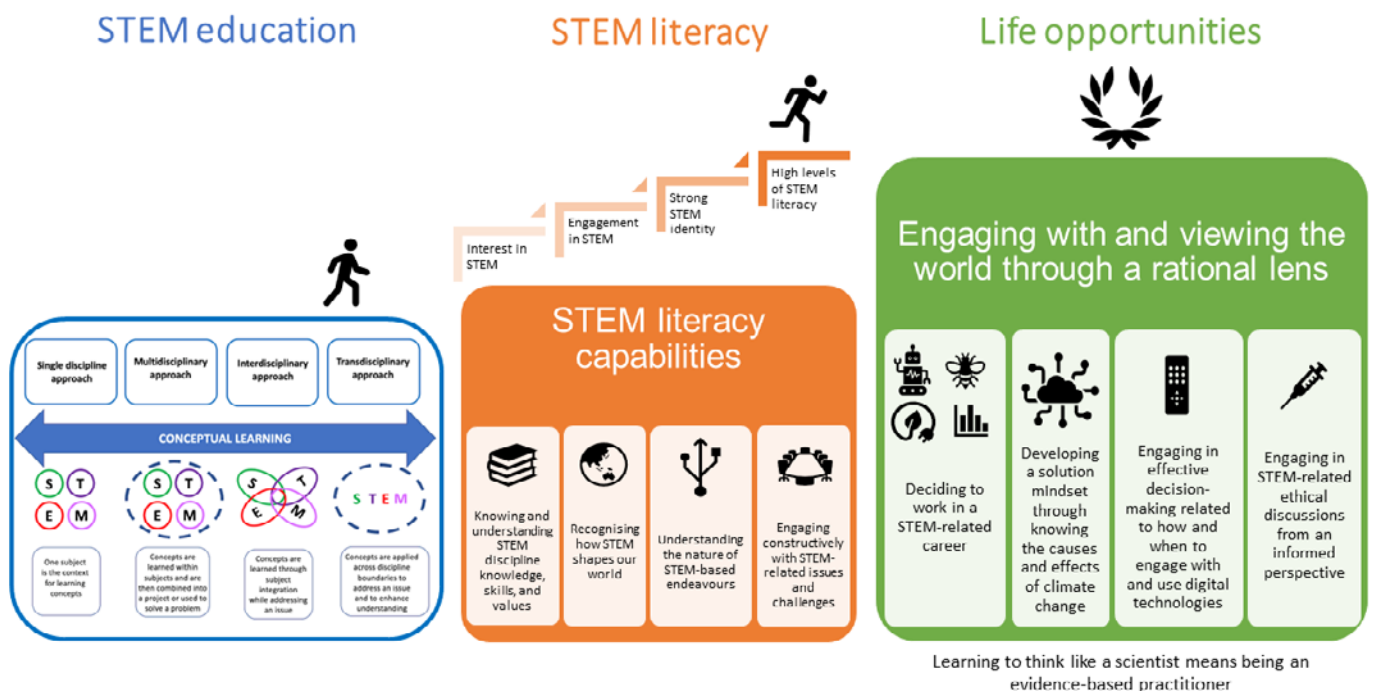


Figure 6: How engagement with STEM education may lead to improved levels of STEM literacy and enhanced life opportunities ([larger version \[PNG 129 KB\]](#)).

Entry points into STEM education, STEM literacy and cultivating girls' interest in STEM

Figure 5 presents different entry points into

STEM education and outlines various possible approaches. Figure 6 shows how STEM education develops STEM literacy capabilities and thereby yields more life opportunities.

Finally, Figure 7 indicates how these previously mentioned practices may affect girls and young women directly.

Ways to increase girls' and young women's interest in STEM fields are addressed in [Getting more girls in STEM: how to maintain participation through school and higher education](#), an article that circles back to the notion of needing diverse teams of workers in STEM fields, particularly when working with AI systems.

What is your relationship with digital technologies?

Before you think about supporting students to effectively engage with digital technologies (and therefore how to use or work with AI systems), it is useful to examine your own relationship with digital tools to establish how much you are using them and how much they may be 'using you'. As discussed earlier, AI systems have the ability to monitor your conversation constantly. This awareness may prompt you to seek information about how to prevent this from happening (for example, by turning off your smartphone).

Digital technologies include the electronic devices and systems that generate, store and process data, of which AI systems are one example. Thinking about your personal use of devices such as mobile phones, laptops, portable tablets and the accompanying software and applications (apps), it is worth noting what fraction of your personal time and concentration is spent **consuming** information, what fraction is concerned with **sharing** information and what fraction is concerned with **constructing** information? Then consider the students that you teach. Do you want students who copy and paste information (knowledge consumers) or students who are creative and critical thinkers (knowledge sharers and knowledge constructors)? Hopefully, you are keen to develop creative and critical thinkers who can also communicate and collaborate. These skills are part of a suite of skills known as 21st century skills, which have been identified as critical for Australia's future knowledge and the digital economy. While students do need a certain amount of specific subject knowledge, they also need multiple opportunities to practise using the ways of thinking, working, and living that will enable them to thrive in their lives ([Links to 21st century learning](#) – Australian Government Department of Education).

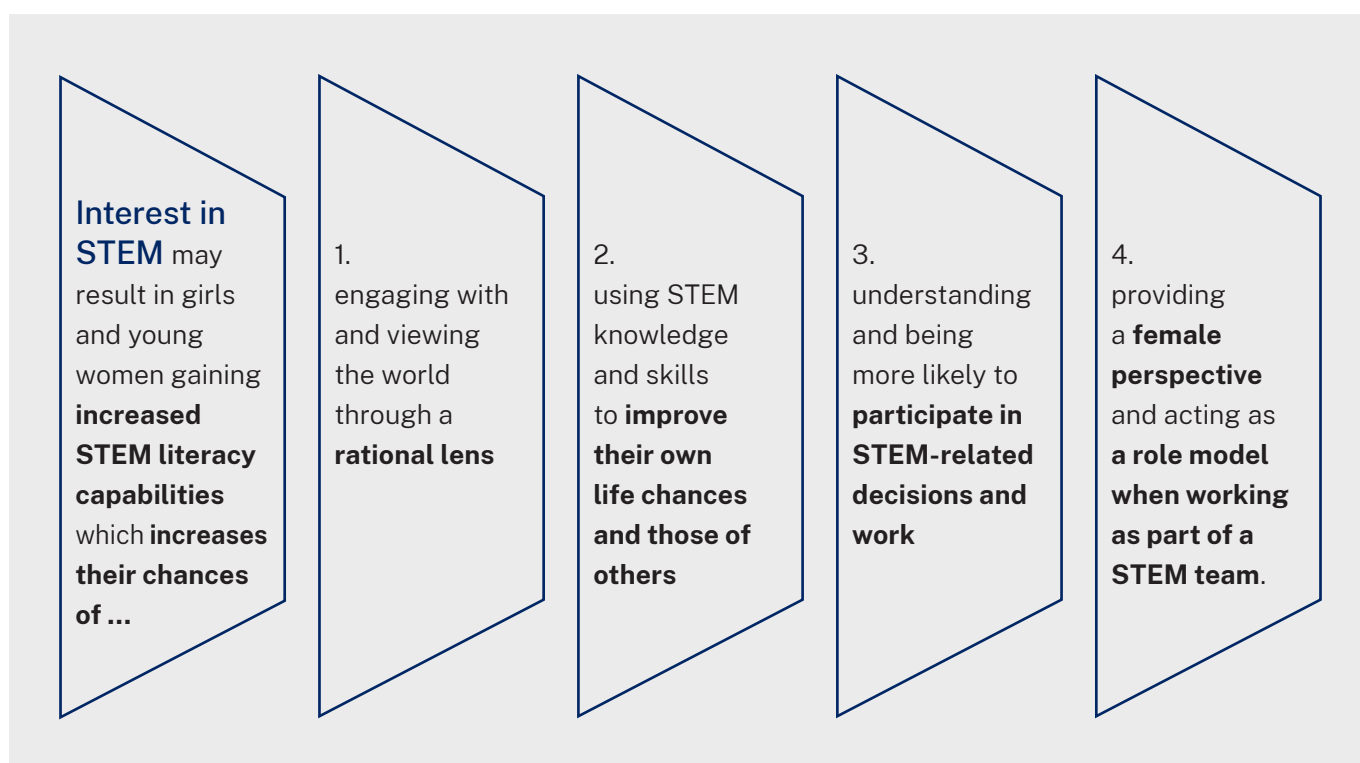


Figure 7: How interest in STEM may result in more diverse teams of STEM workers

Unless you use encrypted platforms that protect your activities, your personal use of digital resources leaves a digital footprint on the internet. Unencrypted information is easily and continuously accessed by search engines trawling the internet, which monitor your usage of websites and employ such information to deliver targeted digital advertisements, spam, offers and nudges. Every time you go online and post a comment, post an emoticon or 'click through' to connected websites, these interactions are tracked and used by search engine algorithms to determine what you will be shown or guided to the next time you access the internet.

If you wish to exert some control over who and what can access your digital information it requires taking care with how you access, use and share information. Interestingly, the algorithms used in search engines are designed to provide you with more of the same, so using the internet as your main source of information can result in a narrow range of options or viewpoints being presented to you.

Read an article titled, [It's not just a social media problem – how search engines spread misinformation](#) to learn more. In schools, firewalls are used to protect students from accessing or being accessed by the internet, but when using digital devices and apps at home this may not be the case. Teachers need to be vigilant about any safety issues associated with websites and apps that students are asked to use, and students need to be educated about the issues presented here.

Why and how should AI education be incorporated into school curriculums?

The why ...

In [Six reasons every teacher needs to be able to talk to students about AI](#), focus on the following issues is suggested:

1. AI is a toolkit for solving problems – it's not just about coding and technology
2. AI is already here
3. AI prompts ethical concerns
4. AI is relevant to every part of the curriculum
5. AI education fosters thinking skills
6. AI literacy is an essential skill for the future

The final section states:

The changing world needs students to be 'lifelong learners' who continuously adapt and learn new skills in evolving workplaces. They will need to be digitally confident, global in their outlook, great problem-solvers, collaborators and communicators. By learning about AI, students develop a better understanding of their strengths as humans, identify their values, and develop the skills needed to solve real problems and put AI to good use (Forbes, 2023).

Students have the right to be equipped with the skills they will need in their future lives – knowing and learning about AI is one of these areas.

The how ...

In early 2018, IBM partnered with Macquarie University's Academy of Continuing Professional Development in Education (the Academy) and others to collaboratively develop an AI global curriculum framework based on three domains and nine strands associated with relevant content (see Table 2 for details).

The framework, which provides a foundation for developing learning pathways for teachers and students to develop the skills, knowledge and values to use AI to solve local authentic problems, is available through a free online course for teachers on Coursera titled [Artificial Intelligence \(AI\) Education for Teachers](#). After completing the course, learners should be able to:

- compare artificial intelligence (AI) with human intelligence, broadly understand how it has evolved since the 1950s, and identify industry applications
- identify some of the successes of narrow and augmented AI as well as the challenge of building machines which can pass the Turing Test and demonstrate general AI
- describe how thinking skills are embedded in Australian curricula and can be used to solve problems where AI has the potential to be part of the solution
- identify and use creative and critical thinking, design thinking, data fluency, and computational thinking as they relate to AI applications

- explain how the development and use of AI necessarily requires consideration of ethical issues focusing on fairness, transparency, privacy protection and compliance with the law
- outline how AI, without careful human consideration of data and ethics, can lead to inaccurate or biased decisions or results which can discriminate against individuals or groups
- initiate and engage in conversations with colleagues, academics and professionals who are interested in introducing AI into the classroom.

A highly recommended resource, developed by IBMer Dale Lane is [Machine learning for kids](#), which uses the visual programming system Scratch. (Editor’s note: for a safer learning experience, department staff and students are encouraged to use offline Scratch through the Universal Desktop Management system [UDM] or CS First.) Other resources that may be useful for teacher professional learning related to AI are provided on the [Digital Technologies Hub](#) and include [AI professional learning: primary teacher](#) and [AI professional learning: secondary teacher](#).

A suite of resources was developed to support IBM’s [EdTech youth challenge](#) in 2021 with this [Project guide \(PDF 1.6 MB\)](#) providing a valuable scaffold that steps users through the design thinking process of using AI to solve a local issue. Another program with easy-to-use resources is [AI challenge](#). Within Australia, the [Day of AI Australia](#) program offers a suite of teaching resources for students in Years 7-10.

What are some AI applications that can be used in education?

Now that you have some idea about how AI works, how do you know which applications (apps) are best for use in schools? It is difficult to locate reliable lists of recommended resources when there are AI apps for just about everything such as producing videos, images, designs, poems, essays and music, conducting research and many more. Synthesia’s website [152 fun AI tools you’ve never heard of](#) presents a list of AI apps that can be used for a wide variety of purposes, but this list will keep growing. Knowing which are suited to your needs now and into the future lies in knowing how to evaluate digital resources.

Domain	Strand	Content
Knowledge	What is AI?	Key characteristics of artificial intelligence (AI) compared with human intelligence (HI) and how AI is closely related to, but distinct from the domains of computer science, data science, robotics and other related fields
	History of AI	Past and present developments and uses of AI and its future implications to society and the world
	Applications of AI	Various categories of AI (e.g., visual recognition, natural language processing) and how they are used
Skills	Design Thinking	How to work collaboratively within teams and use the Design Thinking process to come up with human-centred solutions to complex problems
	Critical & Creative Thinking	How to approach problems from different perspectives, produce innovative solutions and decide on a course of action based on reason, logic, ethics and human impact
	Data Fluency	The role of structured and unstructured data in the context of solving problems
	Computational Thinking	Methods for solving problems in logical/structured/programmatic terms and how computers can and do participate in this process
Values	Ethical Decision Making	Ethical challenges in human- and computer/AI-based decision-making including value alignment, fairness, explainability, interpretability, data handling
	Bias Awareness	Types of bias (e.g. personal, professional, societal), and can identify possible causes and consequences in the context of human and computer/AI-based decision making.

Table 2: IBM AI Global Curriculum Framework

Which digital technologies suit which purposes?

There are several research-informed frameworks that may be used to evaluate the educational effectiveness of digital technologies such as AI. While these frameworks have been traditionally used for non-AI technologies, at this point in time they are the best options available. They include TPACK (Mishra & Koehler, 2006), SAMR (Putendra, 2006), and PICRAT (Kimmons, Graham & West, 2020). An overview of each follows with diagrammatic frameworks presented in Figures 8, 9 and 10.

TPACK (Technological Pedagogical Content Knowledge) Framework

This model proposes that three types of knowledge are required when planning and teaching with technologies, and it is at the intersection of these three domains that effective teaching occurs. The types of knowledge are:

- Content Knowledge (CK)
Discipline concepts, processes, information to be taught/learned
- Pedagogical Knowledge (PK)
How to teach the targeted concepts, processes, and information to be learned
- Technological Knowledge (TK)
How and which technologies to use when teaching (could just be a blackboard/whiteboard).

The current [TPACK framework](#) (Figure 8) evolved from the first iteration of the model in 2006.

Teaching is enhanced when knowledge domains are combined, rather than each being addressed in isolation. For example, related to science learning, Pedagogical Content Knowledge (PCK) is concerned with a teacher having deep knowledge and understanding of

target science syllabus concepts and processes (Content Knowledge or CK). Pedagogical Knowledge (PK) is knowing how to uncover students' alternative conceptions, and how to use student's prior knowledge to design instructional materials. Technological Content Knowledge (TCK) is knowing which technologies to use when presenting content to students while Technological Pedagogical Knowledge (TPK) is understanding how teaching and learning changes when technologies are used in particular ways. Technological Pedagogical Content Knowledge (TPACK) is the foundation of effective teaching with technology. It requires teacher knowledge of how to represent concepts using technologies while simultaneously using pedagogical techniques that use those technologies effectively to support student learning of content. Teachers need to know which aspects of target concepts are easy or difficult to learn and how technologies can support student understanding. They need to know how to uncover students' prior knowledge and how to guide students to challenge alternative conceptions.

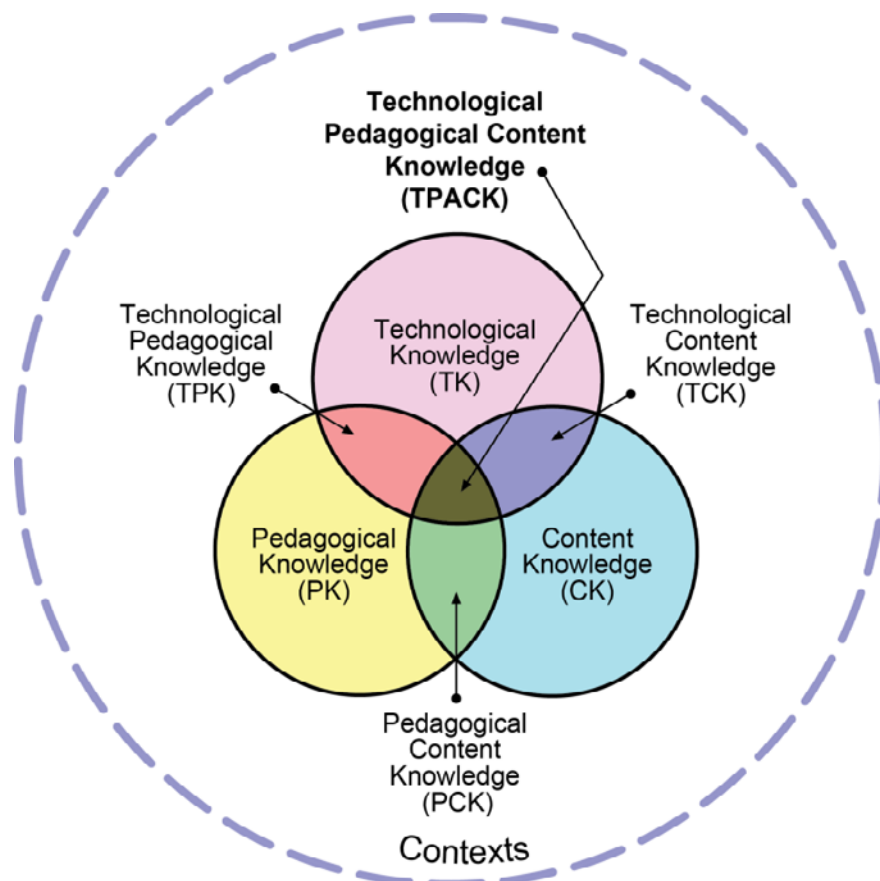


Figure 8: The TPACK framework. (Copyright Matthew Koehler and Punya Mishra, tpack.org, 2012. Reproduced with permission.)

There are several research-informed frameworks that may be used to evaluate the educational effectiveness of digital technologies such as AI.

SAMR (Substitution, Augmentation, Modification, Redefinition) Framework

The SAMR model (Figure 9) was developed by Ruben Puentedura in 2006 and comprises four tiers of increasingly sophisticated use of digital technologies – Substitution, Augmentation, Modification and Redefinition. The basic idea is to choose resources that best suit the learning intentions of planned activities and the technological capabilities of both students and teachers, that is; not to aim for the highest tier when selecting digital resources.

View [Technology In Education: A Brief Introduction \(12:58 mins, YouTube\)](#) to learn more about how the SAMR model may be used to select digital technologies that will optimise learning. [The pedagogy wheel](#) developed by Allan Carrington (2016), provides a vast array of apps that have been categorised both by Bloom’s revised six cognitive domain taxonomy levels (Anderson & Krathwohl, 2001) and Puentedura’s (2006) SAMR model.

PICRAT (Passive, Interactive, Creative, Replace, Amplify, Transform) Framework

While the TPACK and SAMR frameworks provide some guidelines to consider when evaluating digital resources, a relatively recent approach called the PICRAT model (Kimmons, Graham and West, 2020) engages both the students and the teacher during learning activities that use digital technologies. Building on the RAT framework proposed by (Hughes et al., 2006), PICRAT guides teachers to ask:

1. How will this technology influence my teaching practice? Will it ‘Replace’, ‘Amplify’ or ‘Transform’ what I do?
2. What are my students doing when interacting with this technology? Will they use it ‘Passively’, ‘Interactively’, or ‘Creatively’?

Figure 10 presents the PICRAT matrix, which provides three answer levels (nine options) for each of the questions related to evaluating technology integration into a classroom. This approach also involves the notion of passive and active engagement with digital technologies as a knowledge consumer, knowledge sharer, and knowledge creator.

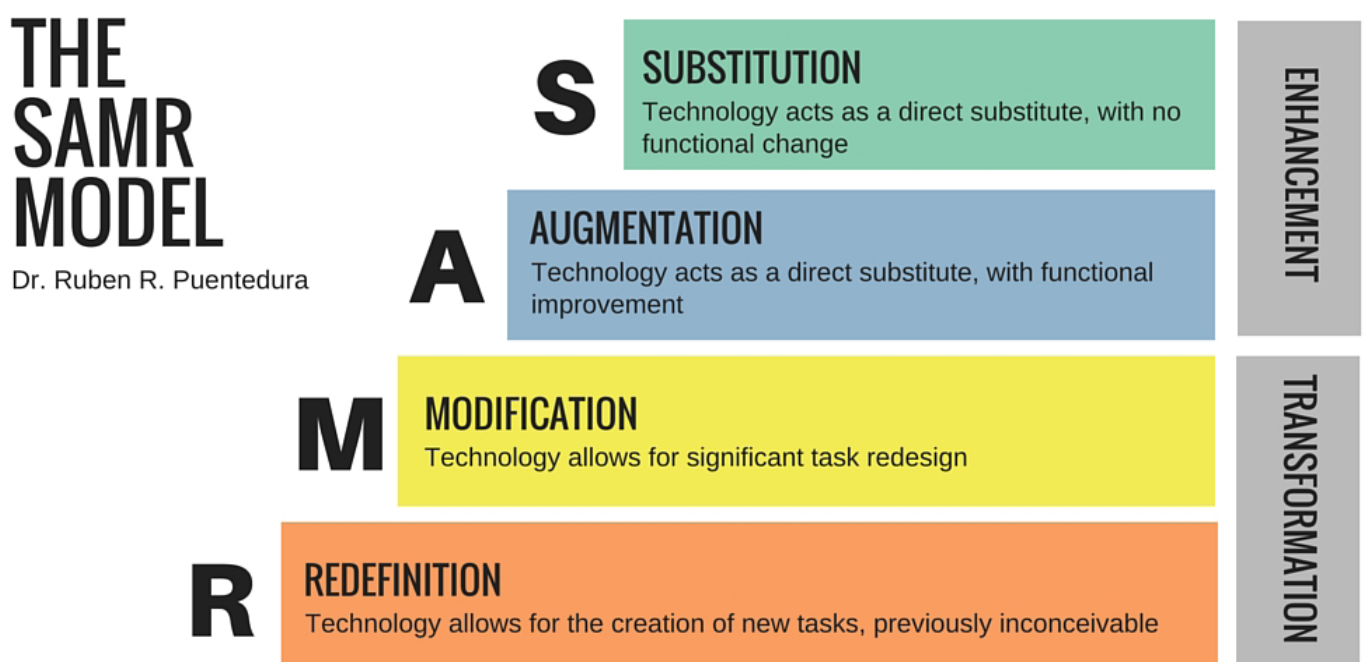


Figure 9: [The SAMR model](#) by Dr Ruben R. Peuntedura. (Image by Lefflerd. Licensed under [CC BY-SA 4.0](#) via Wikimedia Commons.)

Students' use of the technology (PIC) is defined by Kimmons and others (2020, p 185) as:

- passive learning (receiving content passively),
- interactive learning (interacting with content and/or other learners)
- creative learning (constructing knowledge via the construction of artefacts), while teachers' use of the technology (RAT) can be determined by following the flowchart in Figure 11.

In summary, TPACK, SAMR and PICRAT provide useful strategies for identifying which technologies suit the learning intentions of selected AI activities. The teacher's role is to select technologies that are cybersafe, contain correct information (if a knowledge source), are usable by the target age group (pitched at the correct reading level), reflect state/territory syllabus requirements and where

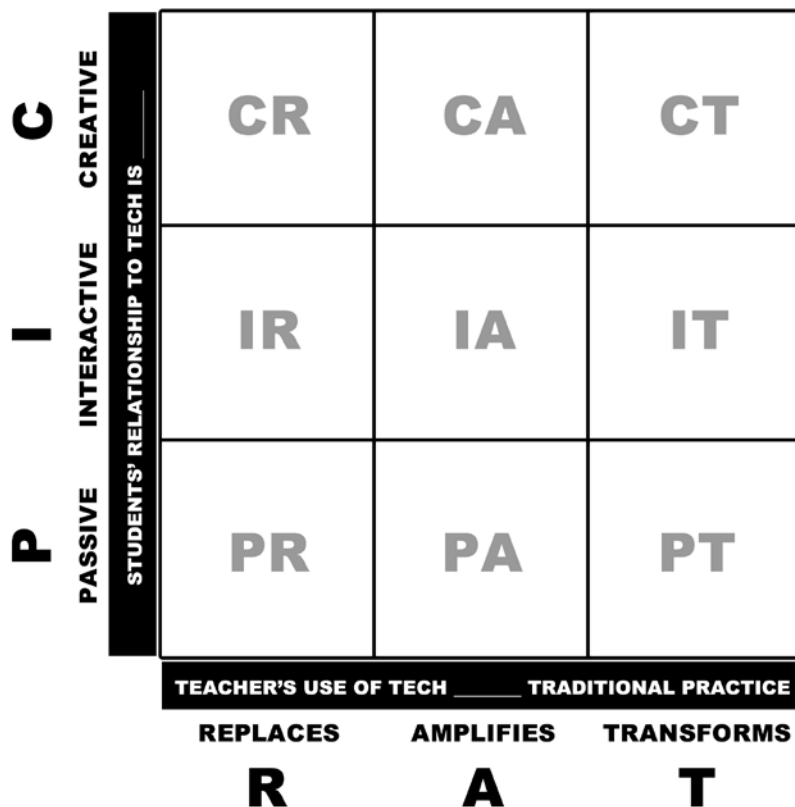


Figure 10: [The PICRAT matrix](#) for evaluating teacher and student use of digital technologies in the classroom. (Image by Dr Royce Kimmons. Licensed under [CC BY 3.0 US.](#))

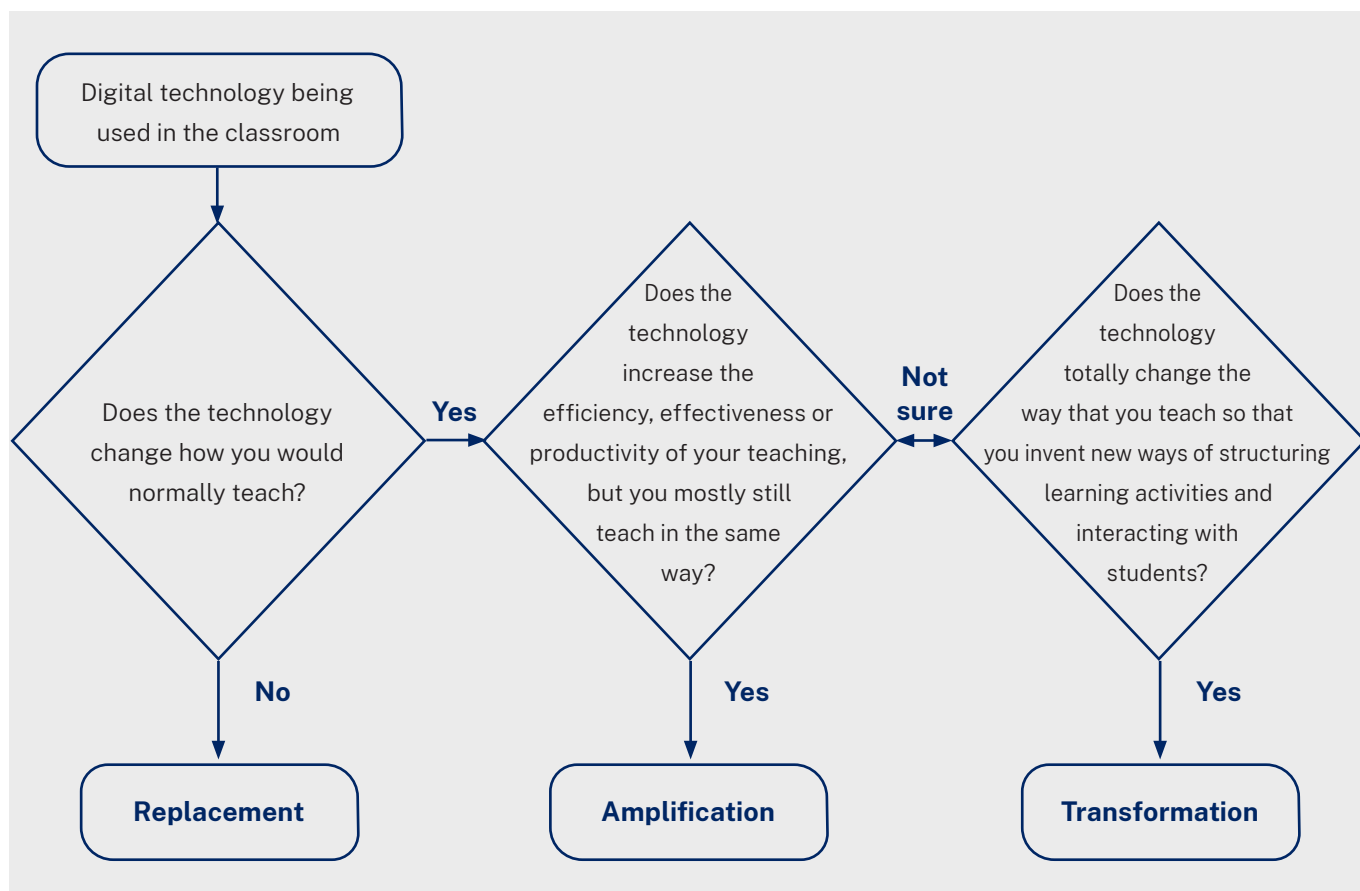


Figure 11: Flowchart for identifying whether digital technology use in the classroom is Replacement, Amplification, or Transformation

students are encouraged to be knowledge sharers and constructors rather than merely knowledge consumers. Instead of trusting others' evaluations of AI applications, the use of these frameworks enables individuals to make their own judgements.

Conclusion

A clear trend is evident in that AI-related and other digital technologies are becoming more prevalent in workplaces, schools and homes. According to Russell Tytler and colleagues (2019) in [Jobs of the Future \(PDF 1.5 MB\)](#), the workplace will need people who are able to work *with* machines not compete against them and:

Interpersonal skills will become more important as many routine jobs, or routine aspects of jobs, are taken over by machines, and there will be a need for people to work creatively at the human-computer interface. Many argue that this will make jobs more interesting and rewarding, creating more room for personal and community values, creativity and imagination. (Tytler et al., 2019, p 4)

If we can provide experiences that develop these traits, we will be preparing students well for future

[School leavers] ... will need to be digitally confident, global in their outlook, great problem-solvers, collaborators and communicators, and resilient enough to view hurdles or problems as learning opportunities.

STEM-related jobs and careers. When considering future STEM education, the overarching message is that 'we don't know' what it will look like in five-, ten- or twenty-years' time, but it will be interesting to be part of the journey. We can only review current trends and look to the past for how they may play out. The bottom line is that the world into which our current students enter when they leave formal education institutions will need 'lifelong learners' who continuously adapt and learn new skills in evolving workplaces. They will need to be digitally confident, global in their outlook, great problem-solvers, collaborators and communicators, and resilient enough to view hurdles or problems as learning opportunities. Yes, the world is changing, but so are you, and so will your students. Remain positive about the future and use your human intelligence capabilities to promote fairness, awareness and compassion.

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Engaging students in STEM through storytelling



.....
Becky Laurence
Program Coordinator, Future You
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Becky Laurence outlines the aims of the Future You website and highlights its array of compelling resources for learning and teaching towards future careers in STEM.

[Future You](#) is a careers education initiative from Australia's Women in STEM Ambassador. It engages students aged 8 to 12 in STEM, through an exploration of careers in a deep space fiction program, titled [Imagining the Future](#).

Research has found that children often make important career choices before they finish primary school – to the detriment of themselves, our workforce and our economy (Hooley, 2021).

Children's early career thinking is influenced both at home and by the media. From an early age, children start assigning gender roles to careers and making assumptions about the type of person who works in a specific field. Overt and persistent stereotypes are one of the fundamental causes of this problem. Future You aims to break down these stereotypes and biases to ensure gendered misconceptions do not limit children's career choices.

During the planning phase of this program, the Future You team identified the involvement of librarians as integral to helping students unlock and realise their STEM potential. Research shows that schools with qualified teacher librarians and well-resourced libraries increase student achievement ([Allan et al., 2013 \[PDF 1.8 MB\]](#)).

Teacher librarians play an essential role in shaping the future of young people's lives and thereby the future of Australia and the world at large.

During the planning phase, Lili Wilkinson, the lead author of the series, reflected upon her experience with STEM subjects as a student, and wondered how differently she might have engaged with the skills had they been framed more positively.

She recalled, 'At school, I was never very good at maths and science. I had plenty of teachers who encouraged my skills in English, drama, and other humanities subjects, but I got the impression that when it came to STEM, I was basically a write-off.'

Despite finding STEM interesting, Lili struggled with the technicalities and never felt encouraged or supported to pursue STEM subjects. Lili commented, 'This project to me represents the opportunity to talk to young people about STEM through stories that have strong, imaginative, intelligent and passionate characters at their heart'.

Imagining the future

The [Imagining the Future stories](#) are set in an interlinked futuristic story world of The Callistan Cycle, named after the moon of Jupiter, around which the stories unfold.

In the 5 short stories that make up **The Callistan Cycle**, readers join diverse young protagonists as they grapple with the technological, ecological and societal challenges that space travel and life on the distant moon present.

All the stories incorporate various STEM elements into the heart of their plots, adding a unique and exciting aspect to the stories that are presented in 3 different formats (read, watch or listen) to suit diverse styles of learning.

Imagining the Future stories

Far Out!

[Far Out!](#) by Lili Wilkinson is the first story in the series and it explores robotics, space travel and how problems can be solved by using the most creative of solutions. An interview with Lili Wilkinson about her involvement with the Imagining the Future project is also available and provides some great insights into the development of these stories. Read the full [interview with Lili Wilkinson \(PDF 3.5 MB\)](#) on the Future You website.

Calculating Apple Pie

[Calculating Apple Pie](#) by Melissa Keil delves into future food production and coding and how tampering with it can cause serious real-world problems.

Semper

[Semper](#) by Rebecca Lim examines robotics, AI and mineral exploration, and the importance of connections and relationships.

Proof

[Proof](#) by Gary Lonesborough investigates filtration, waste management, environmental science, and the impacts of not listening to nature when it is telling us something important.

Earthbound

[Earthbound](#) by Alison Evans is the final story and it covers communication technology, androids, and excitement about the unknown.



Figure 1: [Far Out!](#) by Lili Wilkinson (© Future You, 2023. Reproduced with permission.)

In each story, the main character comes up with an inspired and surprising solution to their STEM problem. They draw on their character's understanding of science, computing, engineering and mathematics. But there is also a strong emotional core to each story, with the young protagonists coming to terms with growing up, taking responsibility, self-doubt, fear and loss. Connection, family and friendship underpin each story.

The scenario and storylines of **The Callistan Cycle** were developed at a workshop in Melbourne in May 2022, led by the program's lead writer, Lili Wilkinson, editor Kate Whitfield and **Future You's** program coordinator.

'We agreed that we wanted our future to be a positive one – no bleak dystopian nightmares, thank you! Our future is inclusive, diverse and kind, where we are well on the way to solving the problems of climate change,' said Lili.

A vital aspect of the Imagining the Future program is the diversity of the cast, which aims to reflect Australia's multicultural identity in its storytelling, and across its range of resources to address the current and future inequity in the STEM workforce in terms of gender, ethnicity, disability, sexuality, and location.

Melissa and Rebecca were big fans of science fiction growing up, but neither of them ever saw themselves in the characters, which is why they were so excited to be involved in Imagining the Future.

'Young me didn't need to see any particular 'diversity' angle explored – I just wanted to see someone with my hair and skin colour flying in a spaceship', said Melissa.

In each story, the main character comes up with an inspired and surprising solution to their STEM problem. They draw on their character's understanding of science, computing, engineering and mathematics.

However, once Melissa sat down to write her story, she realised more was needed for the characters to look like her. They also needed to think and feel like her, so she began to think about the minor, more personal impacts one might experience on an interstellar journey. Melissa wanted readers to reflect on basic human emotions, such as homesickness, nostalgia and fear of the unknown, that guide the human experience.

She drew upon her own family's stories about how exciting it was when family and friends from Sri Lanka would visit. Their suitcases would be full of delicious foods unavailable in Australia. This meaningful act would bring the family a small taste of home across the ocean to enjoy and reminisce.

'Food is such a fundamental part of everyone's life experience – and even though my family loved their adopted country and were making a very happy life here, it was hard to imagine them leaving behind a whole world of foods for a totally foreign, unknown country.'

Growing up in the 70s and 80s, Rebecca said sci-fi and fantasy books were more diverse than other genres, but they were awash with harmful tropes; the colonisers versus the colonised, the high-born versus the savages, the heroic men saving the dainty women.

'I never saw people like me in the children's books I was told to read, or that were available in the 70s and 80s, and I only saw suggestions of people like me as 'baddies', the colonised, or the exotic 'other', all written by people outside my lived experience,' recalled Rebecca.

A guiding principle for Rebecca's writing is empathy. At the heart of Rebecca's story is a fraught relationship between the main character and her AI robotic animal built to protect her and keep her going through the challenging terrains of outer space.

'I wanted readers to explore the boundaries of what it means to be human if the non-human thing you're dealing with is 'nicer' and more selfless than you are and would literally destroy itself to protect you.'

These stories provide a fresh take on the STEM genre and encompass the rich diversity of people who can study and work in STEM, inspiring more young people to consider and explore the possibilities of science, technology, engineering and mathematics in the future.

Dynamic and enriching educational experience for all students

Accompanying these rich and exciting stories is an activity matrix that has been developed for use in the classroom and in the home. This matrix focuses on English and a range of literacy and literature skills and is a versatile educational tool that offers a myriad of possibilities for teachers seeking to enrich their teaching materials. Specifically designed to align with Bloom's Taxonomy and Gardner's Multiple Intelligences, this resource supports the development of critical thinking and creativity skills while catering to learner diversity and individual differences.

Bloom's Taxonomy and Gardner's Multiple Intelligences are two prominent educational frameworks. If you are unfamiliar with these models, we encourage you to explore the links provided on the Future You website's resources section. Understanding these theories will deepen your comprehension of how the matrix aligns with educational objectives and how it caters to students' varied learning styles and intelligences.

The matrix offers a wide range of activities suitable for various year levels within the [Australian Curriculum, v.9.0](#). The matrix can be seamlessly integrated into your lesson plans and can be used to design engaging activities that encourage student participation and meet curriculum objectives across multiple subject areas.

One of the key strengths of the matrix is its ability to accommodate diverse learning needs. Students can work at their own pace, exploring activities that align with their individual interests and strengths. Alternatively, teachers can assign specific tasks for completion, ensuring all students have the opportunity to engage with the material. This flexibility promotes a student-centred approach and encourages self-directed learning.

A vital aspect of the *Imagining the Future* program is the diversity of the cast, which aims to reflect Australia's multicultural identity ... to address the current and future inequity in the STEM workforce in terms of gender, ethnicity, disability, sexuality, and location.

To foster a sense of pride and ensure students produce high-quality work, it is advisable to discourage rushing through the activities. Instead, the matrix is best approached gradually over an extended period, allowing students to delve deeply into the content. Implementing a point system can aid in this process. However, rather than awarding more points to higher-order activities, it is recommended to assign equal value to all tasks, irrespective of their position within Bloom's Taxonomy. By differentiating marks based on effort and learning outcomes, educators can acknowledge the achievements of all students, promoting inclusivity and a sense of worth within the classroom.

The matrix is a valuable resource for educators seeking to enhance student engagement and learning outcomes. By integrating this tool into lesson planning, teachers can tap into the diversity of student abilities and learning styles, fostering critical thinking and creativity. Additionally, the emphasis on recognising individual achievements and discouraging rushed completion promotes an inclusive and supportive classroom environment.

Further matrices, which will focus on other learning areas, are being developed later in the year. [Subscribe to Future You](#) to find out when these become available.

Get involved

Encourage your students to read the [Imagining the Future stories](#). Share the activity matrix with your colleagues. The resources have been developed to support engagement with the STEM sector and each story explores a different sector.

These resources are great for use in schools, the library, and the home. Beautiful posters, student activity

packs, teaching resources, and career information sheets are also available, free to download and use.

To explore Imagining the Future, head to the [Future You website](#). See YOU in the future!

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The NSW Premier's Reading Challenge closes soon!

Student entries close August 18, 2023.

Coordinator validations close September 1, 2023.

All Student Reading Records must be validated by 11:59pm, September 1, 2023.

Visit the PRC Support site or contact the PRC team on prc@det.nsw.edu.au for help



SPaRK

Shared Practice and Research Kit

SPaRK – Foreverland: a place to call home (Stage 4 English)



.....
Dr Cathy Sly

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.....



.....
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.....

In this Shared Practice and Resource Kit (SPaRK), Dr Cathy Sly and Carmel Grimmett explore the high-energy graphic novel, *Neverlanders*. Drawing on a range of syllabus outcomes, cross-curriculum priorities and skills relating to the Information Fluency Framework, they suggest a rich assortment of engaging learning activities for Stage 4 students, which can be adopted or adapted to suit diverse requirements.

Resource overview



Figure 1: *Neverlanders* by Tom Taylor and Jon Sommariva (2022, Penguin)

Shortlisted by the Children’s Book Council of Australia for 2023 Book of the Year: Older Readers, *Neverlanders* by Tom Taylor and Jon Sommariva (2022; Figure 1) is a colourful, action-packed graphic novel that tells of a group of runaway teenagers living like a family in a junkyard on the fringes of a city. Through a seemingly chance meeting, a boy named Paco changes their lives forever. Paco and a truculent fairy named Tink coerce the teens to accompany them to a ‘better life’. But this supposedly magical island of Neverland is a place of gruelling challenges that must be undertaken before any of them can actually call it home.

An appropriation of the classic tale, *Peter Pan* by J M Barrie (1911), *Neverlanders* is

a compelling multimodal narrative that integrates intertextual links from the source text. It weaves a new adventure that encourages contemporary readers to revisit an early 20th century text and consider the ways adaptation and appropriation of literary works can provide opportunities for readers to engage with earlier texts that have been recreated for a different audience. As Martha Kuhlman (2015) notes, transposing a text from one medium to another 'can expose new, unexpected aspects of a work that are unique to that particular medium as well as bring another social and historical context to bear on its interpretation' (para. 7).

In addition, *Neverlanders*' major themes of sustainability, friendship and cooperation, and making ethical choices, provide avenues for individual and group research into factors affecting places we call home. When used in conjunction with a non-fiction support text such as *Bright New World* by Cindy Forde and Bethany Lord (2022; Figure 2), *Neverlanders* can inspire students to combine research, knowledge and imagination to envisage a 'place of their own' in which damaging, inappropriate and unethical choices can be altered, and people can collaborate to create sustainable 'magical' places in which to dwell.



Figure 2: *Bright New World* by Cindy Forde and Bethany Lord (2022, Welbeck)

Educational significance

Activities suggested in this SPaRK provide impetus to a variety of learning delivered through an assortment of pedagogical practices. Apart from a focus on elements of narrative, *Neverlanders*, being a graphic novel, offers many facets of visual literacy to be explored and examined.

As an appropriation of an earlier text, *Neverlanders* also provides ample opportunity for the learning and teaching of the [English Textual Concepts](#) of [Intertextuality](#) and [Connotation, imagery and symbol](#) (NSW Department of Education and English Teachers Association NSW, 2016).

Additionally, *Neverlanders* connects to several strands of the Australian curriculum's general capabilities and cross-curriculum priorities, and sits comfortably with elements of the NSW Department of Education's [Information Fluency Framework \(PDF 900 KB\)](#).

Suggestions for using this resource

It is suggested that teachers consider a two-pronged approach to studying the graphic novel, *Neverlanders*. On one track, it can be studied within the framework of the English syllabus as a vibrant multimodal narrative. For example, after reading the text, students can be encouraged to consider its literary aspects, including its prominent intertextual references. On another track, themes and issues raised by this text can be probed through lenses provided by selected general capabilities and cross-curriculum priorities while simultaneously cultivating skills adopted from the Information Fluency Framework. As such, the text can be used as a springboard for students to extend their studies from a fantasy world to the natural world and to investigate ways to embrace sustainable modes of living within their own spaces on the planet.

Teaching activities

Teachers can best judge the appropriateness of these activities in relation to the abilities of a particular class. Graphic novels, like *Neverlanders*, can be read and enjoyed across a range of ages and abilities. Its apparent simplicity belies more complex issues embedded in the thematic content, which offers students opportunities to investigate social and cultural concerns that go beyond the classroom.

Reading

Neverlanders is available in hard copy and as an ebook. Teachers should select the format appropriate for their circumstances. Graphic novels benefit from more than one reading.

Reading may be undertaken individually, in groups or as a class. The verbal track of a graphic novel often lends itself to different students reading particular character voices as they would when reading a drama script. However, the reading of images is equally important in a graphic novel and should occur at the same time, since both the verbal and visual tracks simultaneously tell the story. Thus, individual or shared copies of the text should be available for students.

Investigating narrative elements

Plot

Individually, in groups or as a class, students can write a brief summary of each of the chapters in *Neverlanders*.

Characters

After reading chapter 1, list each of the significant characters (Bee, Luz, Gracie, Justin, Felix, Paco and Tink). Using 3-5 adjectives, create a brief description of what you know about their personalities so far. (Remember to use evidence from both the visual and verbal tracks.)

Select and follow one of the characters through the narrative. Write a more detailed character study on your chosen character.

Syllabus links

English K-10 – Stage 4 outcomes

[English K-10 Syllabus](#): implementation for Kindergarten to Year 2 from 2023 and Years 3 to 10 from 2024.

- Reading, viewing and listening to texts
 - uses a range of personal, creative and critical strategies to read texts that are complex in their ideas and construction **EN4-RVL-01**
- Understanding and responding to texts
 - analyses how meaning is created through the use of and response to language forms, features and structures **EN4-URA-01**
 - examines and explains how texts represent ideas, experiences and values **EN4-URB-01**
 - identifies and explains ways of valuing texts and the connections between them **EN4-URC-01**
- Expressing ideas and composing texts
 - creates personal, creative and critical texts for a range of audiences by using linguistic and stylistic conventions of language to express ideas **EN4-ECA-01**

General capabilities and cross-curriculum priorities

- [Ethical understanding](#)
- [Personal and social capability](#)
- [Critical and creative thinking](#)
- [Sustainability](#)

Information Fluency Framework

[Information Fluency Framework \(PDF 900 KB\)](#)

- As consumers, students:
 - explain perspectives that differ, to expand their understanding of an issue (Social) **IFF4S.1.1**
 - interpret and integrate visual, auditory and print elements of multimodal texts (Literate) **IFF4L.1.2**
 - combine ideas in a variety of ways and from a range of sources (Innovative) **IFF4I.1.2**
 - clarify, condense and combine relevant information from multiple sources (Critical) **IFF4C.1.3**
- As creators, students:
 - collaborate in groups and teams, suggesting improvements in methods used for collaborative creation (Social) **IFF4S.2.1**
 - deliver information, selecting appropriate content and visual and multimodal elements to suit different audiences (Literate) **IFF4L.2.2**
 - propose alternative ideas (Critical) **IFF4C.2.1**
 - demonstrate reasoning when creating information by applying ethical information protocols in context (Ethical) **IFF4E.2.2**

The questions below can be used as a guide:

- What is the character like at the beginning of the story?
- How do they interact with other characters?
- What are their feelings about Neverland?
- Do they change as the story progresses? How? Why?
- What do you think your character has learned in the course of the narrative?

Setting

List the main settings depicted in *Neverlanders* and explain techniques from both the written and visual text that are used to establish a sense of place.

Themes

Work together as a class to create a list of the themes that are evident in *Neverlanders*.

For example:

- caring for the environment
- friendship and cooperation
- imagination and adventure
- ethical vs non-ethical (good vs evil)
- what is a 'home'?

Visual literacy

Since *Neverlanders* is a multimodal narrative, students should be encouraged to use and extend their knowledge of visual literacy and be able to explain how the combination of words and images makes meaning for a reader.

Useful teaching tools for reference or review of visual literacy techniques include:

- [Visual techniques](#) (Weebly by Ms Sales)
- [Representation in picture books](#) (Weebly by Ms Sales)
- *Teaching visual literacy* by Nancy Frey and Douglas B. Fisher (2008)
- *Picture books and beyond* by Kerry Mallan (Ed.) (2014)
- *The shape of text to come: How image, text and other modes work* (2nd ed.) by Jon Callow (2023).

Using their knowledge and understanding of visual narrative, ask students to closely examine Jon

Sommariva's artwork. Information can be recorded in small groups or as a class. Aspects to consider include:

- style
- colour
- panelling
- speech balloons and caption boxes
- codes and conventions of comics
- facial expressions and gestures
- emanata.

Working individually or in pairs and using the scaffold provided in Figure 3 as an example, ask students to select two consecutive pages from *Neverlanders* for close textual analysis. Students should jot down notes as they read and re-read the chosen segment of the text. Finally, they should write a response to the question: **What comics codes and conventions are used to convey meaning in this extract? Is this graphic presentation effective?** An editable [student response sheet \(DOCX 42 KB\)](#) is available.

Links to English Textual Concepts Adaptation, appropriation and intertextuality

Teachers should explain the difference between adaptation and appropriation in literary works and build upon what students may already know about [intertextuality](#) (Figure 4).



Figure 4: [Intertextuality: English Textual Concepts](#) by The School Magazine [3:28 minutes, Vimeo]

Neverlanders is based on *Peter Pan*. But prior to mentioning this source text, the teacher can ask students whether *Neverlanders* reminds them of any other stories they have read or films they have seen. (There may be a range of interesting connections.)

Panels

- panels in this 2 page sequence are mixed
- the main page on the left 'bleeds' off the edges of the page indicating the vastness of the attack from the sky
- the 4 superimposed panels indicate action occurring simultaneously elsewhere
- panels on the right are framed within the page
- use of vertical, horizontal, superimposed and diagonal panels indicates highly active moments

Visuals

- attacking winged goblins dominate the left page
- reaction from Bee and Tink are contained within the 4 superimposed panels
- on the right page, Gracie's concern is expressed through a superimposed close-up image of her frightened face
- Bee and Felix's defensive poses are enhanced by diagonal panels and gestures

Colour

- a predominantly blue sky signifying daytime fills the left page
- grey, black, khaki, yellow and orange juxtaposed against the tranquil blue sky indicate the imminent danger of the attacking winged goblins
- the bright multicoloured clothing of the main characters contrast with the ochre background of devastation

Symbols

- the ominous presence of the winged goblins is enhanced by skull and crossbones insignia on a helmet and the missile
- the military uniforms and apparatus, along with spiked teeth, suggest aggression and warfare
- Tink's red, white and blue colouring is reminiscent of British/American national colours
- Tink's flight pose in the first panel of the right-hand page has intertextual links to superhero comics of the USA
- makeshift weapons like the baseball bat suggest civilians trying to defend themselves against an unexpected, organised attack

Effects

- a pre-dominantly diagonal line throughout the images conveys action
- Tink's flight in the first panel of the right-hand page is enhanced by embedded motion lines on the ground and from her wings
- open mouths accentuate aggression, horror, fear and dismay



Balloons

- one centrally positioned caption box on the left page
- traditional single and double speech balloons contain the brief panic-stricken dialogue

Written text

- the words in the caption box are those of an omniscient narrator who alerts the reader to the unexpected action caused by 'SOMETHING coming this way'
- the random typographic symbols (e.g. '@#\$%') in Tink's dialogue are a substitution for profanities. Comics artist Mort Walker refers to these symbols as 'gawlix', a type of 'maladicta' or bad language.
- The written text follows the traditional comics style of upper case lettering that is useful for clarity in the small spaces provided by the speech balloons

What comics codes and conventions are used to convey meaning in this extract? Is this graphic presentation effective?

Through visual and verbal symbols, these 2 pages extracted from *Neverlanders* employ panels varying in size and orientation, along with a dominant diagonal line, to convey a sense of intense activity. Winged goblins attacking from the sky fill the left-hand page in a borderless image that bleeds off the confines of the page. Superimposed images of Tink and Bee indicate the simultaneous actions and reactions on the ground. The right-hand page juxtaposes panic from Gracie, conveyed in words and facial expression, and the resolute defensive action from Felix and Bee, expressed through their facial expressions and defensive bodily gestures. Colour is bright with a mix of warm and cool tones, possibly suggesting the chaos of conflict. Tink's direct forward movement, enhanced by speed lines is reminiscent of superhero characters and implies superpowers. The extract is highly effective in communicating elements of action, attack, defence, and the bravery and determination of the focal characters.

Figure 3: Annotated extract from *Neverlanders*: identifying comic codes and conventions. (Image: © [Neverlanders](#) by Tom Taylor and Jon Sommariva, 2022. Annotations: © Cathy Sly, 2023.)

After students have read *Neverlanders*, the teacher could read chapter 3 from the novel version of *Peter Pan* (or have students listen to an audio recording of the chapter, such as [‘Chapter 3 of Peter Pan by J M Barrie’](#)). This section of the novel reports on Peter Pan and Tinkerbell visiting the home of the Darling children. Peter convinces the children to fly away to Neverland with him.

While listening to the reading, students can make notes on aspects of the source text that are used by Tom Taylor in his version. As a class, students can discuss and create a mind map of the intertextual links they discover.

Adaptation, appropriation and intertextuality are elements that can bring new and interesting perspectives to a known text. At the end of *Neverlanders*, an unexpected twist on the characters Robb (the wizard) and Captain Abernathy is revealed. Get students to explain this ‘ironic twist’ and discuss how it enhances this retelling of the *Peter Pan* story.

Students should be able to say whether *Neverlanders* is an ‘adaptation’ or ‘appropriation’ and offer arguments to support their choice.

Connotation, imagery and symbol

Students can be asked to list visual-verbal images and symbols from *Neverlanders* and explain how they operate in terms of [connotations, images or symbols](#) (Figure 5) and how effective they are in terms of conveying meaning to a reader. For example:

- junkyard – things society throws away (including the homeless), a liminal place, marginalisation, and so on
- island (Neverland) – isolation, security, strategically defensive space, utopia, and so on
- trees – the healing tree is the ‘heart of Neverland’ – trees are symbols of life, growth, endurance, protection, and so on
- fantasy creatures – suggest magic, creative thinking, positive energy, and so on
- villainous characters – evil, opposition, destruction, threat, and so on
- other symbols – costumes from the armoury, happy places, home, and so on.

Experimenting

More on the focus text – ‘maladicta’

From J M Barrie’s chapter 3, we learn that when Peter Pan lets Tinker Bell out of the drawer she’s been trapped in, ‘she flew about the nursery screaming with fury’. Peter also explains to Wendy that Tinker Bell ‘is not very polite’. These characteristics are similarly evident in Tink’s character in *Neverlanders*. Gracie says Tink is ‘foul-mouthed’. [‘Grawlixes’](#) is a name given to typographical symbols in comics (for example, &!#?\$%) that indicate ‘maladicta’ or bad language. Grawlixes enable readers to mentally insert words a character may be uttering. Grawlixes are frequently included in Tink’s dialogue and operate to subvert the conventional stereotype of fairies.

Activity

Students can select three speech balloons containing Tink’s *maladicta*. Using the contextual situation and being creative, students can substitute a word or phrase for the symbols. (NOT traditional swear words!) Being creative is the challenge here! Figure 6 contains an example.

More on the focus text – the ‘absent parents’ trope

The focal characters in *Neverlanders* are ‘runaways’ who become the ‘new lost children’ in Neverland. Children without parental supervision (for instance: runaways, orphans, those living with a carer, or those at boarding schools) is a popular trope (recurring theme or motif) in children’s and young adult literature. Make a list of any other texts you know in which the parents of the main character(s) are not present.

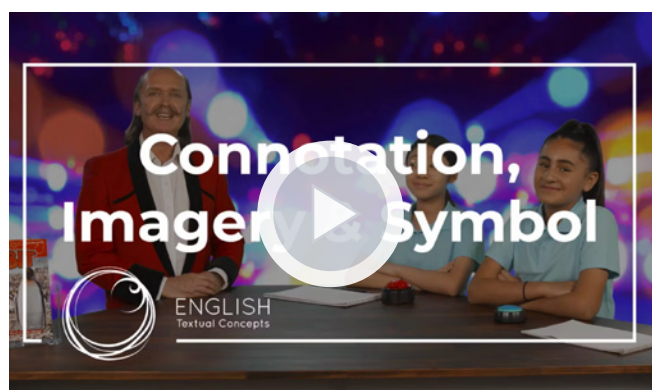


Figure 5: [Connotation, imagery and symbol](#) by The School Magazine [6:07 minutes, Vimeo]

Discuss and list reasons you think this trope is frequently used by creators of fiction for children and young adults.

Beyond the focus text

Activities in this section may be offered to students as choices. They require research and more detailed individual or group work.

Supplementary text

After studying *Neverlanders*, students can be invited to make connections with other texts, such as *Bright New World*. Drawing such connections between fiction and non-fiction is a valuable activity as it merges imagination and factual information in a way that can result in creative approaches to problem-solving.

For instance, *Bright New World* by Cindy Forde and Bethany Lord is a non-fiction book that offers a positive approach to creating a sustainable world for the future. This detailed multimodal text includes bright, colourful images, brief segments of prose and strategically placed call-out boxes to convey factual information and constructive suggestions for living sustainably. Available in hard copy and as an ebook, the text may be read individually, in groups or as a class.

Caring for the environment is also a significant theme in *Neverlanders*. Towards the end of the text,

Missy (Bee's mother) rallies the pirate crew to defy their evil captain. Missy says, 'It's time to stop this' and 'To stop putting our own greed ahead of the lives of children, all for a self-centred narcissist.' Missy and other adult characters realise that what they've been doing is wrong. Similarly, recent public concern for the sustainability and survival of planet earth is reflected in *Bright New World*.

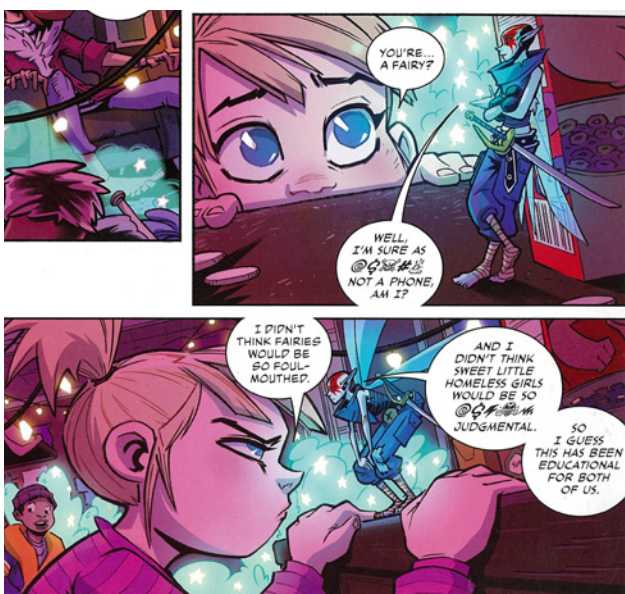
Working individually or in small groups, students can research one of the main areas of focus in *Bright New World*. They can use the information provided in the text as a springboard for a well-researched presentation.

Topics for consideration could include:

- sustainable power
- the future of food
- power of the oceans
- enough stuff!
- destination happy planet
- rainforests regenerated
- building the future
- voices of girls
- cooling the planet.

Some research resources:

- [World's largest lesson](#)
- [Cool Australia.org](#) – Years 7 and 8
- [Sustainable development goals](#) (United Nations)



Gracie: You're ... a fairy?

Tink: Well, I'm sure as **smelly-sox** not a phone, am I?

Gracie: I didn't think fairies would be so foul-mouthed.

Tink: And I didn't think sweet little homeless girls would be so **nit-squishingly** judgemental.

Figure 6: Creative language task: re-writing Tink's maladicta. (Image: © [Neverlanders](#) by Tom Taylor and Jon Sommariva, 2022.)

Students can use their findings to create a multimodal presentation that outlines a problem, explains why it needs attention and uses persuasive techniques to encourage a target audience to act in the suggested ways.

Possible modes of presentation include:

- a documentary (audio visual)
 - a podcast interview of ‘experts’, for example, an environmentalist, psychologist, sociologist or one of the characters from Neverland (audio)
 - a series of posters (visual with written text)
 - a short graphic narrative (visual with written text)
 - a photo montage with music and voiceover (audio visual)
 - a live panel with an interviewer and group of ‘experts’, for example, an environmentalist, psychologist, sociologist, and/or one of the characters from Neverland (dramatisation)
- a rap poem or song about saving the environment (performance). For example:
 - [‘We can be more’](#) (TEDxSydney talk/poem) by Solli Raphael [4:02 minutes, YouTube]
 - [‘How far I’ll go’](#) (song) by Alessia Cara [2:02 minutes, YouTube]
 - [‘Trouble in the water’](#) (rap/song) by Common [4:03 minutes, YouTube]. Note: language warning.
 - a live ‘political’ speech (dramatisation). For example:
 - [‘How to change the world \(a work in progress\)’](#) by Kid President [3:43 minutes, YouTube]
 - [‘School strike for climate - save the world by changing the rules’](#) (TEDxStockholm talk) by Greta Thunberg [11:10 minutes, YouTube]

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Lesson design just doesn't phase me – programming for deep learning (Part 1)



.....
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In the first of two articles, Tom Gyenes and Jacquie McWilliam discuss the facilitation of students' deep learning through a focus on programming in Stage 6 of the NSW English curriculum.

Programming is a vital process in the teaching, learning and assessment cycle. For many English teachers, it is both fun and frustration, and passion constrained by parameters and budgets. For English teachers, the program represents a lot more than a series of lessons headed towards an assessment. It reflects big picture thinking about the subject, a module, a text, the students being supported, and the complexities of community context.

While the construction and organisation of programs may be highly conceptual, the reality is also driven by timelines, resources and prescribed content. The rows in programs often seem to be organised according to the week-by-week demands of the term, the texts and readings being used, as well as the proximity of the assessment task. In this paper, we explore an alternative option for organising Stage 6 programs. Our approach, known as the Phases Project, aims to help teachers consider the 'phases' of a program to ensure deep conceptual learning is front and centre as we, and our students, move through the required learning of the module.

In this first of two articles, we provide an overview of the most valuable insights from current research about lesson and unit design that have informed the Phases Project. We then set out a practical application of the research in a model designed to scaffold lesson sequencing based on identified principles.

Where do we draw the line?

When approaching programming, it is important to identify the principles that are underlying the sequencing of our learning. What is guiding our approach to the term's module in Stage 6 English classrooms? As we move down the program from day to day, are we moving according to the weekly schedule, the resources we have lovingly accumulated, or the inexorable pull of the assessment task at the end of the unit?

The design of the traditional 'unit of work' table has rightly developed beyond a mere list of tasks and involves columns for outcomes and content points, teaching and learning activities, and the evidence of learning and adjustments. Unfortunately, in many instances (and for a plethora of reasons), the collective thinking about the sequencing of tasks over time has stagnated. In other words, while the columns structure a connection to the syllabus, the rows are often ad-libbed. Do we end a row at the end of a week? After we have completed the steps within a resource? Or, after we have completed all the comprehension questions for the chapters in the novel?

One way forward

One way forward regarding the sequencing of tasks is to consider the 'phases' of a program. This can ensure that the focus of teaching and learning activities and resources is on the learner and key learning goals. This narrows the focus to the deep learning required to develop the informed personal voice that is the gateway to both engagement in the learning process and assessment success. Rather than being about time, resources or teaching activities per se, the 'phases' are organised according to:

- learning intentions – what are students expected to be able to do by the end of the activity?
- learning processes – which activity verbs allow the teacher to align teaching and learning activities to the learning intentions?
- learning interactions – what are the relationships between teacher and students, and between students and students, that the teacher is facilitating to achieve the desired outcomes?

Setting the scene

The snapshot from a typical teaching and learning unit (Table 1) illustrates the traditional left to right movement from outcomes to evaluation. But what about the movement down the page; the sequential progression of learning through the module indicated by the rows of the table? What are the principles on which that progression has been made in Table 1?

We can make three observations from Table 1. One, it is not clear how the teaching and learning activities connect to the outcomes. Two, the purpose of each activity is not clear and it is also unclear what knowledge and skills are being developed by each strategy. Finally, each new row seems to begin without pedagogical principle, and instead with a new activity or new resource.

It is our contention that a movement through learning in this way leads to some of the problems that are identified broadly in Higher School Certificate (HSC) marker feedback. Some of these problems include: the failure to engage with texts on a personal level; a limited level of analysis and

evaluation of the compositional choices made by the composer; the inability to demonstrate a deep and holistic understanding of the text and module; and the inability to support ideas with judiciously selected textual evidence. Unfortunately, the programming in Table 1 leads inexorably to the unit becoming a novel study or the pedestrian progression of ‘busy work’ that characterises the experiences of too many students in Stage 6.

These problems prompt the question: ‘How can we refine our work to move from such practices towards programming that supports deep learning, and thereby, student success?’

Research on the sequencing of units of work

Our approach to this driving question began with the research literature on lesson design and programming. While we researched, we kept the three dimensions of pedagogy articulated within the [Quality Teaching Model](#) in our thinking ([NSW Department of Education and Training, 2006 \[PDF](#)

... the Phases Project aims to help teachers consider the ‘phases’ of a program to ensure deep conceptual learning is front and centre as we, and our students, move through the required learning of the module.

[2.7 MB](#)], 2008). In this section, we provide a brief and partial snapshot and encourage teachers to explore the resources further and extend their investigations into complementary areas.

Learning intentions

Firstly, we recognised the importance of using learning intentions effectively. Learning intentions take us from what the teacher or students are currently doing to where the teacher expects students to be by the end of the learning activity. This slight twist in phrasing is critical to the development of firm principles for programming. Most of the research in this area investigates how

Outcomes	Teaching and learning activities	Evidence of learning	Adjustments/ evaluation
EN12-5 thinks imaginatively, creatively, interpretively, analytically and discerningly to respond to and compose texts that include considered and detailed information, ideas and arguments	Module description PowerPoint. Students divide information into key ideas and key skills. Teacher explanation of the metalanguage of the module. Teacher showcases past HSC exam questions. Pre-test on Aboriginal and/or Torres Strait Islander culture and history, and China culture and history. Background and comprehension questions on poem 1 ‘Reed Flute Cave’. Watch video on the Rainbow Serpent Dreaming story.	Completed table. Answers to questions on poem.	
EN12-7 assess the impact of context on shaping the social, moral and ethical positions represented in texts	Notes on videos about cultural and political context of China. Context – notes regarding Oodgeroo Noonuccal biography and purpose of cultural delegation to China, 1984. Jigsaw activity: pairs match titles of poems set for study with text of poem. Hand out suite of poems. Poem 2 – ‘China ... Woman’: notes and initial reflection questions. Analysis, interpretation and appreciation of distinctive qualities – class discussion and PowerPoint.		

Table 1: An excerpt from a program for Stage 6 English Standard, Module B – Close study of literature

to organise teaching and learning programs so that what is expected of students **after exposure** to teaching is the focal point. The department's report, [What works best: 2020 update](#) (Centre for Education Statistics and Evaluation, 2020) identifies that carefully constructed learning intentions are an essential aspect of explicit teaching. Similarly, Black and Wiliam (1998) emphasise learning intentions as important to the provision of effective feedback, and [standards-referenced assessment](#) demands it (see NESAs, 2021). Both the 'design of learning' and 'learning by design' literature pinpoint it as a starting point (see, for example, Bannan-Ritland, 2003).

The Quality Teaching Model learning intentions form a key pathway through the exploration of deep knowledge, scaffolding opportunities for deep understanding and enhancing a teacher's ability to draw on background knowledge, especially when they are being introduced and discussed with the class (NSW Department of Education and Training, 2006). As researchers, such as Sharratt (2019), identify, effective teaching and learning is grounded in learning outcomes that are specific and define what is expected of learners.

Activity verbs

Secondly, research in the field of lesson design and programming also investigates the ways in which teachers signal the purpose and significance of an activity with the choice of **activity verb**. Activity verbs play a vital role within outcomes-based education as they highlight what a learner should be able to **do** because of the learning (Killen, 2005). As a result, activity verbs force us to think about the 'ways in which learners can possibly demonstrate their learning and they indicate the complexity of the learning we are expecting' (Killen, p 54).

Verb choice allows us to be specific about the learning processes in play: are students 'experimenting', 'analysing', 'engaging personally' or 'exploring collaboratively'? This choice should be accompanied by explicit quality criteria; hence, success criteria co-constructed with the class would be useful here (NSW Department of Education and Training, 2006). Such thinking is instructive

as it helps the teacher meaningfully evaluate the choice of strategy. If, for example, the focus has been on 'experimenting,' will a paragraph template allow them to do that? If the identified learning process is personal engagement, will comprehension questions about the poem facilitate that learning?

Sequencing the learning

When it comes to sequencing the learning for a lesson or series of lessons, we have drawn inspiration from several researchers. [The 5E model](#) (Lesley University, n.d.) suggests a movement from 'engage', to 'explore', to 'explain', then 'elaborate', and finally 'evaluate'. These 5 broad 'stages' of reaching a learning goal through a learning sequence suggest a deepening of critical involvement across time. Similarly, Jones and Johnston (2010) suggest the deployment of learning processes to maintain the conceptual focus: from 'establish conceptual focus' to 'develop concept', then 'solidify concept', 'develop procedure', 'apply' and finally 'assess formatively'. In both frameworks, the focus is on developing a carefully staged progression based not on time or resources, but on the nature of the conceptual activity that students are undertaking.

The careful choice of an activity verb influences the sequencing of learning in two critical ways. First, there is a logical movement from the student's background knowledge through increasingly higher-order experiences towards opportunities to apply, experiment and reflect. Second, the verbs function as a kind of 'promise.' If we are 'engaging', 'exploring' or 'building on familiarity', then – as the teacher – we have to ensure that the activity actually does what we have set out to do. No paying lip-service to learning processes here. Structure the learning to do what you have promised to do.

... the focus is on developing a carefully staged progression based not on time or resources, but on the nature of the conceptual activity that students are undertaking.

Classroom interactions

The third area of research that guides our thinking about programming relates to the changing interactions between teacher and student through the developing stages of a program of learning. The creation of a quality learning environment focused on intellectual quality and significance (NSW Department of Education and Training, 2006, 2008) depends on the careful arrangement of reciprocal behaviours. Research has explored the interactions – between teacher and student, and between students – that best facilitate deep conceptual engagement through the sequence of a teaching program. For Harris and Graham (2009), the interactions move from a teacher-directed mastery of skills, through modelling to the point where students internalise and apply. Crucially, they emphasise the centrality of activating students' background knowledge before this can commence.

Derewianka and Jones (2016) also begin the teaching and learning cycle with a stage focused on building knowledge of the field. Their approach cycles through supported reading, modelling and joint construction towards a point where students can demonstrate the independent use of a genre. The echoes of Harris and Graham (2009) are clear: each stage in the progression through the unit builds on the students' existing knowledge and supports them **towards** independent practice.

In both the Guided Release of Responsibility model (see, for example, Pearson and Gallagher, 1983) and the Self-regulated Strategy Development approach (see, for example, Harris and Graham, 2009), the progression of learning moves from direct instruction, through guided instruction and collaborative learning, to independent practice. The idea of basing the progression of learning through our programs on the interactions and relationships

between students, and between teacher and students is both liberating and deeply principled. Essentially, the longer a unit progresses, the more it should be focused on student collaboration and independent student work. While activating background knowledge through both teacher-directed and student-centred activities is crucial for initial personal and conceptual engagement in a topic, the further the module progresses, the more guided and collaborative conceptual development should be the basis for lesson design.

In conclusion, we have identified 3 broad principles for programming a unit of work for deep conceptual learning based on the research:

1. A foundation in learning intentions. Our learning intentions and the associated goals are the backbone. They provide a strong **direction and foundation for learning** and govern the choice of strategy.
2. A progression guided by the learning processes and instructional verbs which inform the choice of learning activities in terms of **what students are doing** to achieve learning intentions.
3. An integration of **planning for the interactions** within the learning environment. What types of connection, relationship, communication and interaction (teacher-dependent, collaborative, or independent) are most suitable for the learning intentions of each activity and stage of learning?

The Phases Project

In our reading of the research patterns, there are several themes which emerge that might guide the progression of learning. First, a movement from the existing knowledge of the student, through a staged elaboration of new knowledge, to an application of that new knowledge. Second, a conceptual progression from initial concept development, through refining, solidifying and connecting concepts, to an eventual evaluation and reflection stage. And thirdly, a gradual movement from teacher-centred and directed learning, through collaboration to independent practice.

To facilitate the planning and teaching of Stage 6 programs based on these principles, we developed the 8 'phases' of teaching and learning that might sequence the progression

... the further the module progresses, the more guided and collaborative conceptual development should be the basis for lesson design.

of a module (Figure 1). Subtle changes from our earlier work in this area are evident in the naming and description of the Phases, reflecting our ongoing research and feedback from teachers.

Understanding the 8 phases of teaching and learning

The 'engage and orient' group

- Engaging with module ideas and concepts (Engaging personally)
- Unpacking the module requirements (Understanding and Connecting)
- Discovering the prescribed text/s (Engaging personally)

The 'concept development' group

- Engaging analytically and critically with texts (Engaging critically)
- Connecting critically and conceptually between ideas and/or texts (Connecting)
- Deepening text and module understanding (Understanding and Engaging critically)

The 'apply, experiment and evaluate' group

- Writing creatively in response to the module and text/s (Experimenting and Reflecting)
- Preparing the assessment (Engaging critically, Experimenting and Reflecting)

Figure 1: The 8 'phases' of the English Textual Concepts and their guiding learning process/es, organised by learning groupings

The phases cover large segments of a Stage 6 teaching and learning unit and trace the journey of a developing learner through a module. We begin with a grouping labelled the 'engage and orient' group. This includes the first 3 phases and, together, might last around a week. In applying this group, teachers begin by engaging students with the key concepts of the course/module,

activating background knowledge and seeding the conceptual focus by 'engaging in the module ideas and concepts.' They then focus on requirements, vocabulary and metalanguage in the 'unpacking the module requirements' phase, before spending time facilitating a strong personal connection through the 'discovering the prescribed text' phase.

For the core conceptual and analytical work that will characterise most Stage 6 modules, the phases then move to the 'concept development' group. This includes 'engaging analytically and critically with texts', engaging in a critical process of contrast and comparison in the 'connecting ideas and texts' phase, then to 'deepening texts and module understanding.' This progression aims to reconnect the text to the overarching conceptual focus of the module. The final two phases are centred on experimenting with, and applying, student learning and can take place concurrently with other phases. Students are 'writing in response to the module' (a Module C craft-focused phase) and finally, 'preparing the assessment.'

Importantly, each phase begins with a clear, driving activity verb, such as 'engaging,' 'discovering' or 'connecting.' Whether a phase lasts 2 lessons or 4 weeks, every learning activity within it, every row in the teaching and learning program, should hit the target of this process verb. Every learning intention and each strategy being implemented should be clearly aligned to the development of the skills, understanding and knowledge needed to achieve the intention flagged by the chosen verb. In this way, with the learning processes represented in brackets after each phase, our thinking aligns to the [English Textual Concepts](#) (NSW Department of Education and English Teachers Association NSW, 2016).

The research kept us coming back to a focus on designing a supportive and flexible structure that would enable teachers to maintain a focus on learning intentions, student activity verbs, and teacher-learner interactions as they plan a program. The Stage 6 Phases Project was developed for this very purpose. Our understanding is that, in the typical eight-week timeframe, a teacher will move through several stages, aiming to meet the required outcomes, cover essential content and prepare for assessment. Thinking carefully about the nature of each of

these stages (or phases), enables teachers to focus on what matters: deep understanding and personal engagement connected to the conceptual focus of each module.

Table 2 provides an overview of the 8 phases, the essential knowledge and skills associated with each phase, and the learning processes and strategies that we might expect to match with those aims.

Our approach is very much that – an approach. It is not a rigid, one-size-fits-all template. We like to think of it as a ‘disposition’, or mindset, that ensures teachers are always aligning teaching strategies to purpose and impact. The phases are not prescriptive in several ways: teachers might weave separate phases together; a phase may last for part of a lesson or across several weeks depending on the module or class context; not all phases are needed in all circumstances; phases can be combined, recursive or con-

... the phases’ organisation is not mechanistic. It is meant to encourage teacher thinking and reflection, as well as careful planning and programming that is responsive to course, module, students and community context.

current; strategies could and should be adapted from one phase or module or case study text to almost any other if the thinking is there to support a teacher’s choices. Above all, the phases’ organisation is not mechanistic. It is meant to encourage teacher thinking and reflection, as well as careful planning and programming that is responsive to course, module, students and community context. So, for example, if you want to leave the unpacking of the module description until later, then so be it, as long as the delay is based on the sound principles we have established.

The phase	Essential knowledge and skills	Learning process and approaches
Engaging with module ideas and concepts	Develop a meaningful, personal and conceptual connection to the module	Engaging personally – you questions: personal preferences and the connection to student’s lives
Unpacking the module requirements	Guide student thinking about the nature and essentials of the module, and the role of the prescribed text	Understanding and connecting – what, when, where and how questions: student requirements, and the place in Stage 6 sequence of learning
Discovering the prescribed text/s	Facilitate a strong personal connection to the prescribed text and establish a ‘way of thinking’	Engaging personally – you questions: enjoyment, exploration, valuing personal responses and challenging perspectives
Engaging analytically and critically with texts	Develop an informed personal interpretation of the text while exploring its distinctive qualities	Engaging critically – why, how and evaluate questions: researching form, context, perspective; analysing and evaluating the positioning of the audience
Connecting critically and conceptually between ideas and/or text	Encourage meaningful connections in order to deepen critical and conceptual analysis	Connecting – how and why questions: connections within texts, across texts, across modules and across responders and forms; engaging critically in similarities and differences
Deepening text and module understanding	Explore and analyse how the text functions as a unified whole in relation to the module concepts	Engaging critically – when, how and why questions: debate, collaborate and synthesise
Writing creatively in response to the module and text/s	Experiment and reflect in order to enhance critical and creative response and composition	Experimenting and Reflecting – what if and how questions: ‘How are my writing and thinking impacted on by the texts studied?’
Preparing the assessment	Support students to action feedback and utilise planning and drafting procedures	Engaging critically, Experimenting and Reflecting – how questions: reflect on and evaluate progress

Table 2: Overview of the 8 phases, including essential knowledge and skills, learning processes and teaching approaches

The Phases approach in practice

Looking down the 'learning process and approaches' column of Table 2, a 'pathway' or scaffold through the teaching of a Stage 6 module is evident. This may be close to what is already being done, and simply provides the terminology to refine practice and ensure that the strategies chosen reflect the aims of each stage of the program. If, however, teaching has become somewhat directionless, floating from activity to activity or resource to resource, then this approach can help to structure the program so that the pathway is focused on deeper understanding and reflects the outcomes and conceptual thinking.

Importantly, the principles we have established apply both broadly across the term (macro level) and within the planning a teacher will do for an individual lesson (micro level). In the follow-up article in the next issue, we will dive more deeply into the distinction between macro (whole module) and micro (lesson) levels. We will also explore examples of individual lessons sitting within a broader macro phases progression.

To support teachers' work in Stage 6 programming, and prepare for our next article, several phases sequences are available on the NSW Department of Education website in the [English curriculum](#) section. We are also using the Phases to develop the sample teaching and learning material for the English 7-10 Syllabus (NES 2022) and this is available on the [Planning, programming and assessing English 7-10](#)

part of the English curriculum pages. Before our deeper dive into activity and lesson-planning, have a look at a number of these sequences to familiarise yourself with the layout, and to ground the explanations in this article in a few specific examples. Be mindful, again, that phases currently on the website reflect an earlier iteration of the project and you will notice some older phrasing. For example, the 'discovering the prescribed text' phase (formerly 'introducing the prescribed text') has been renamed to reflect a focus on the processes of the student, not the teacher.

On the website you will find, for example:

- ['Engaging analytically and critically' phase](#) – Standard English Year 11 Module B – poetry of Owen
- ['Engaging with module ideas and concepts' phase](#) – Standard English Year 12 Module B – *Curious Incident of the Dog in the Night-time*, and Advanced English Year 12 Module B – *King Henry IV Part 1*
- ['Unpacking module requirements' phase](#) – Standard English Year 12 Module B – *Curious Incident of the Dog in the Night-time*, and Advanced English Year 12 Module B – *King Henry IV Part 1*
- ['Connecting critically and conceptually' phase](#) – Standard English Year 12 Module C – Luka Lesson

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Animals in schools



.....
Sally Bannerman

Animal Welfare Coordinator, NSW
Department of Education
.....

Sally Bannerman outlines legal and welfare guidelines for the use of animals in schools.

The use of animals in schools is governed by several pieces of state and commonwealth legislation, with different pieces of legislation focusing on different species and their uses. The [Animals in schools](#) website aims to interpret this range of legislation and describe what schools need to know about the different ways various animal species can be used in NSW schools.

The legislation requires that all use of animals in schools is overseen and approved by the Schools Animal Care and Ethics Committee (SACEC). The membership of the SACEC includes veterinarians, teachers, animal welfare experts, community members and school sector representatives. The SACEC is responsible for developing the advice provided on the [Animals in schools](#) website and to the school sectors.

Over the last 5 years, there has been a rapid growth in the use of dogs to support students and staff in NSW schools. While no school deliberately mistreats or wishes to cause

distress to these dogs, the reality is that most programs focus on student welfare and the welfare of the dogs is at times compromised.

Many dog owners do not have the correct level of knowledge and skills to develop a program that delivers effective student and staff welfare while maintaining good animal welfare in the school context. Good animal welfare starts with understanding the physical and behavioural characteristics of the animal and this varies from species to species. Dogs are not human beings and therefore have different characteristics and needs. These can also vary between breeds.

The outcome of this is that a dog that is used in a school must be well trained and have particular behaviours that make it suitable for interacting with a range of students, without having its own welfare compromised.

The [School support dog guidelines](#) have been developed to inform schools about what they must do if they wish to use a dog. In developing these guidelines, consultation and advice was sought from a range of experts on the legal matters, as well as animal welfare and training.

As dogs are companion animals, the SACEC considers it unsuitable for a dog used in a school to be owned by the school. This makes the [Story Dogs](#) program an excellent way of introducing the benefits of a dog to a particular school. While Story Dogs is aimed at assisting students with their literacy, it also has benefits for staff and students in improving wellbeing and gives the school community a positive experience with a dog.

The use of animals in schools is governed by several pieces of state and commonwealth legislation, with different pieces of legislation focusing on different species and their uses.

Story Dogs are well trained, calm dogs and their handlers are well experienced in providing a really positive time for students who may be struggling with their reading. It has proved to be an excellent way of gaining the benefits of a dog without the additional work and resources required for a dog owned by a staff member.

Any school that is considering having (or already has) a school support dog must comply with the [School support dog guidelines](#) that are housed on the [Animals in schools](#) website. It is essential that schools adhere to the advice on this website as it is a requirement of the Animal Research Authority that is issued each year.

Additional information is available from the Animal Welfare Coordinator, animalwelfare@det.nsw.edu.au.

How to cite: Bannerman, S. (2023). Animals in schools. *Scan*, 42(3), 39–40.

The 'School support dog guidelines' have been developed to inform schools about what they must do if they wish to use a dog.



Figure 1: School support dog



Story Dogs – reading for fun, reading for life!



.....
Janine Sigley

Cofounder and Managing Director,
Story Dogs
.....

Janine Sigley discusses the value of the Story Dogs program for struggling and reluctant young readers.

The Story Dogs vision

The Story Dogs vision is to make reading fun for children so they become confident lifelong readers.

[Story Dogs](#) is a reading support program for primary school children who are struggling with their reading. That said, it's a program with a BIG difference; we use calm, gentle dogs to make the sessions fun and bring children into the wonderful world of reading and books.

When children read to a dog, the outcomes are amazing. The accepting, loving nature of dogs gives this program its magic and helps children relax, open up, try harder and have fun while reading to a friendly, calm dog. In a non-judgemental setting, the children's focus improves, their literacy skills increase and their confidence soars.

Story Dogs has grown in leaps and bounds. From our first Story Dog school in 2009, Murwillumbah

East Public School in northern NSW, the program now runs in over 363 schools around the country and helps over 3000 children every week.

'Oh gosh – the chaos of a dog in the classroom!', I hear you say. Wagging tail knocking books from desks, big sloppy licks to small faces, shrieks of excitement; all order thrown out the window! But this is not what the Story Dogs program is about. Story Dogs volunteers work closely with the classroom teacher, who chooses the students, and the dogs NEVER come into the classroom unless invited. This could be very disruptive and not every student or teacher likes dogs. The one-on-one 20-minute reading sessions, therefore, happen outside the classroom in a nearby area.

Our volunteers are trained to let the children go at their own pace; to read to them if they are not yet ready to read and to use the dog to break down any barriers. The volunteer might say, 'Polly doesn't quite know what is happening on this page, can you explain it to her?' and all of a sudden the child is the teacher and their confidence blossoms.

Our four-footed friends

The story dogs are calm and gentle and have gone through a 10-point accreditation assessment, so only the most suitable dogs go into schools. The welfare of the dog is very important to Story Dogs; one of our mantras being, 'A happy dog is a safe dog.' If our dogs are happy and want to be with the students, then the students are also safe.



Figure 1: [Story Dogs promotional video](#) [2:36 minutes, YouTube]



Figure 2: Poppy the Story Dog and his owner enjoying being read to by a young student

Our volunteers are trained to look for signs of stress in the Story Dogs. If a dog gets stressed, our volunteers will change the situation or end the reading session. They also monitor their dogs to check for subtle signs that may suggest that the dogs are no longer delighted to be going to school. In those cases, we retire the dogs and let them sleep away their days in a sunny spot at home.

The benefits of Story Dogs

We know there are many benefits of the Story Dog program, as exemplified in this comment from a parent:

My son read to Polly last year and looked forward to Wednesdays every week. He is so much more confident now because of Robyn and 'Polly'. Even though he is too old for the program this year, he mentions at least once a week how much he misses 'Polly'. He even shed a few tears knowing that she won't be attending the school anymore. Thank you so much Robyn and 'Polly', you have changed my son's life for the better.

Schools have also provided feedback on the effectiveness of the Story Dogs program: 'Our students love seeing Ginger and Alison each week' says Uki Public School Principal, Rachel Watkins: 'We've had the Story Dogs program running here for many years, and the benefits across the school are enormous. Not only do children develop greater confidence with their reading, but having a beautiful dog in the school helps all our kids develop sensitivity and empathy. Ginger keeps everyone calm and makes us all smile!' Best of all is the

mutual benefit of the program. Alison, Ginger's owner, notes that 'Ginger's had an adventurous life and takes most things in his stride ... he loves his visits to Uki Public – he and I both.'

Beyond voices in praise of Story Dogs, 'measuring' the benefits of the program is a little trickier. Teachers do a wonderful job of teaching reading and parents are also often involved, so separating the work of Story Dogs from all the other inputs a child has towards their reading is hard. However, we consistently receive feedback from teachers that reluctant students, who did not like reading or struggled with it, are now wanting to read, turning up for their sessions and looking forward to reading with a dog. This change in attitude then flows onto the classroom, where the students become more engaged and show higher self-confidence.

Getting involved

The Story Dogs organisation tries hard to make it easy for teachers to adopt its program. Setting up the program entails a school orientation meeting with the volunteer Dog Team, the Story Dogs regional coordinator, teachers involved, and the



Figure 3: Student reading to a Story Dog

When children read to a dog, the outcomes are amazing. The accepting, loving nature of dogs gives this program its magic ... In a non-judgemental setting, the children's focus improves, their literacy skills increase and their confidence soars.

main contact from the school who will be the liaison person. At this meeting, teachers get to meet the dog (the fun part!), work out the nitty gritty (what day and time for visits), and choose an appropriate and comfortable place for the reading sessions that ensures child protection aspects are acknowledged. After the initial program set-up, the weekly visits flow along with no need for any intervention. In no time at all, the Dog Team soon become the superstars of your school. Students love our dogs and put reading at the top of their wish list.

We have volunteer Dog Teams in NSW, Queensland, Victoria, Tasmania, Western Australia, South Australia and the ACT. Unfortunately, the program does not operate in all areas, but we are always looking to expand. If you are in the following areas of NSW and want the program in your school, we can currently help and would love to hear from you: NSW North Coast, Grafton, Kempsey, Illawarra, Newcastle, Collaroy, and Cronulla.

If your school is in an area that we do not currently support, we would need to find a local person who is willing to start a chapter of Story Dogs in your area. We are happy to provide training and support, if you and your school can find a suitable volunteer (and dog). More information to get the ball rolling is available on the Story Dogs [School Information](#) page.

Let's work together to create a safe, fun, supportive, non-judgemental environment for primary school aged children needing assistance with literacy. Woof Woof!

How to cite: Sigley, J. (2023). Story Dogs – reading for fun, reading for life. Scan, 42(3), 41–43.



Motivating readers – using Rosenblatt’s transactional theory to enhance literacy learning



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Dr Taryn Moir

Senior Educational Psychologist,
Inverclyde Council, Scotland
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In the context of the broad literacy landscape, Dr Taryn Moir draws on the principles of transactional theory to illustrate one possible approach teachers can use to create more meaningful, engaging and interactive reading environments for students.

As a senior educational psychologist, I am often called upon to support schools with complex issues related to teaching and learning. One recent dilemma that I encountered involved a struggling reader in a classroom setting. The student, who we will call Susie, lacked motivation and interest in reading, which made it difficult for the teacher to engage her in anything connected with books. The teacher, who we will call Jane, had tried a variety of approaches but nothing seemed to work. She was getting increasingly frustrated and so to assist, I drew Jane’s attention to the principles of transactional theory.

What is transactional theory?

Transactional theory, developed by Louise Rosenblatt in 1978, is a model of reading that emphasises the importance of the transaction between the reader and the text. Although a seemingly 'old' model, it remains relevant today. According to Rosenblatt, reading is not a passive activity where the reader simply absorbs information from the text. Rather, it is an active process that involves a back-and-forth interaction between the reader's background knowledge, prior experiences, emotions and attitudes, and the text itself. This interaction is what creates meaning and comprehension.

Through the concept of the efferent-aesthetic continuum, Rosenblatt's model was one of the first to highlight differences in the way that readers can approach a text, whereby, in the reading process, the reader uses signals in the text to adopt the appropriate approach. An efferent stance by the reader is associated with non-fiction, or informational texts, where the reading goal is primarily to extract information from the text in an efficient manner. The focus here is "outside" the reader and the information/ideas encountered are for use beyond the reading session.

In contrast, an aesthetic stance is usually associated with fiction texts and reading for pleasure. There is a creative process involved that brings together the signals on the page with the reader's stream of thoughts and feelings (also regarded as the environment of engagement). This active and dynamic relationship develops a framework within which the information can be organised. The text becomes understood through the dynamic transaction, interaction and relationship created between the reader and the text. Therefore, the same piece of text may be interpreted in completely different ways, depending upon the reader's relationship

... reading is ... an active process that involves a back-and-forth interaction between the reader's background knowledge, prior experiences, emotions and attitudes, and the text itself.

with, and experience of, the text. Here, meaning is developed through the process of reading and creating interpretations within the mind, rather than comprehension being solely a product of the text.

Implications for the classroom

The implications of the transactional model for the classroom are that, since different types of text exist for different purposes, instruction around the reading of each piece of text needs to be suitable. For example, asking a child only fact-based, memory-driven questions within a narrative text lesson may reduce enjoyment and motivation to read. Instead, a range of carefully considered question types should be employed across the variety of texts. If the wrong questions are asked, we could, as educators, be inadvertently killing our students' motivation to read.

Teachers, therefore, need to help students discover the purpose and benefits of reading by focusing on why they should learn to read, how reading is beneficial and the use of reading in real life. Sometimes, the purpose might be to read purely for pleasure. If this is articulated, teachers are giving children permission to immerse themselves in fiction. If they know the child, they can use knowledge of the students' interests to tailor the reason for any lesson. For example, if a child is reluctant to write, but wants to develop friendships, reframe the purpose of that writing to be about developing the skills needed for writing cards and letters to friends.

Identifying appropriate reading strategies

Returning to the example of Jane and Susie, and putting transactional theory into practice, Jane discussed with Susie what her interests were. Susie liked swimming and so Jane helped her select a book about a young girl who wanted to swim in the Olympics. Together, I worked with Jane to help her identify some reading comprehension strategies that would be appropriate for this type of text and, because Susie was an avid swimmer, we recognised that a good metacognitive strategy would be 'linking to wider experiences.' This is one of several metacognitive strategies which enable the development of autonomous learners (Moir, 2022).

Using the 'link to wider experiences' strategy, the connections between a text and a student's life experiences and knowledge:

- deepens students' understanding
- helps students to understand how characters feel and the motivations behind their actions
- sets a purpose for learning and maintains focus
- encourages learners to be actively involved
- helps them to remember, connect and ask questions.

I discussed with Jane how she could get Susie to think about how the text related to what she already knew. What had Susie already read on the subject? What did she do? What was new to her? Would she react in the same way as the main character? Jane then encouraged Susie to relate the text to herself. Jane modelled her own thought process while reading by saying things like, 'When I was reading this, it immediately reminded me of a time when ...' or 'That's interesting because something like that happened to me.' This helped Susie become more aware of her own thought processes during reading and, therefore, made her more metacognitively aware.

Embedding the strategy

I also discussed with Jane how the skill of linking other texts to their experience and knowledge might be embedded in Susie and other children, and we came up with the following ideas:

- Have students visit different places around the school, take photographs and make sketches of what they see.
- Have students interview local people and carry out research about the information they gather and how it is connected.
- Discuss how an abstract form, such as a sculpture, could connect with and represent students' new knowledge, then have them design and make a sculpture.
- Visit another school and have students draw comparisons with their own by noticing connections and links and talking about them explicitly. Encourage students to explain the links that they identify.
- Remind students of links between skills and areas of knowledge.
- Model integration as a way of learning.

- Turn stories into other media, such as videos and poems. Talk about what stayed the same and what was different.
- Use graphic organisers. Spidergrams or mindmaps help students to work from a central idea to create a rich and more complex network of associated ideas in a non-judgemental and non-linear way. They can also help plan essays.
- Identify language links. Find words that sound similar in different languages; for example, words ending in 'ation.' Use colour to highlight similar sounds.

Consolidating the strategy

Jane and I also recognised the importance of implementation. One of the things that supports new strategies being put into practice is the words that we, as educators, use. Therefore, we began to identify some language and phrases that Jane could use to help further embed the skill of 'linking to wider experience' and came up with the following prompts:

- What does it tell you about ...? How is it different to your own experiences?
- Can you see any connections?
- Can you see a pattern here?
- What do you know already that could help? What else do you know?
- Can you see a link between what we did in ... and what we do ...?
- How might knowing ... help you do ...?

Successful learners

Susie became really immersed in the stories about the swimmer and this enabled her to see herself as a successful reader. It is important to create such opportunities for students to see themselves as successful as motivation is highly linked to self-efficacy (Bandura, 1977). Pitching a task so that it is a challenge without being demoralising, however, is not easy. The activity needs to be moderately, not excessively, stretching; too easy is boring and too difficult is disheartening. Pitching a task at the right level can only be done effectively by getting to know the learner both directly and by having discussions with others who have also taught or teach the child. Transitions between schools is an obvious time to share information, yet the quality of transition information can vary, just as the level of engagement with transition information might differ.

How could your transition discussions be improved? Usually, transition information about children is more meaningful in face-to face-discussions rather than in the volume of paperwork.

Student choice and student voice

Giving Susie learning or reading choices was very important to re-engage her in reading. Where possible, it is always worth trying to give reading and learning choices as it increases the learner’s sense of autonomy. Even as adults, we are more likely to read a book that either we have chosen ourselves or has been personally chosen for us than one that is randomly handed out; why would it be any different for children?

The importance of vocabulary

It is worth noting that, because Susie regularly went swimming, she was familiar with the vocabulary in the text. This highlights how important it is to ensure that children understand the vocabulary in a text, since vocabulary is the basic building block of comprehension. If one knows the core vocabulary within a topic, the learning process will be much easier. If words within the text cannot be understood, inference and bridging strategies (higher-order strategies) will be useless.

Table 1 can be used to do a vocabulary audit prior to starting a new topic, so that the teacher can see what vocabulary needs to be explicitly taught. Students should be made aware that the table is a formative assessment tool to help the teacher and definitely not an assessment of the student.

Once teachers have gathered the information from the vocabulary audit, explicit vocabulary instruction

is generally accepted as necessary to ensure that the literacy gap between higher and lower-achieving students is minimal. Intentional instruction in vocabulary is especially beneficial for children living in areas of high deprivation with a higher proportion of struggling readers. However, some research (Burns et al., 2017) indicates that this is not regularly part of lessons.

From a cultural equity perspective, prerequisite knowledge should never be presumed, and topic-specific vocabulary needs to be taught to enhance students’ understanding and inference skills. In addition, when teaching children of varying socioeconomic backgrounds, there is potential for unintentional discrimination within the group when new ideas may not be equally accessible to all children. We can address these issues by taking a multisensory approach whereby, instead of only giving a definition for a word that students are trying to learn, we give them more things to attach meaning to the new word. For example, talk about what the word looks like or sounds like. The more ‘hooks’ a child has for different words, the more likely they are to understand it. Children also learn new vocabulary better if the learning is active and social; for example, in drama skits or drawing maps with a partner.

Transactional theory throughout the curriculum

The principles of transactional theory can be applied more broadly across literacy and indeed, throughout teaching. By emphasising the importance of active engagement and interaction, teachers can create more effective and meaningful learning experiences for their students. This approach also has implicat-

Key unit vocabulary	I know this word, it means ...	I have heard of this word, but I’m not quite sure what it means	I don’t know this word

Table 1: Vocabulary audit

ions for student motivation, which is a key factor in academic success. One practical example of how to increase motivation in the classroom is to focus on students' intrinsic motivation. This means tapping into their natural curiosity and interest in the subject matter, rather than relying on external rewards. Teachers can do this by incorporating real-world examples and connections into their instruction, as well as providing opportunities for student choice and autonomy.

Continuing to motivate

Another key element of motivating students is to create a sense of community and belonging in the classroom. Teachers can do this by incorporating collaborative activities and opportunities for peer-feedback into their instruction, as well as creating a positive and supportive classroom culture.

Ultimately, the principles of transactional theory and the focus on student motivation have significant implications for teaching and learning in the Australian context. By tailoring instruction to meet the unique needs and interests of individual students, teachers can create more engaging and effective lessons.

In the case of Susie, we used the principles of transactional theory to create a more engaging and interactive learning environment. We started by identifying her interests and incorporating reading materials that aligned with those interests. We also worked on building Susie's confidence and self-efficacy as a reader. This meant providing regular opportunities for her to succeed and celebrating those successes when they occurred. We used positive feedback and encouragement to build Susie's confidence and encourage her to take risks in her reading. Another key element of our approach was to create a sense of ownership and autonomy for Susie – we empowered her to take an active role in her learning. This meant giving her choices and allowing her to have a say in her reading materials and the types of activities she engaged in.

Through these strategies, we were able to create a more engaging and interactive learning environment that motivated Susie to become more active and involved in the reading process. She began to see herself as a capable and competent reader, which further motivated her to engage with the text and build her skills.

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Writer biographies



Dr Anne Forbes

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Dr Anne Forbes has a wide range of science-related experiences including being a plant pathology researcher, primary school science teacher and currently, a university researcher and educator in STEM education at Macquarie University. She describes her role as ‘finding effective ways to open doors to the world of science and STEM for learners and their teachers’ and hopes that her article provides such an opportunity for readers.



Becky Laurence

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Becky Laurence is the Program Coordinator for Future You, a national awareness-raising initiative from the Australian Government’s Women in STEM strategy. She is passionate about driving equity in STEM through focused efforts that address stereotypes and build stronger communities. Becky has previously been responsible for developing marketing and communications strategies that improve the lives of Australians.



Dr Cathy Sly

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Cathy Sly is an independent researcher and writer. After teaching English in NSW Department of Education high schools for many years, she completed a PhD in Media, Communications and Creative Arts at Deakin University. Cathy has a keen interest in visual literacy and multimodal literature for readers of all ages. She has presented at academic conferences and contributed to scholarly publications both in Australia and overseas.

Writer biographies



Carmel Grimmert

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Carmel Grimmert is Library Coordinator with the NSW Department of Education. For 20 years, Carmel was a teacher librarian at a large primary school in the inner west of Sydney. Before becoming a teacher, she worked as a children's librarian in the public library system. Carmel has previously served on the committee of her local teacher librarian network and has acted as a mentor for newly graduated teacher librarians in NSW public schools. She is committed to supporting the provision of high functioning school libraries which encourage reading engagement and enable the development of information fluency and critical thinking skills.



Dr Tom Gyenes

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Dr Tom Gyenes is a Curriculum Implementation Officer within the Secondary English curriculum team at the NSW Department of Education. He is passionate about supporting secondary English teachers with engaging and effective programming development, teaching resources and professional learning. He has a PhD in education and has been a high school English teacher in the public system for 22 years, four of those as a Head Teacher.



Jacque McWilliam

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Jacque McWilliam is the English Advisor 7-12 with the NSW Department of Education's Secondary English curriculum team. She has worked in semi-rural and metropolitan high schools as an English teacher and Head Teacher. She is passionate about supporting teachers and faculty leaders during their English curriculum implementation journeys. She is currently researching teacher perspectives of programming and has an interest in curriculum enactment.

Writer biographies



Sally Bannerman

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Sally has been the Animal Welfare Coordinator for the three school sectors in NSW for over 20 years; a role that reflects a successful career as a teacher of agriculture and science. She has spent her life working and managing animals, which have given her practical skills and experiences that complement her degree in agricultural science and teaching qualifications. Sally currently works in the Curriculum Secondary Learners team for the NSW Department of Education where she manages the use of animals for 3500 schools across NSW.



Janine Sigley

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Janine has a science background, working for over 20 years in environmental management, including 10 years managing volunteers in a community water quality monitoring program throughout south-east Queensland. She has grown up with dogs and, on seeing a similar program in the USA, realised how Story Dogs could fill a need in Australia. Janine and Leah Sheldon founded Story Dogs in 2009 and Janine has worked ever since to make sure the program is helping as many children as possible.



Dr Taryn Moir

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Taryn Moir is a Practitioner Senior Educational Psychologist practising within a local authority in Scotland and responsible for project work, policy development and in-service training for many primary and secondary schools. She was a lecturer in Educational Psychology at the University of Strathclyde and is now an assessor and supervisor for the Level 2 Qualification of Educational Psychology Scotland. Taryn is also Review Editor for two international journals, and author of *How to Create Autonomous Learners* (2022); *Teaching metacognitive, self-regulatory and study skills – a practitioner’s guide* (Routledge).

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