NSW GOVERNMENT | Education

Volume 35, Issue 2, 2016

Scan

the journal for educators

In this issue

Scan

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Volume 35, Issue 2, 2016

Scan is a quarterly refereed journal that focuses on information in a digital age and effective student learning. *Scan's* articles and reviews explore the use of curriculum resources in the learning environment.

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from the editor

Welcome to the second issue of *Scan* for 2016.

How can we prepare our students for a future global workforce? What skills and knowledge will they need? What opportunities and support do digital technologies offer? The focus on STEM education highlights opportunities to develop relevant skills and classroom practice so that our students are prepared for a global future. Share the resources and ideas with colleagues at your school.

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reflections

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Digital technologies for learning

How do you use digital technologies to engage students? There are ever increasing options. How do you select the best for working with your students? Are there curators you follow?

Allan Booth's introduction to the coming national digital learning hub, consideration of what we mean by digital technologies and resulting exciting learning opportunities, makes thought provoking reading. It is a succinct curation of some linked gems for dipping into and for further exploration, with particular reference to the Australian curriculum context. Readers may also wish to consider the Digital Education Research Network's (DERN) latest articles: *How teachers impact digital literacy* and *MOOCs and professional development of teachers*.

Joyce Valenza offers stimulating curations for further professional reading. Explore, for example:

- *Joyce Valenza's homepage*
- *Digital storytelling tools*
- *Tech learning*
- *What school leaders need to know about digital technologies and social media*

Integration for student focused inquiry

Synergies with aspects of digital technologies for engaging students are reflected across the articles in this issue. *STEM education: the story so far* reflects on NSW Department commitments to integrated approaches to develop critical and creative thinking skills in meaningful contexts. *A science, technology, engineering and mathematics (STEM) review of the research* reinforces the evidence base for this approach. It covers significant issues that inform effective STEM education, including pedagogical practice. The STEM related springboards in the Resource reviews section offer practical ideas for using resources to support programming. We look forward to more on school projects in future issues.

Dr Peter Gould's article provides an enticingly readable view on the nature of problem solving. He offers creative ways to translate this in the mathematics classroom.

Using Oliver to engage learners and *Rough medicine: a Twitter tour* further explore the meaningful use of digital tools and resources.

Sharing Learning with *Oliver*

Again, *Scan* offers much to stimulate and engage. Share it with colleagues at your school. Let us know how you make use of the ideas in your practice and professional learning.

Libraries for future learners 2016

It's on again on Monday 17 October 2016! See *Share this* and watch the School libraries support website for further information.

Finally, I would like to welcome on board our updated and broadened *Scan* Editorial Board. We look forward to their wisdom and support guiding *Scan* into the future.

Exploring *Scan's* **online edition**

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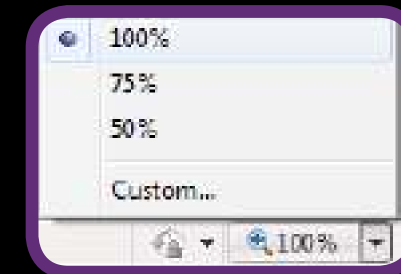

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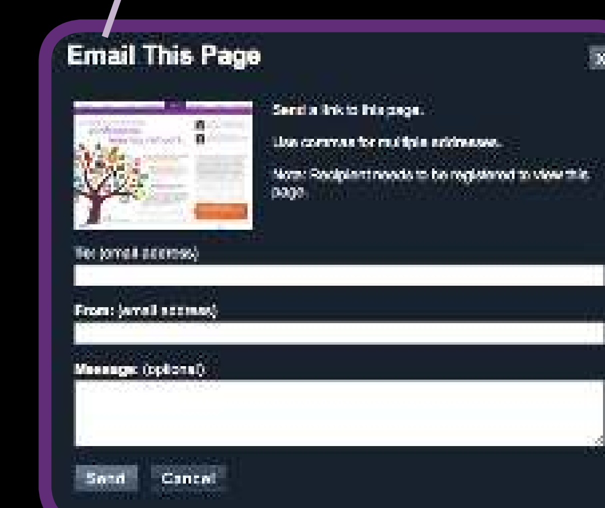

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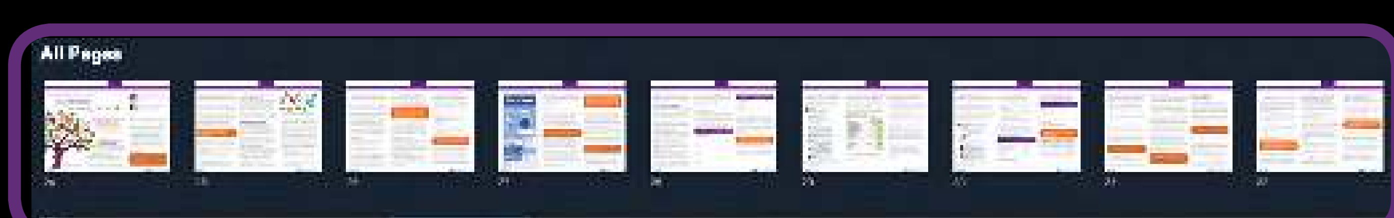

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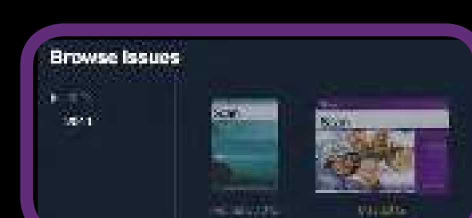

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For more tips, **click here** to view ***Scan's*** video taster.

STEM education: the story so far

The STEM education advisory team, Learning and Teaching Directorate, introduces STEM education. The article indicates the team's collaboration with schools on numerous projects and programs to enhance and promote STEM as an integrated approach to teaching.

STEM | SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS

NSW Department of Education

STEM education is the learning of science, technology, engineering and mathematics in an interdisciplinary or integrated approach. Students gain and apply knowledge, deepen their understanding and develop creative and critical thinking skills within an authentic context. STEM education is for all students and should be incorporated throughout all stages of learning from preschool through to Year 12.

The *Melbourne declaration on educational goals for young Australians* (MCEETYA, 2008) identified knowledge of disciplines, literacy and numeracy as core skills and the development of critical and creative thinking, problem solving skills and digital technology skills as essential to all occupations. The opportunity to develop these areas is at the core of STEM education. The Chief Scientist's report, *Science, technology, engineering and mathematics: Australia's future* (2014) raised awareness across the nation for the need to develop a national STEM strategy.

In 2015, the Education Council (COAG) released the *National STEM school education strategy 2016–2026, a comprehensive plan for science, technology, engineering, and mathematics education in Australia*. The strategy outlines two goals:

- Goal 1: Ensure all students finish school with strong foundational knowledge in STEM and related skills.
- Goal 2: Ensure that students are inspired to take on more challenging STEM subjects.

These goals focus on students' journeys within and beyond secondary schooling. However, the Department sees the importance of a STEM strategy that is inclusive of the early years of learning for students to develop the necessary skills and processes required to build this strong foundation. Therefore the Department's response to these goals is to ensure both primary and secondary schools are involved in integrating STEM disciplines and making connections across relevant syllabuses.

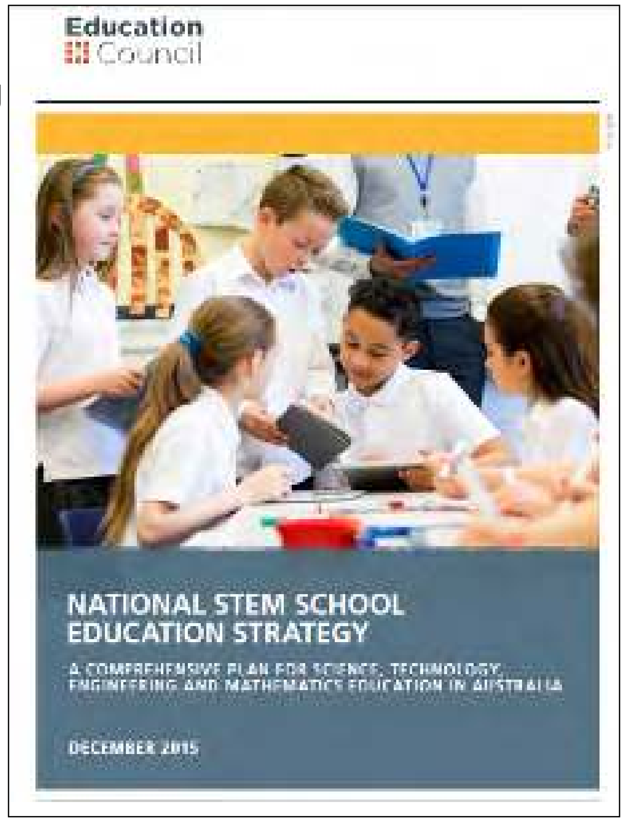
This strategy (COAG, 2015 p.7) identifies five key areas for national action:

1. Increasing students STEM ability, engagement, participation and aspiration.
2. Increasing teacher capacity and STEM teaching quality.
3. Supporting STEM education opportunities within school systems.
4. Facilitating effective partnerships with tertiary education providers, business and industry.
5. Building a strong evidence base.

STEM directions

The Department is taking the following directions to ensure the delivery of quality STEM education for all students. It is:

- raising expectations and enhancing the quality of student learning in STEM
- fostering quality teaching and leadership in STEM
- creating innovative ways of delivering STEM education.



Actively engaging students in authentic and challenging STEM learning experiences by creating learning environments that foster innovation and creativity is fundamental to the success of STEM education in schools.

The Department has initiated numerous STEM projects during 2015 and 2016.

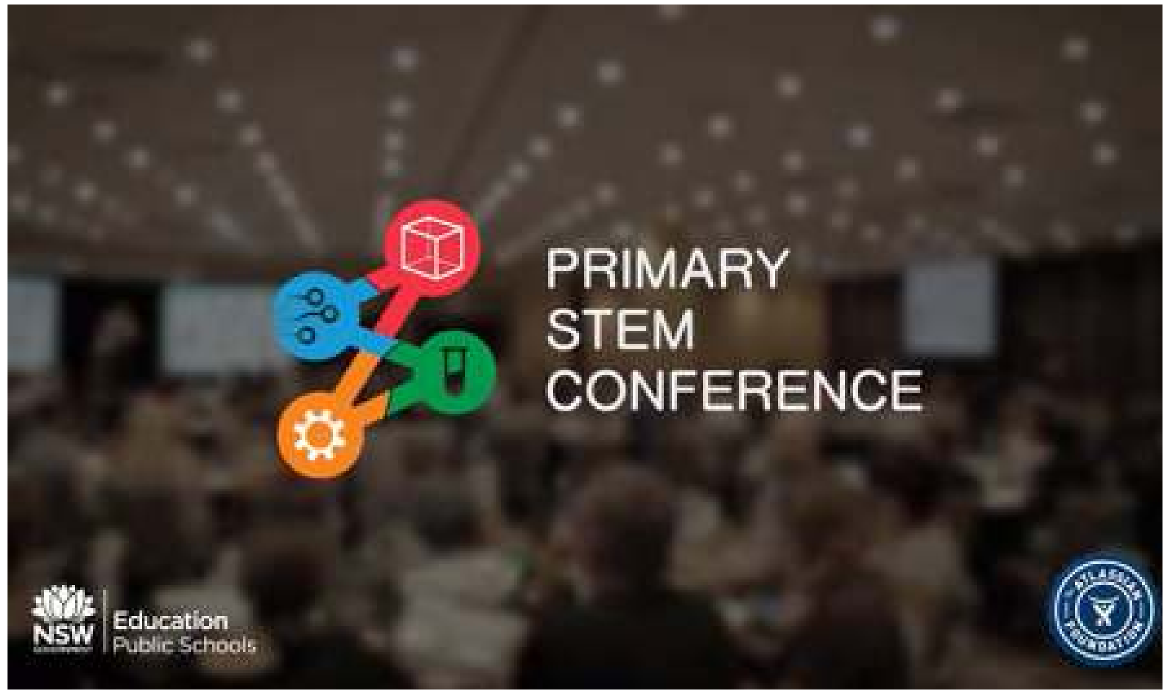
Stage 3 STEM Project

The *Stage 3 Integrated STEM* Project has adopted an integrated approach to teaching mathematics and science and technology in Stage 3 classrooms. The Project aims to:

- develop learning experiences through the use of project based learning strategies
- improve student learning through pedagogical change
- provide schools with the opportunity to evaluate teaching and learning practices
- trial quality integrated STEM programs in schools across NSW.

Teachers from 35 schools, working either as individual schools or communities of schools, are involved in the project. Schools will document their journey in STEM education, highlighting their processes for embedding STEM in their school culture and in classroom teaching and learning practices. The focus is on developing working mathematically, working scientifically and working technologically developing skills through design processes and making connections across the NSW *Mathematics K–10 syllabus* and NSW *Science K–10 (incorporating Science and Technology K–6) syllabus*. Teachers will use design thinking methods to develop problems and find solutions, engaging their students in these processes as co-creators of the learning.

Integrating STEM learning allows teachers to place a greater focus on the general capabilities of our syllabuses such as critical and creative thinking, information and communication technology capability and personal and social capability. Teachers create opportunities for students to have a voice and choice in the problems they solve while addressing the necessary outcomes. Teachers can provide flexible learning spaces where students can collaborate and communicate their ideas, building necessary interpersonal skills that are so highly valued by future employees.



NSW Department of Education, Primary STEM Conference, Sydney **by NSW DoE**

This video highlights the experiences of the Stage 3 project school teachers as part of the professional learning conference. Schools were provided with opportunities to work within their school team and across school teams during the conference. The teachers were highly engaged in the design thinking tasks and developed plans for future innovative programs to be implemented in their schools. Teachers embraced STEM as an integrated approach to providing students with authentic, meaningful project based learning that made connections across both the mathematics and science and technology syllabuses.

Some teacher comments on the conference:

> *I am very keen to use the HOW to teach the WHAT, using inquiry as a strategy to engage and inspire my students.*

All students are able and will be able in the future to take ownership of authentic learning experiences in and out of the classroom.

These positive beginnings to our project provide a starting point to innovative practices that will result in a bright future for students in NSW Public Schools.

Stage 4 STEM Project

The *Stage 4 Integrated STEM Project* promotes an interdisciplinary approach to teaching science, technology, engineering and mathematics in Stage 4. Teachers engaged in cross-curriculum planning with a major focus on aligning syllabus outcomes, promoting higher order thinking through authentic project based tasks. The unit of learning provided a guide for integrated teaching and learning, inquiry learning and design thinking. These resources will soon be available on the NSW Department of Education STEM website.

In addition, eight secondary STEM Action Schools were identified across the state with the intention of supporting other schools in STEM education. Schools involved in this project share and support effective STEM pedagogy, illustrate innovative practice for student engagement in STEM and demonstrate successful leadership, professional learning and industry partnerships.

One approach that secondary schools within our project have taken was to integrate science, mathematics and technology through project based learning. To integrate STEM successfully into the curriculum the first step to planning involved teachers discussing existing programs, scope and sequences and assessment strategies. Working together as the STEM team, teachers shared the concepts, made connections between outcomes and designed authentic teaching and learning experiences for students. By discussing the possible contexts for application and project learning ideas, teachers made connections between subject areas and designed appropriate student centred projects.

STEM and project based learning

Project based learning provides an opportunity for real world connections to be made and contexts explored within the four disciplines of STEM. Project expectations are made at the start of the project and are revisited with checkpoints for understanding using a range of assessment strategies. Students have models and guidelines for high quality work and know what is expected of them to successfully complete the project. Opportunities for reflection, feedback, and modifications are provided through various stages in the project. Technology is used in a range of ways to enhance and promote student learning and deepen understanding.

Projects pose important question for students to think about and inquiries for students to explore. Students engage in critical and creative thinking as they solve the problem presented. Teachers play a crucial role in framing questions and guiding students to think and frame their thoughts, and to devise possible solutions as they work mathematically, scientifically and technologically to solve problems which present themselves.

A major consideration when planning projects is catering for the learning needs of all students. Students learn best by making connections, designing, building, testing, evaluating and modifying designs until the project outcomes are achieved. Throughout this process students are actively engaging in critical and creative thinking. They engage in active problem solving by gathering data to inform their:

- planning when they conduct investigations
- designing
- development of prototypes and solutions.

Students leverage digital technologies throughout the project in communicating findings, solving problems, and assisting with the collation and analysis of data.

The *Reasons to do better* video explores 21st century learning concepts. It highlights the skills developed during project based learning, collaborations between students and teachers, the integration of technology and the importance of assessment during the learning experiences.

Reasons to do better **by Intel**

An example of curriculum planning for integrated STEM in primary schools

STEM learning experiences involve explicit learning and teaching of syllabus content which is applied in project, problem or inquiry based learning situations that are authentic and contextual.

Considerations:

1. Students have a voice in facets of their learning
   - focus of project
   - mode of communication of findings/solution
   - materials, investigations and strategies to be undertaken.
2. Length of allocated class time needs to sustain deep thinking, investigation and an integrated approach.
3. Co-creation of learning experiences and assessment tasks need to include all stakeholders, classroom teacher, teacher librarian, RFF teacher and students.
4. Students have the opportunity to experience a variety of strategies, manipulate a variety of materials and develop skills in the use of a variety of tools and equipment.
5. STEM education is a way of thinking and doing which involves pedagogy, spaces, internal and external agencies.
6. Results and/or products of project based learning experiences need to be shared and presented to authentic audiences.

Effective curriculum planning and programming for STEM learning and engagement supports teachers to differentiate their practice in response to the varied ways students learn. Figure 1 features aspects for consideration when designing engaging STEM learning programs for all students.

Every student:

- has unique abilities and potential
- has needs shaped by background
- is entitled to learning across the curriculum
- needs teachers to cater for abilities
- needs teachers to have high expectations.

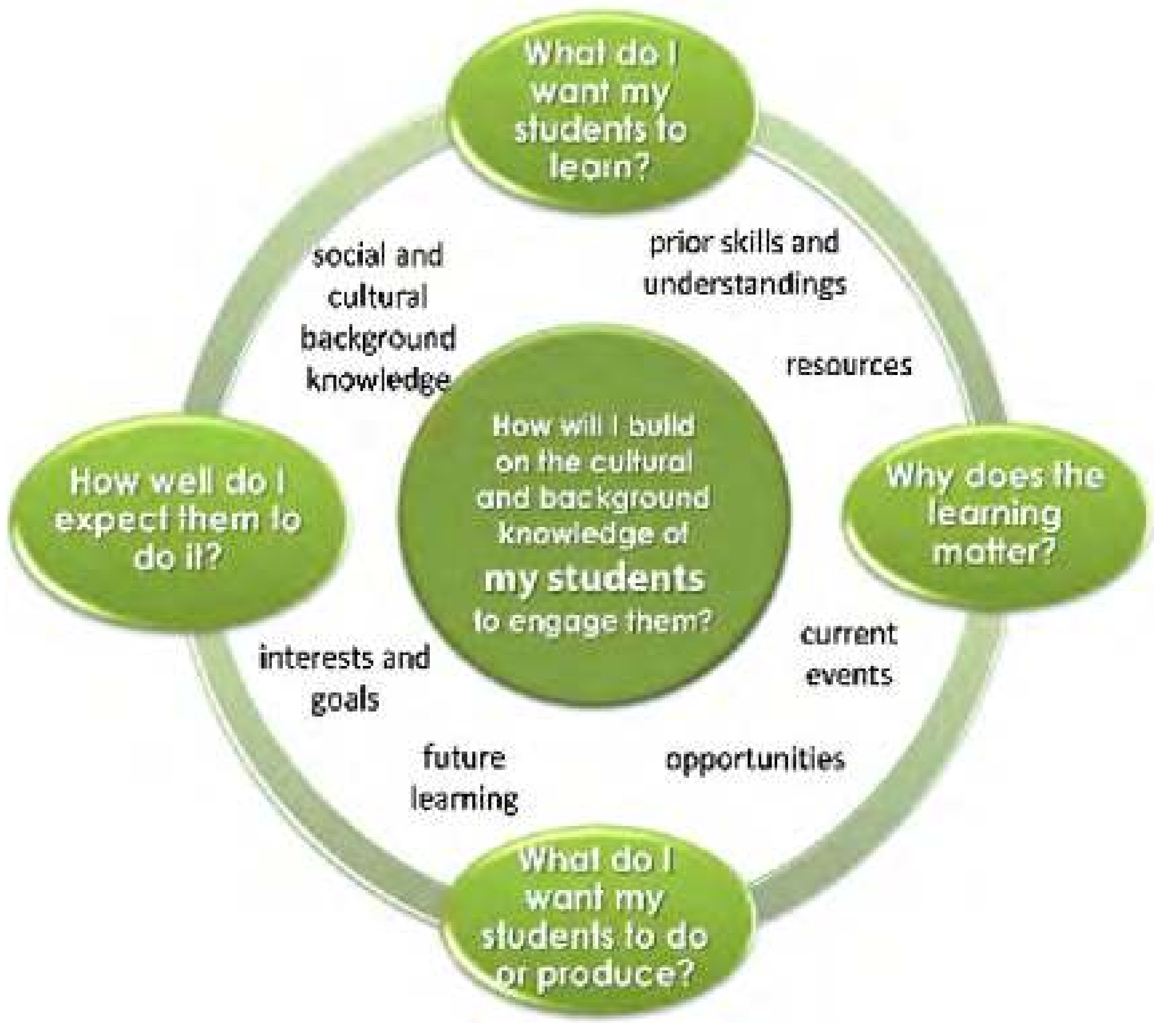


Figure 1 ***Designing engaging STEM programs*****, Learning and Teaching Directorate, NSW Department of Education**

An example of curriculum planning for integrated STEM in secondary schools

Considerations:

1. Integrated STEM programs are both skills based and content rich with a major focus on the applications in science, technology, engineering and mathematics.
   - developing skills that improve literacy and numeracy, with references to the Literacy continuum K–10 and the Numeracy continuum K–10
   - applying the processes of working technologically, working mathematically and working scientifically skills as intended in the syllabuses
   - providing opportunities for development of 21st century skills and general capabilities such as communication, collaboration, problem solving, self-evaluation, ICT, critical and creative thinking, personal and social capability.
2. Ensure and monitor the presence of academic rigour and ongoing assessment.
3. STEM programs become embedded into the school culture. They are valued, driven and owned by the whole school learning community
4. STEM programs are planned, developed and implemented by an integrated STEM team with succession planning considered to ensure sustainability.
5. STEM programs are an alternative method of delivery of part of the curriculum, not compromising, or adding to, existing curriculum.
6. Consideration could be given to financial implications and how schools fund professional learning, teacher release and resources.

An Integrated STEM framework – development process for secondary education

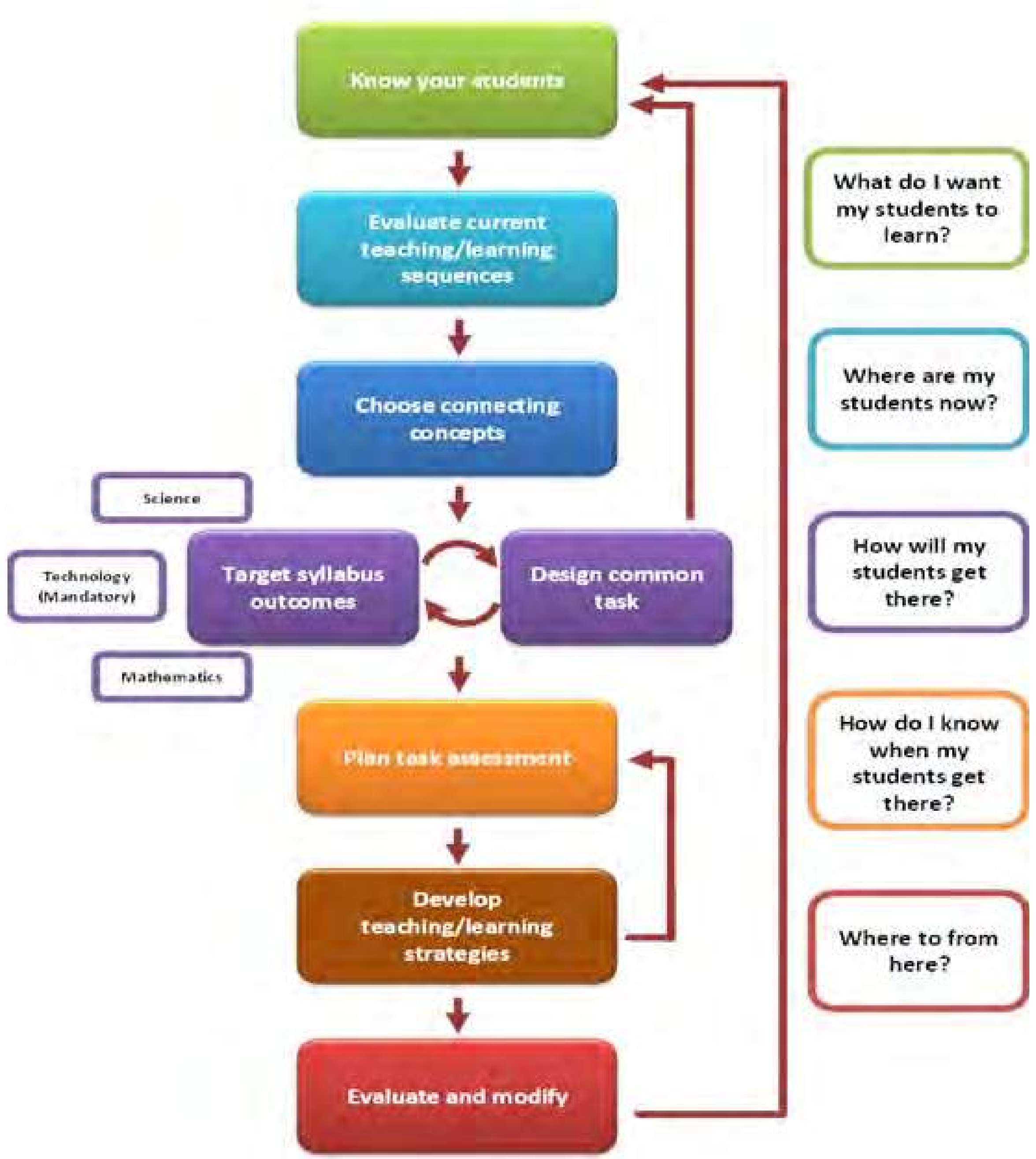


Figure 2 *An Integrated STEM framework – development process for secondary education*, Learning and Teaching Directorate, NSW Department of Education 2015

STEM education caters for all students. When planning a STEM project, it is essential for teachers to:

- know your students, their needs and interests
- evaluate current teaching and learning sequences, and develop an integrated sequence for the STEM project
- choose the connecting concepts, ideas or theme and map to an appropriate STEM context
- design the common student task and various assessment checkpoints for students to demonstrate learning
- target syllabus outcomes, highlight skills students will require to be successful with the project work
- plan assessment of the common student task with explicit quality criteria and success checklists
- plan teaching and learning strategies, sequences for explicit teaching of certain skills required for the project
- evaluate and modify.

As these projects and programs continue to develop and expand, we hope to be able to share the innovative practices of the schools involved with the wider education community and Departmental schools. We have been encouraged and amazed by the commitment of these schools and teachers to take steps towards integrating STEM education in their contexts. They are working collaboratively across stages and faculties, embracing new techniques and adjusting school structures to achieve a common goal: designing educational programs that are future focused, mindful of the 21st century demands of the world, highlight connections across STEM disciplines and that equip students with the thinking skills and processes to be successful, lifelong learners.

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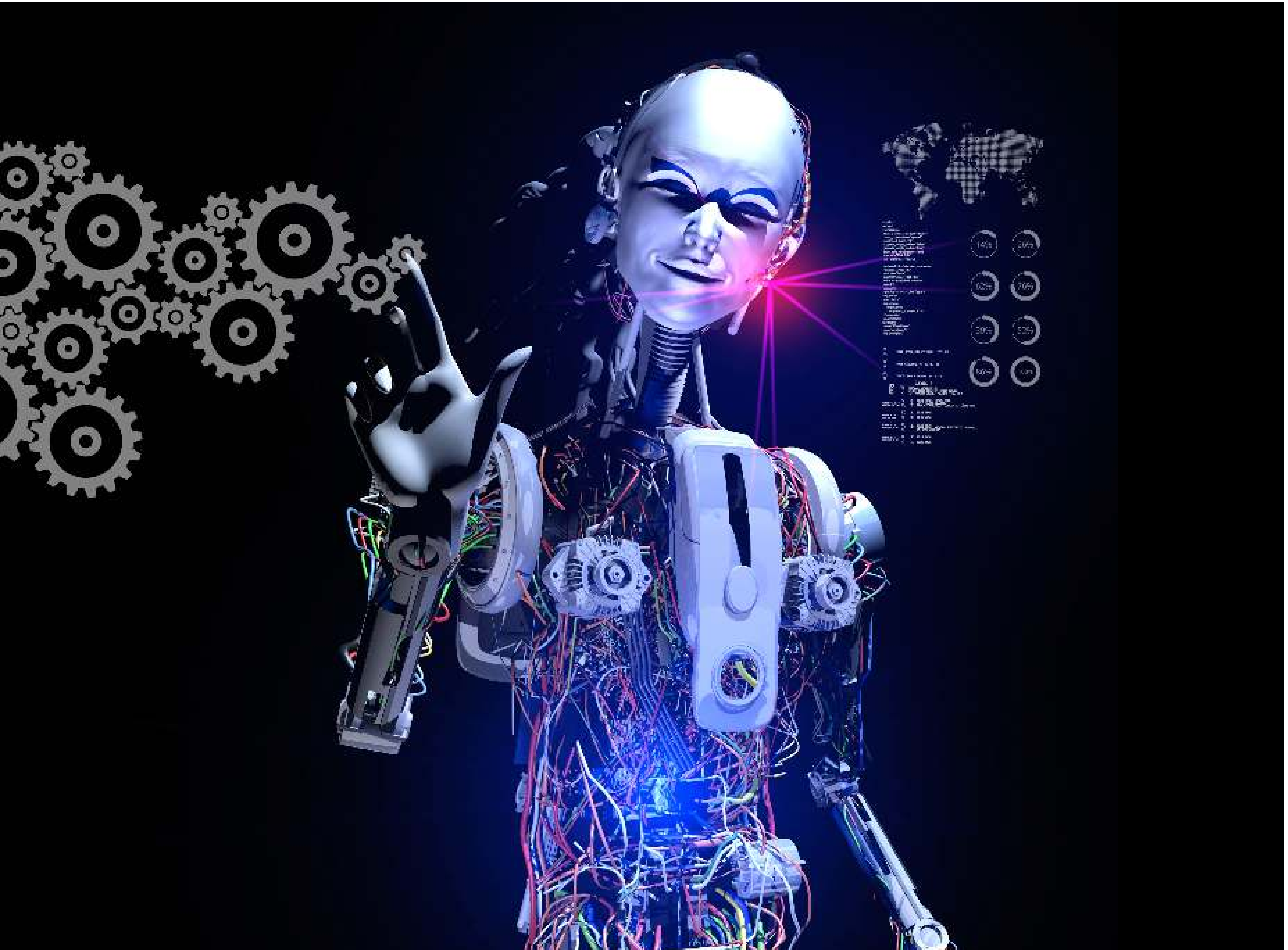


Allan Booth, Director Learning Systems, School Operations and Performance, introduces the national *Digital Technologies Hub*, briefly explores digital technologies and considers engaging student learning opportunities.

Digital technologies

The release of the Australian Curriculum: Digital technologies and a strong national focus on innovation has resulted in Education Services Australia being funded by the Australian Government to develop a Digital technologies hub. The hub will support Australian primary teachers, secondary teachers, students, and school communities in engaging with the Australian Curriculum: *Digital technologies*. This article explores digital technologies and some of the exciting student learning opportunities emerging in this work.

What do we mean by digital technologies?

Digital technologies as a term is used widely in the community to describe a broad range of hardware, software, concepts and tools used to improve productivity, increase engagement and solve problems. So what does this mean for teachers and students in our schools who are being identified as key players in developing our young people to be ready for the digital world? The following video produced by the Australian Curriculum, Assessment and Reporting Authority (ACARA) provides a good introduction to digital technologies in the school context.

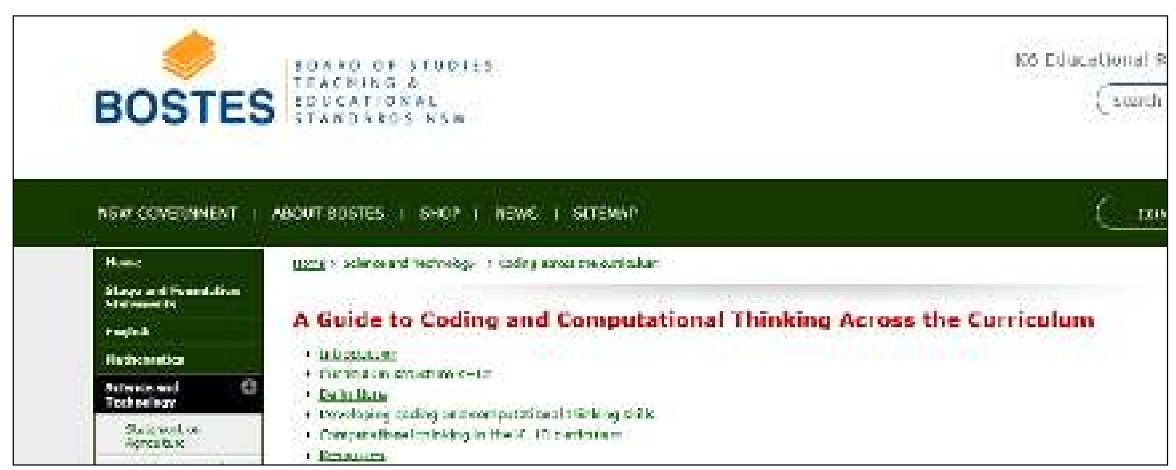
[Digital technologies: an introduction] **by ACARAeduau**

This video provides a good starting point to clearly understand why we need to focus on digital technologies and the scope of the subject.

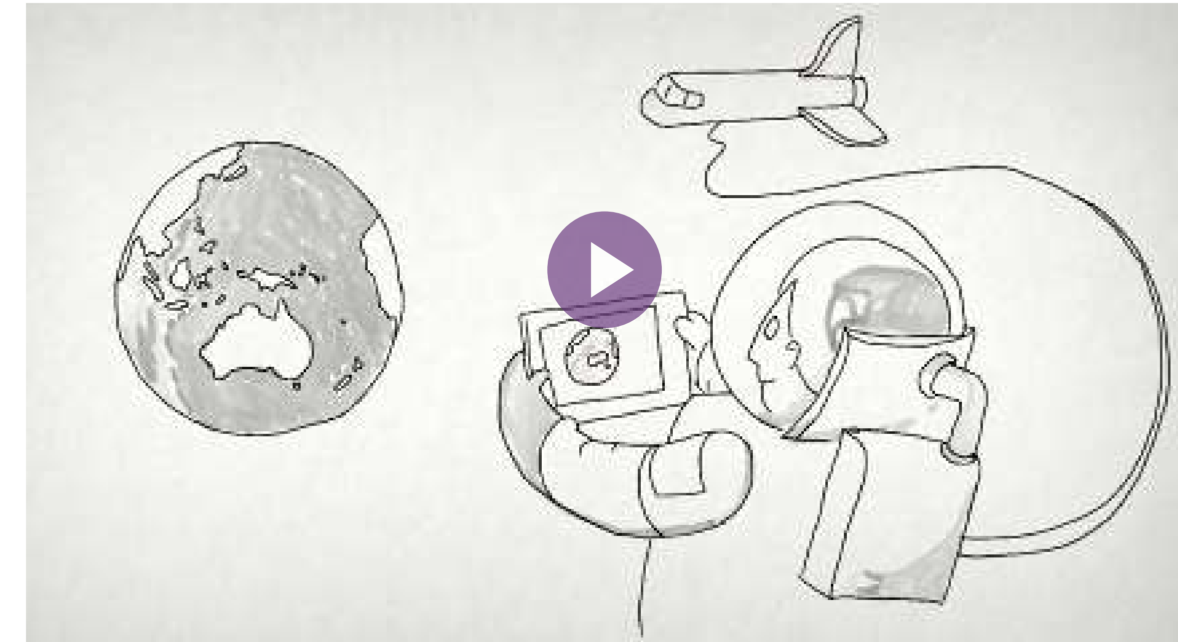
The [soundbites] recorded in South Australia are also worth a listen to get some public perceptions of digital technologies.

Teachers in NSW should also refer to *A guide to coding and computational thinking across the curriculum* (BOSTES, 2016) to develop an understanding of what is happening in NSW regarding digital technologies. This information provides an excellent overview of ways that we can already implement many of the concepts ideas and practices encouraged through the Australian curriculum.

Technologies sound bites: what you value – finding the essence **by Teaching and Learning in South Australia**



A guide to coding and computational thinking across the curriculum, BOSTES NSW



Digital technologies – what are they for? **by Teaching and Learning in South Australia**

South Australia has also published an interesting video about digital technologies titled *Digital technologies – what are they for?*

There has been a strong media focus on selected parts of this curriculum, such as coding, in recent announcements about the new curriculum and it is important to maintain focus on the broad range of skills required for our students to engage effectively in today's digital world and workplaces. While coding is at the core of working in the digital world and the core language, it has sometimes become a distraction from the other core skills, knowledge and understanding promoted through learning about digital technologies. Computational thinking, for example, is core to working effectively in the digital world. Recent media articles stating that coding has replaced history and geography in Australia's new digital technologies curriculum have misrepresented the breadth and depth of learning about digital technologies that the new curriculum will provide.

The hub being developed by Education Services Australia (ESA) will be a valuable resource for all teachers and is due for release in mid-2016. The *Digital technologies hub* (ESA, 2016) will include:

- over 250 resources to support teachers working at all bands of the Australian Curriculum with links to the content descriptions
- case studies of school practice
- resources for students
- resources for parents and school communities
- a searchable resource bank.

The resources will also be discoverable via *Scootle*.

I encourage you to read the great articles and springboards about STEM education in this edition of *Scan* to gather more ideas and information to support the development of comprehensive learning experiences for our students. Digital technologies and STEM go hand in hand.

The following videos are also worth watching:

- *NSW Department of Education Primary STEM Conference, Sydney*
- *MEPS meets Atlassian*
- *Atlassian Foundation – Workshop for Public School Leaders*

Since the commencement of the *Digital technologies hub* project, the Australian Government has also increased its focus on innovation through *The National Innovation and Science Agenda*.

The National Innovation and Science Agenda,
Australian Government

This agenda will generate many opportunities for students and schools to participate in authentic learning projects. Some highlights include:

- *Embracing the digital age* that includes online computer challenges, ICT summer schools, annual cracking the code competitions, and support for teachers implementing digital technologies
- *Little scientists* that is aimed at engaging young children's curiosity in playful experiments and other activities.
- *The CSER digital technologies teacher MOOCs* – the University of Adelaide's highly regarded Massive Open Online Course (MOOC) that supports teaching the *Australian Curriculum: Digital technologies* and targets upper primary and lower secondary teachers to help them develop fundamental teaching skills and knowledge relating to the new digital technologies curriculum.
- *Scientists and mathematicians in schools*

Watch this project closely for opportunities for your school.

There is a rich range of opportunities for schools to embrace learning about digital technologies. Building these around a solid school delivered curriculum will engage our students and better prepare them for living and working in a digital age. It is impossible to list all of these however, a few opportunities that have come across my desk recently are listed below.

- *Shapeshifters: 3D printing and CAD workshops*
- *Yammer* groups in the NSW Department of Education *Yammer* such as Digital technologies curriculum, Coding for fun and learning, Code Club Australia, and STEM: Science, Technology, Engineering and Mathematics
- The DART Connections *Virtual excursions* program has been targeting some interesting STEM opportunities
- *Digital technologies curriculum* at Digipubs
- *Making* at Digipubs.

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Dr Peter Gould, Leader Numeracy, Early Learning and Primary Education Office, explores the nature of problem solving, the ways mathematics is used for everyday living and creative ways this can translate to mathematics in the classroom.

The will, the skill and the understanding

In talking about what makes a champion, Muhammad Ali once stated … *that they have to have the skill and the will*. He then added … *that the will must be stronger than the skill* (Quotes.net, 2016). But are the will and the skill sufficient when it comes to student learning? If you have no interest in solving a problem, you are unlikely to engage with the problem. If you do not possess the necessary skills, you are also unlikely to be successful in solving a problem. The will and the skill are certainly necessary conditions for solving problems, but are they sufficient?

Do I really need to learn this?

Some types of questions that children ask change little over time. In particular, children frequently wonder, why do I need to learn this? This question can be applied to even the most fundamental components of schooling, such as reading, writing and arithmetic. As adults we know how important these things are to living in a post-Guttenberg era. Yet sometimes we make use of reading, writing and arithmetic so frequently we do it without conscious thought. This is true of many ways that we use mathematics.

Who uses mathematics?

Although we rarely think of using mathematics as we navigate our way each day, we rely on it. A study carried out in 1998 involving 200 adult Australians who recorded the mathematical calculations they did in a typical 24-hour period found that most calculations (85%) were done mentally (Northcote & McIntosh, 1999). The research also showed that the most common purpose for calculation was the calculation of time — 25% of all calculations.

We regularly engage in estimating and measuring time and distance, as well as likelihood. Most often (about 60% of the time) our mental calculations require only an estimate rather than an exact answer. Although people may not be consciously aware of it, quantitative reasoning is required to cross a road, just as it is required to construct a road.

The way we interact with the world requires us to reason with number, measurement, probability, data and spatial sense. However, these interactions often value a timely approximate answer over a delayed exact answer.

The study by Northcote and McIntosh also found the second most common purpose for calculating was shopping. In particular, those interviewed generally found it much easier to do calculations with money, adding up and taking away, than doing similar sums in written form. Can we build on these preferences for mental computation and day-to-day financial transactions in teaching arithmetic?

The mathematics of commerce

In many developing economies there exists a large section of the economy known as the informal economy. The informal economy is sometimes described as the economy of the poor and frequently includes children.

In Brazil, which has a large informal economy, three researchers went out into the street markets with a tape recorder, posing as ordinary market shoppers (Nunes, Schliemann, & Carraher, 1993). At each stall, they presented the young stallholder with a transaction designed to test a particular arithmetical skill. The purpose of the research was to determine how effective traditional mathematics instruction was, which all the young market traders had received in school since the age of six.

About a week after they had recorded the children explaining the costs of various quantities at their stalls, the researchers went back and asked each of them to take a pencil-and-paper test that comprised exactly the same arithmetic problems that had been presented to them in the context of purchases the week before.

Although the children's practical arithmetic was accurate when they were at their market stalls, the percentage of correct answers dropped to 74% when doing similar verbal problems and they averaged only 37% when virtually the same problems were presented to them in the form of an arithmetic test.

One of the questions asked of a young vendor when he was selling coconuts costing 35 cruzeiros each, was: *I'm going to take four coconuts. How much is that?* The boy replied: *There will be one hundred five, plus thirty, that's one thirty-five … one coconut is thirty-five … that is … one forty.*

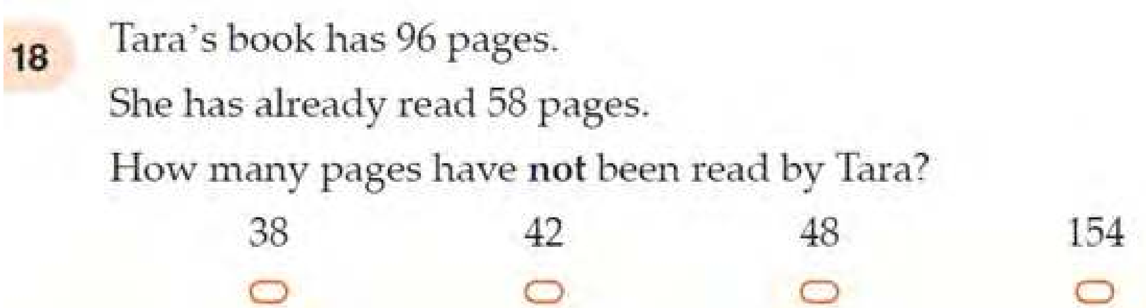
Purchases of two or three coconuts are quite common and these are values that street traders often know. The boy began by breaking the problem up into simpler quantities — in this case, three coconuts plus one coconut. This enabled him to start out with the fact he knew, namely that 3 coconuts cost Cr$105. Then, to add on the cost of the fourth coconut, he first adds Cr$30 to give Cr$135 before restating the cost of one coconut and adding the final Cr$5.

On the formal arithmetic test, the boy was asked to calculate 35 x 4. He worked mentally, vocalising each step as requested, but the only thing he wrote down was the answer. His problem solving was: *Four times five is twenty, carry the two; two plus three is five, times four is twenty*. He then wrote down 200 as his answer. Despite the fact that, numerically, it was the same problem he had answered correctly at his market stall, he got it wrong.

In a later study by Paterson and Bana (2005) looking at students in Years 3, 5, 7 and 9 in Western Australia, it was found that neither experience with nor the use of the context of money had any effect at all, except in Year 3. In Year 3 the students' performance was worse when dealing with money problems.

In our classrooms

Is the type of problems we ask the main challenge we face? In 2015, the Year 3 Numeracy Assessment for NAPLAN contained the following question.


18 Tara's book has 96 pages.
She has already read 58 pages.
How many pages have **not** been read by Tara?

38 42 48 154

Figure 1. Q18 in the Year 3 Numeracy assessment in NAPLAN 2015

Although less than half of the Year 3 students in NSW correctly answered the question, even more troubling is that over one-quarter of Year 3 chose 42 for the answer. This error of subtracting the smaller number from the larger, that is subtracting 6 from 8 when attempting to subtract 58 from 96, appears to be widespread. This prompted a more in depth investigation of the problem, starting in our primary schools taking part in Early Action for Success.

When students were asked to show their working out in response to a number of questions designed to have students use place value when adding or subtracting, it soon became apparent how they were thinking. Figure 2 shows a Year 4 student's reasoning when attempting to subtract $27 from $53.

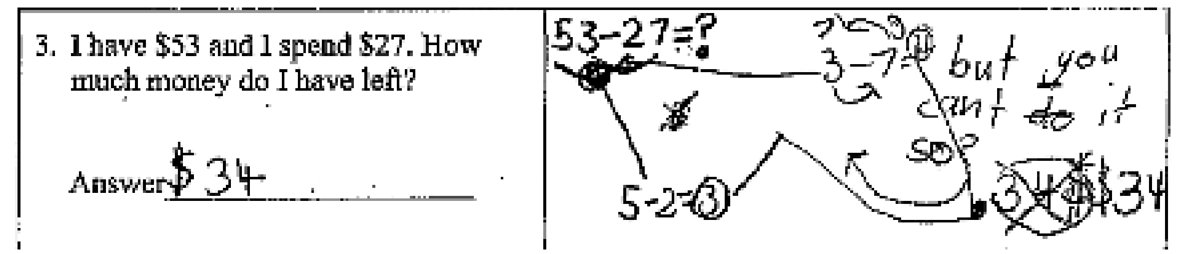


Figure 2. A Year 4 student's explanation of the smaller from larger error

He considers subtracting the digits in the numbers separately. He first subtracts 2 from 5 to obtain 3, but when he attempts to subtract 7 from 3 he realises that he cannot, so he reverses the order of the subtraction to obtain 4. Educationally, this process of splitting the digits is a bad practise, as the digits no longer reflect their place value.

It is important to realise that this problem of splitting the digits in a subtraction and then losing their place value was not restricted to those students who are struggling with mathematics. The response shown in Figure 3 comes from a Year 3 student who achieved the top performance band for numeracy in the National Assessment Program – Literacy and Numeracy.

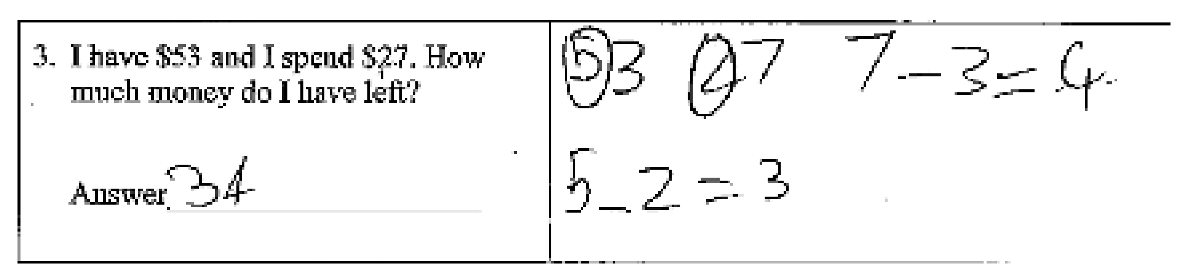


Figure 3. A high-performing Year 3 student's response of splitting the digits

How common was the answer 34? In examining the responses of 711 Year 3 students to Question 3, out of 398 students who answered incorrectly, 117 answered 34. That is, 29% of the incorrect responses displayed the smaller-from-larger error. Moreover, the responses displaying this error were not restricted to students performing in the lower bands on NAPLAN. As in the Paterson and Bana study, the use of money in the question setting did not reduce the procedural errors the students made.

When the questions were not about money, the unusual modes of answering questions that required an appreciation of place value did not diminish. The response shown in Figure 4 was produced by a Year 3 student who achieved the second highest performance band for numeracy in NAPLAN.

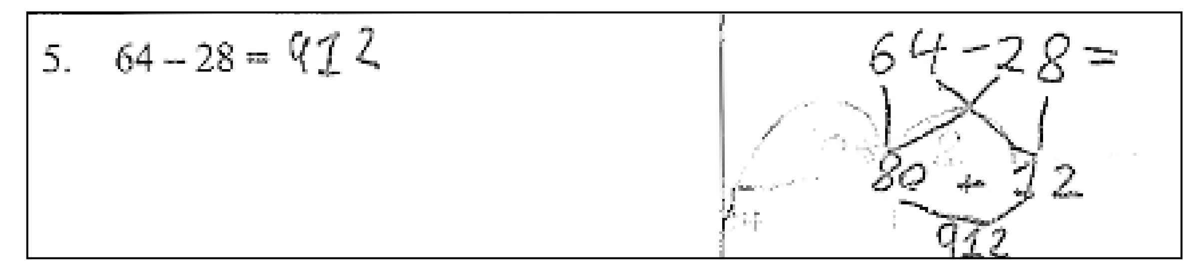


Figure 4. A Year 3 student's response using an incorrect splitting procedure

The working in Figure 4 suggests that although the student has decomposed the numbers into the correct units of tens and ones, the student has added the component parts to obtain 80 and 12, before combining these results to produce an answer of 912. This answer of 912 to a subtraction involving two 2-digit numbers does not make sense.

The loss of sense-making can be a product of focusing solely on procedural knowledge — *what* without the *why*. Consider the answer provided to 64 – 28 in Figure 5.

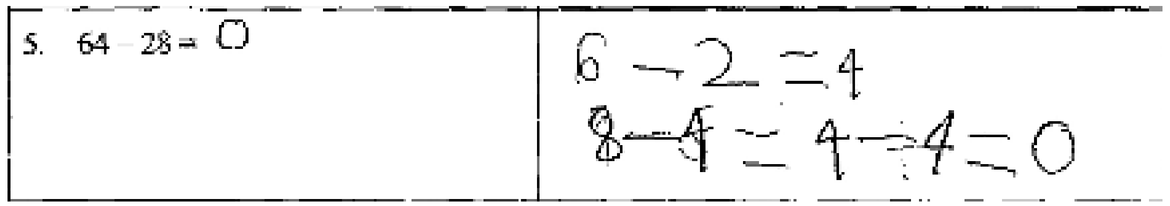


Figure 5. An answer displaying a lack of conceptual knowledge

If you look only at the answer of zero, it doesn't make sense. When you read over the steps that the student has followed to achieve this answer you can begin to understand how an answer that makes no sense was achieved. After separating the digits and subtracting the smaller from the larger, the student appears to have taken this one step further, and subtracted the resulting answers (4 – 4 = 0).

When students learn to do arithmetic it is possible to focus only on the procedures that need to be followed. However, without understanding why the procedure works we have no way of telling if an answer is reasonable. This has led me to frequently ask students if there is any way they can tell if their answer is correct. If the students respond no, I tend to think that they may not have a sense of the size of the numbers involved in the question.

We need to be very careful in our teaching that students *do not lose conceptual knowledge in the process of gaining procedural knowledge* (Narode, Board, & Davenport, 1993, p. 260). The student's response of 0 shown in Figure 5 appears to be a clear example of a student whose procedural knowledge has supplanted conceptual knowledge. Namely, that the difference between two numbers can only be zero if the numbers are the same.

Although the mathematics that we use every day is within very practical contexts, problems involving money are not always interpreted by students as anything associated with their lives. Moreover, many conscientious students appear to be learning and practicing calculation procedures that do not make sense.

Helping students to appreciate place value

If students provide responses with errors similar to those above, an additional question can help them to focus on the size of the answer before they start to respond to the question. Some teachers like to ask students to estimate the answer before they work it out. Lately, I have been trying a more specific question to prompt students' thinking about place value.

I have $53 and I spend $27.
How much money do I have left?
Is the answer more than $30 or less than $30?

Before students begin to subtract $27 from $53 to indicate how much money is left, I want them to commit (usually by recording *more* or *less*) to the size of the answer, compared to the value of $30 provided. This recording becomes important in follow up discussions, particularly if a student answers 34. Think about the purpose for using the value of $30 in the prompt rather than $20 or $40. With 2-digit subtraction I always use a multiple of ten in my prompt question to focus on place value.

It is important to determine how students solve mathematics problems. Not just whether they have relevant skills but also if they understand what they are doing. When students practice procedures they do not understand there is a clear danger they will practice incorrect procedures. The longer students use incorrect methods to calculate the more difficult it is to learn correct ones.

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Using *Oliver* to engage learners

Celebrating *Oliver* at Banks Public School

The Department of Education recently celebrated the halfway mark in the implementation of the new web based library system, *Softlink Oliver*. Over 1132 schools now have *Oliver*. The event was hosted by Banks Public School, an *Oliver* Lighthouse school that moved to the new library system early in the project. In attendance were:

- Pate Cooper, Principal, and members of the Executive
- 20 students from Years 2 to 6, who starred in a showcase led by Julie Grazotis, teacher librarian, Relieving AP
- Stephen Loquet, Chief Information Officer, Information Technology Directorate
- Geoff Jones, Solutions Delivery Manager, School Library Project
- Allan Booth, Director, Learning Systems
- Doug Jenkins, Senior Subject Matter Expert, School Library Project
- Wendy Dawson, Subject Matter Expert, School Library Project
- Colleen Foley, Libraries Coordinator, Learning Systems
- Nathan Godfrey, Managing Director, Softlink International
- Hilary Noye, Director Business Development APAC, Softlink International
- Rob Gibson, Technical Analyst, Softlink International
- Evonne Webb, Social Media Officer, Learning Systems, supporting the event.

Pate Cooper commented on the smoothness of the transition to *Oliver*, the eagerness and high level language reflected when students share their learning when using *Oliver*, and the engaging, collaborative approach it supports in the teaching and learning cycle across the school.

Pate Cooper, Principal, Banks Public School comments on the smooth transition to *Oliver*

Stephen Loquet reflected on the professional commitment of teacher librarians like Julie Grazotis, and their role leading the way. He also commented on the quality implementation of the project that was attested in survey feedback, the passion shared by the Project Team led by Geoff Jones. Stephen also mentioned the successful partnerships across the Department and with Softlink for the benefit of student learning in a digital age.

Allan Booth observed the excitement of students using the *Orbit* interface in an interactive way, how it encourages peer learning and engagement, and how *Oliver* gives students the opportunity to explore their own school library and global collections of resources.

Nathan Godfrey shared a commitment to the shared vision of *Oliver* as a library system that supports the work of teachers, and the significant contribution of teacher librarians to the success of that, as reflected by research.

Cutting the cake at Banks Public School *Oliver* celebration and showcase

It was also exciting to observe an outdoor library pop up during lunchtime. It was overseen by a library monitor, who emphasised how much students loved the library, and that this was their solution when the library was closed during lunch break.

Pop up outdoor library for lunchtime at Banks Public School

For a taste of the celebration, see the [compilation of tweets]() sent from the event.

According to Julie Grazotis:

> *Banks Public School was proud to share in the celebration. The students were keen to showcase their knowledge and enthusiasm for the* Oliver *library software. Using the* Orbit *interface on a range of technology platforms our students demonstrated the process of searching for a book, identifying Premier's Reading Challenge titles and posting a book review.*
>
> *The true value of the experience was that it allowed all parties: students, teachers, Department and Softlink representatives to see firsthand the importance* Oliver *plays in the delivery of authentic integrated learning.*
>
> *This celebration will further motivate our students to delve into* Oliver *to share and broaden their reading and learning experiences.*

Students using *Oliver* at Banks Public School

Julie discussed some of the school's future directions for using *Oliver* to support explicit learning, including the collaborative implementation of the new geography syllabus over the next two Terms.

Evidence of enhanced learning from Julie's *Lighthouse Project* action research, can be seen in the Filmpond ClassMovie, [*Oliver* – A journey from computer to book to reading](). The video shows a student focused approach, scaffolded activities with students selecting and sharing their reading experiences, writing reviews and publishing them in *Oliver*. Julie shared aspects of her [Lighthouse Project] program, and the excitement of students actively learning in her presentation to the Department's *Libraries for future learners* conference in late 2015.

Oliver – a journey from computer to book to reading
by Banks Public School

More evidence from *Oliver* Lighthouse schools

There are 135 Oliver *Lighthouse* schools (intranet). These were selected through an Expression of Interest (EOI) process and migrated to *Oliver* during Terms 1 and 2, 2015. Through action research projects beginning in 2015, *Oliver* Lighthouse teacher librarians are providing leadership in collaborative, evidence based practice while exploring how *Oliver* can enhance learning outcomes. More information about evidence based practice and *Oliver* Lighthouse school projects is available on the Department's *School libraries* home support site.

Some 70 Lighthouse schools have now completed their action research reports after settling in with their

Sharing Learning with Oliver

new library system, and considering avenues to explore how *Oliver* enhanced explicit learning support. Some of these schools are venturing into further related action research. It has been inspiring to see a number of schools providing additional evidence with their action research reports, such as:

- extracts from learning area programs
- student work samples
- data gathered using surveys, photographs and video
- quantitative data supported by qualitative data.

The nature of survey questions used certainly made a difference to the quality of evidence captured.

Here is a small taster of their action research so far. Further examples will be covered in the next issue. It is certainly not too late for schools to submit their reports.

The research encapsulated in *Scan* will focus on those reports which identified explicit links to learning outcomes, including aspects of learning across the curriculum and General Capabilities, as reflected in syllabus documents.

What research questions were posed?

A range of focuses have been, and continue to be, explored. Broadly, key areas investigated include *Oliver* supporting enhanced student engagement:

- with reading and responding to texts
- through use of the web based technology provided by the new learning system
- by improved use of digital resources
- using scaffolded approaches to successful use of new options, such as Federated search
- to enhance skills in inquiry and judging quality information for a range of purposes including research
- by use of a broader range of resources, including those beyond the school
- through targeted use of resources as jumping off points to deeper understandings and creative learning activities in the chosen learning area.

Some schools included consideration of ways to further enhance collaboration with teachers, and teacher focused needs from the library system.

Examples of innovative research questions posed include:

How has the new library system, *Oliver*, explicitly supported a buddy support program to engage reluctant readers in borrowing and reading? Anna Brewster, teacher librarian, Corowa Public School. More information about Corowa's report will feature in the next issue of *Scan*.

How has the new library system, *Oliver*, explicitly supported improved use of online and digital resources to complement physical resources? (with reference to research for a specific unit of work). Dr Bruce McConachy, teacher librarian, Banora Point High School.

Can having high quality digital resources easily available increase and enhance student engagement and self-direction equipping them to be self-sufficient modern learners? Trudy Weidemann, teacher librarian, Glen Innes Public School.

Innovation and evidence

Lighthouse schools' conclusions and significant findings need to be considered in the context of a school's learning culture, and where they are in their pedagogical journey. Research conclusions which indicated a need for changed approaches, or a more evidenced based approach to resource selection and use, or the need to further explore the chosen enquiry question as *a work in progress*, are valid. They are as significant as those reports which demonstrate and lead into more innovative use of resources as jumping off points for rich learning and creative endeavours.

Here are some examples of comments in response to the research report requirement to indicate *your most significant finding*:

> *Students are more engaged when scaffolded … and given quality resources…*
>
> Debbie Horsley, teacher librarian, Balgowlah North Public School

> *… confirmed by the research study was the central importance of teacher expectation. … As teacher expectation grew, the majority of students responded by researching further afield. By demonstrating how readily a wide range of resource types could be accessed, teacher expectation was increased. Students were, likewise, willing to use new resource types to meet this enhanced expectation.*
>
> *At the commencement of the research project, students typically used no more than 4 different resource types. Following instruction … the number of students who now used in excess of 4 different types of items rose to 54%.*
>
> Dr Bruce McConachy, teacher librarian, Banora Point High School

> *The sample group demonstrated the ability to combat geographical restrictions to research beyond their borders and access resources held in other libraries or by other providers to support their (Society and Culture) PIPs.*
>
> *The integrated features of Federated searching in* Oliver*, provided an increase in the breadth of resources students were able to access. This sample group, consisting of iGen students, traditionally rely on the internet to provide all the answers to their research needs. This sample group clearly demonstrated a greater willingness to utilise the Federated search feature of* Oliver *to access resources from multiple providers to support their PIP research.*
>
> Kaylene Taylor, teacher librarian, Eden Marine High School

… and more evidence

Beresford Road Public School teacher librarian, Kylie Hamersma, chose book trailers, created by students as the evidence for learning related to specified English K–10 outcomes. The trailers reflected a rich process of scaffolded, engaged learning. This was captured by student comments, such as:

> *So we are all going to be able to see everyone's trailers?*
> *It tells me how to be an author.*

Kara Biordi, Assistant Principal, and one of two teacher librarians reporting from Condell Park Public school, explored cross curriculum aspects of using Information and Communication Technology (ICT) to engage students. Kiara reported that students:

- appreciated being able to personalise their settings, including using an avatar, in *Orbit*
- enjoyed listening to ebooks featured in the *Oliver* home page carousel.

Student reading and listening to an ebook

Other examples highlight the impact of students and teachers being able to make use of a broader range of resources from a time saving single point of entry (*Oliver*). Susan Hannigan, teacher librarian at Hunter School of the Performing Arts, considered the enhanced access to *quality curated information* for students of HSC English *Discovery* Area of Study, Society and Culture, Community and Family Studies, Studies of religion and Aboriginal Studies.

Kiama Public School teacher librarian, Robyn Davis, as joint leader of the committee introducing the new History and Geography syllabuses, is working closely with teacher colleagues, particularly the Assistant Principal and Year 3 teacher Kieren Corbyn. Robyn commented that: *Students found the link in* Oliver *to Kiama Public Library useful. This was confirmed in the survey results showing 67.57% of students used the link.*

Conclusions

From this brief overview of some of the *Oliver* Lighthouse action research reports, and the reports read so far to compile this article, it is clear that the action research process itself has:

- helped the schools to provide evidence of learning that has been enhanced or delivered by the teacher librarian and school library
- assisted with evidence to guide ongoing planning for the way the teacher librarian and school library supports teaching and student outcomes in their school
- highlighted areas where they wish to change practice.

These are significant achievements and reflect professionalism and curriculum leadership.

Schools demonstrated various strengths in their reports. A Lighthouse school not mentioned in this coverage does not indicate either poor action research or a lack of contribution to leadership in the implementation of *Oliver*. Some schools demonstrated particular strength in their ability to focus on their action research question. Others showed specific skills in the quality of their data gathering and range of evidence used. And there were those schools that illustrated particular skill in their ability to encapsulate their learning to continue the evidence based cycle. It is an ongoing journey!

We will all learn together as professionals to make better use of evidence to reflect our practice. *Scan*'s aim is to support that professional learning.

Beyond *Scan*, other areas of support for using *Oliver* to support learning and teaching, and enhancing approaches to evidence based practice, can be found on and linked from the *School libraries* support site and various discussions on the Department internal Yammer forums. Further support for evidence based practice can also be achieved through area professional learning networks and professional associations.

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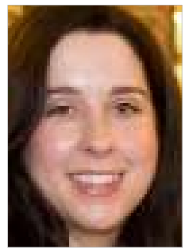
Rough medicine – a Twitter tour



Evonne Webb, Social Media Officer, Learning Systems, outlines some great examples of the use of Twitter, supporting a partnership with the Australian National Maritime Museum, to share exhibitions for educational purposes. More Twitter tours will come.

Social media is increasingly being used by educators and students to connect and share information online. Reflecting this trend, the Australian National Maritime Museum recently embraced the use of Twitter to provide students and teachers with an opportunity to virtually experience the temporary exhibition *Rough medicine: life and death in the age of sail*.

In partnership with the NSW Department of Education Learning Systems team, the Australian National Maritime Museum facilitated a Twitter tour of the exhibition on 3 May. The *Rough medicine: life and death in the age of sail* exhibit complements the teaching of the *Living World* strand for Stage 4 science students and teachers.

The Twitter audience was able to explore the scientific and technological lessons learnt from the experiences of early sea voyages to Australia through a series of live tweets from presenters and participants. Students from Merrylands High School worked with Evonne to share their comments on the exhibition through the #RMTwitterTour hashtag. The museum, students and teachers were able to share photos, links, video and 360° footage of the key objects on display using the #RMTwitterTour hashtag.

This content was then collated through *Storify*, which enables users to collate content from a variety of sources into a long term re-usable asset. The *Rough medicine Twitter tour Storify* is now available for all students and teachers.

A student dictates a tweet for the Twitter tour

An exhibit highlighted during the tour: medical texts, instruments and a fossilised arm

The next Twitter tour will showcase *Ships, clocks & stars: the quest for longitude*, an exhibit of nautical instruments that led to maritime history's greatest scientific breakthrough. It is scheduled for the beginning of Term 3. Follow the Australian National Maritime Museum and Learning Systems Twitter accounts for information about future tour events.

Another exhibition of interest, is the Jeannie Baker Circle exhibition. See the Australian National Maritime Museum website for more information.

June Wall is an independent Consultant, eLearning and Libraries, and an Adjunct Lecturer, School of Information Studies, Charles Sturt University. June is also a member of the *Scan* Editorial Team. In this article June explores key literature and related to Science, Technology, Engineering and Mathematics (STEM), makes links with curriculum documents and suggests possible implications for learning.

A science, technology, engineering and mathematics (STEM) review of the research

Introduction

The purpose of this literature review is to bring together a range of research and resources on the implementation and development of Science, Technology, Engineering and Mathematics (STEM) education initiatives to inform the implementation of NSW statewide and school based programs.

The NSW Department of Education views STEM education as the learning of science, technology, engineering and mathematics in an interdisciplinary or integrated approach. Students gain and apply knowledge, deepen their understanding and develop creative and critical thinking skills within an authentic context. It may include inquiry and project-based learning. By developing curiosity and knowledge of STEM disciplines students make connections and see the relevance for future career pathways. STEM education is for all students and should be incorporated throughout all stages of learning from preschool through to Year 12.

STEM education has been identified globally as a core driver in economic development (Marginson, 2013; Tytler, 2008; Watt, 2009) and the lower educational attainment of females in the STEM subjects has been noted as an indicator of lower economic growth (OECD, 2015a). Innovation as a strong outcome of the STEM culture is core to this economic development (AI Group, 2015; FYA, 2015; PwC, 2015). International research indicates that 75 per cent of the fastest growing occupations now require STEM skills and knowledge (Office of the Chief Scientist, 2014, p.7).

Nationally, the Australian Government has published a STEM strategy, to which all states agreed in 2015, to encourage education systems in supporting the

> *development of skills in cross disciplinary, critical and creative thinking, problem solving and digital technologies, which are essential in all 21st century occupations.*
>
> Australian Government, 2015

An increasingly global society also requires the integration of STEM subjects to solve global and local problems which are multidisciplinary. These complex problems are the driving force behind national calls for changes in STEM education (Wang, Moore, Roehrig & Park, 2011).

Background to this review

The National STEM School Education Strategy 2016–2026 (Education Council Australian Government, 2015) defines STEM as both a collection of subjects with the stated disciplines as well as a cross disciplinary approach to the teaching of these in STEM related fields. In the literature, the definition changes depending on the perspective of the writer (Hogan & Down, 2015). However, core concepts in all definitions are critical thinking, analysis, collaboration, and real world contexts, within the disciplines of science, technology, engineering and mathematics

The five key areas for action from the National STEM School Education Strategy (Education Council Australian Government, 2015 p.7):

1. Increase student STEM ability, engagement, participation and aspiration.
2. Increase teacher capacity and STEM teaching quality.
3. Support STEM education opportunities within school systems.
4. Facilitate effective partnerships with tertiary education providers, business and industry
5. Build a strong evidence base (Figure 1).

These action statements are seen as the drivers to encourage innovation while, at the same time, they have strong links to the NSW Learning Across the Curriculum (BOSTES, 2012) statements which include the General Capabilities in the Australian Curriculum (ACARA, 2012). The following NSW syllabuses specifically link to STEM education skills and knowledge required for future learners:

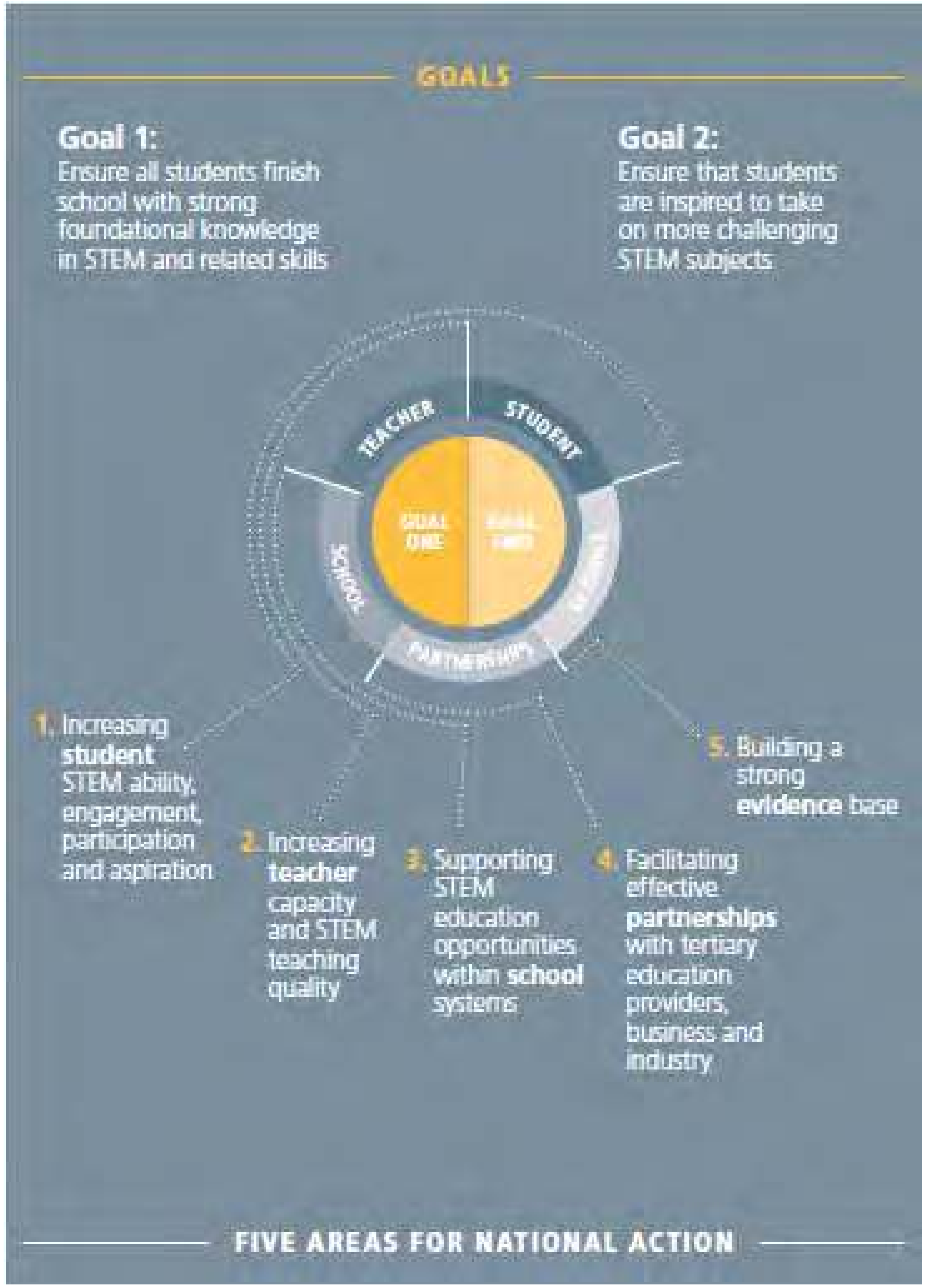


Figure 1 Goals/Five areas for national action, National STEM School Education Strategy (Education Council Australian Government, 2015 p.7)

- Agricultural Technology Years 7–10
- Design and Technology Years 7–10
- Food Technology Years 7–10
- Graphics Technology Years 7–10
- Industrial Technology Years 7–10
- Information and Software Technology Years 7–10
- Mathematics K–10
- Science K–10 (incorporating Science and Technology K–6)
- Textiles Technology Years 7–10
- Technology (Mandatory) Years 7–10

In the primary years, syllabus statements encapsulate the concepts of exploring ideas, questioning, designing solutions and applying critical thinking. In the secondary curriculum, syllabus statements focus on furthering the primary years' concepts and design, planning, development of and evaluation of real world solutions (BOSTES, 2003 & 2012). Table 1 maps the links to STEM skills and knowledge statements in the NSW syllabuses.

Economic growth

Globally and nationally, the workforce has greater mobility and needs to compete on a global scale. The need for increased specialisation in the STEM field and a distribution of skills are issues for the future workforce (Tytler, 2008).

Price Waterhouse Coopers (PwC, 2015, p.9) have identified a 90+% risk of jobs being lost in the next 20 years owing to technological developments and automation. Jobs most likely to endure are those requiring high levels of social intelligence, technical ability and creative intelligence; STEM fosters these skills.

Decrease in STEM students

The STEM pathway shows that students' participation and interest decreases to greater degrees in in the later primary and early secondary years (Tytler, 2008). Students lose interest by age 6; peer influence effects attitudes by age 12; they are bored in class by age 14; and their grades drop in STEM related subjects by age 15. Approximately only 13% of the initial intake remain in STEM by the time they enter the workforce.

In 2013, only

> *50% of ATAR eligible students did General Maths and 18% did 2 Unit. With an additional 15% of students studying no maths at all, this means that of the 2013 cohort eligible to apply for university entrance by HSC, some 65% did elementary level or no maths.*
>
> Wilson & Mack, 2014, p.43

The decreasing enrolment in mathematics and sciences is noted as one of the major issues in developing a STEM education focus in schools. (Kennedy, 2014; Marginson, 2013, p.41).

National participation in intermediate and advanced mathematics is also declining. In 1995, the percentage of Year 12 students studying intermediate or advanced mathematics was 41.5%. By 2011, this had dropped to 29.4%. Decreasing enrolments in intermediate and higher mathematics negatively impact on further STEM related options (Tytler, 2008.). The move away from these levels of mathematics, noted in the NSW HSC data, is consistent with national trends.

Gender

It is not the purpose of this review to closely examine the role of gender in the STEM field, however, there is a higher proportion of male graduates in STEM related fields than female graduates (OECD, 2015). This is noted as a barrier to the development of a more robust STEM career path and ultimately STEM related industries. This is also reflected in female enrolment in senior subjects in high school. Of the ATAR eligible students, 27.5% of females studied 2 Unit mathematics in 2001 and, by 2013, this had decreased to 16.3% (Wilson & Mack, 2014).

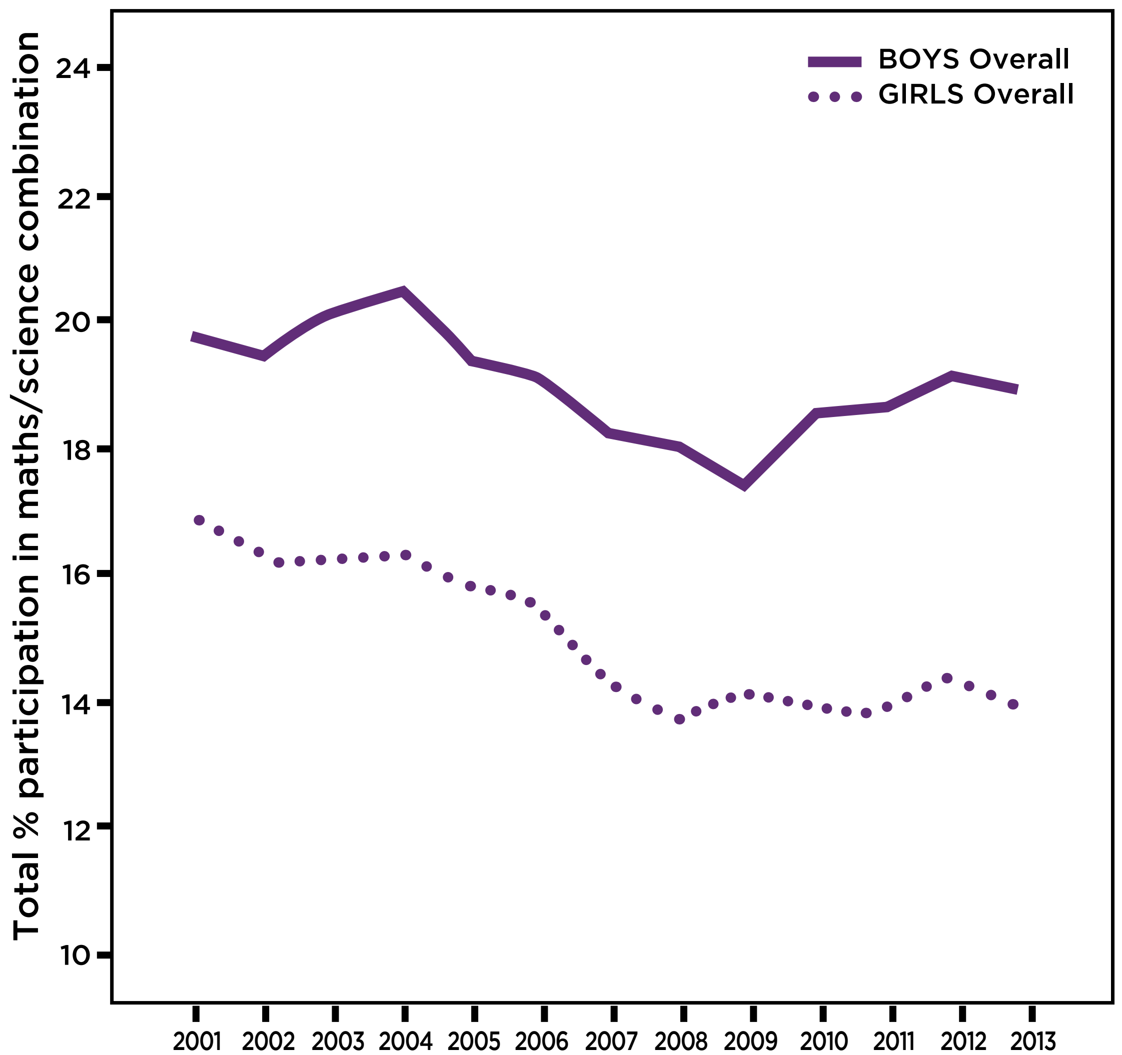


Figure 2 Total participation in HSC maths and science by gender 2001–2013 (Wilson & Mack, 2014, p.40)

NSW syllabus	STEM education integration
Agricultural Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: practices and skills required in producing plant and animal products; skills in problem-solving including investigating, collecting, analysing, interpreting and communicating information in agricultural contexts (pp.10–11).
Design and Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: engaging students in technological innovation; developing knowledge and understanding of and skills in innovation, creativity and enterprise; skills in communicating design ideas and solutions; knowledge and understanding of and skills in managing resources and producing quality design solutions (pp.10–11).
Food Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: evaluate the relationships between food, technology, nutritional status and the quality of life; and designing, producing and evaluating solutions (pp.10–11)
Graphics Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: thinking creatively, devise solutions and communicate information; interpret, design, produce and evaluate (pp.10–11).
Industrial Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: planning, development and construction of quality practical projects; design and production of practical projects, relationship between the properties of materials, ability to critically evaluate manufactured products (pp.10–11)
Information and Software Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: analysing, designing, developing and evaluating information; problem-solving and critical thinking skills in order to design and develop creative information and software technology solutions (pp.10–11).
Mathematics K–10 (BOSTES, 2112)	Mapped to STEM education in the primary years through: questioning and use of known facts to explore mathematical problems and develop fluency with mathematical ideas; give valid reasons when comparing and selecting from possible solutions, making connections with existing knowledge and understanding. Mapped to STEM education in the secondary years through: demonstrate fluency in selecting, combining and applying relevant knowledge, skills and understanding in the solution of familiar and unfamiliar problems.
Science K–10 (incorporating Science and Technology K–6) (BOSTES, 2012)	Mapped to STEM education in the primary years through: observing, questioning and exploring ideas; design projects, and in collaboratively completing the tasks. Mapped to STEM education in the secondary years through applying scientific understanding and critical thinking skills to suggest possible solutions to identified problems.
Technology (Mandatory) Years 7–8 (BOSTES, 2003)	Mapped to STEM education through: design, produce and evaluate quality solutions; skills in design processes, researching, experimenting, generating and communicating creative design ideas and solutions, impact of innovation and emerging technologies, skills in managing quality solutions to successful completion (pp.10–11).
Textiles Technology Years 7–10 (BOSTES, 2003)	Mapped to STEM education through: design, production and evaluation of textile items; examining properties and performance (pp.10–11).

Table 1. An integrated approach to STEM education through mapping NSW syllabuses

The disparity between the university intake, based on gender in the technology and engineering fields, is of concern. In 2010 (Marginson, 2013, p.45), the intake for females in the information technology field was 18% and only 16% in the engineering field.

The gender gap in both girls' participation in and selection of STEM subjects and STEM related careers has been identified as a concern for educational attainment and economic growth (Butler, 2014; Halpern et al, 2007; Knezek, Christensen & Tyler-Wood, 2011; Sadler, Sonnert & Hazari, 2012).

National STEM education programs

The Australian Industry Group (AI Group) (2015) identified the following common characteristics of countries with successful STEM education programs:

- school teachers enjoy high esteem, are better paid and work within meritocratic career structures
- countries have unbreakable commitment to disciplinary contents – focused on STEM knowledge, teachers are expected to be fully qualified
- active reform programs in curriculum and pedagogy focused on making science and maths more engaging and practical
- innovative programs developed to lift STEM participation among formerly excluded groups
- strategic national STEM policy frameworks developed with centrally driven and funded programs, world class university programs, partnerships and engagement that link schools, vocational and higher education with industry.

For school systems to develop a strong STEM education program that leads into STEM related careers, there are three areas to consider. These will be the focus of the remainder of this review:

1. STEM education in K–12 schools
2. Pedagogical practices for STEM education
3. Teacher development.

Implementation of STEM education in K–12 schools

The Office of the Chief Scientist (2013) identified the following strategies in order to reverse the declining trends in STEM participation:

- focus content on the evolving character of STEM knowledge and provide a strong focus on the practice of STEM
- encourage curiosity and reflection
- emphasise inquiry based learning with a focus on critical thinking and the scientific method
- guide study decisions of students, at all levels of education, to highlight the diversity of the STEM workforce
- forge enduring and real partnerships between employers and education authorities/schools
- develop and implement approaches to raise the STEM participation of females, and disadvantaged and marginalised students.

Various research (CHSS, 2011; Duschl & Bybee, 2014; Tytler, 2008) articulates the need for STEM education to commence in the early years of schooling and develop into more sophisticated levels of performance.

Multidisciplinary vs interdisciplinary

There are a range of perspectives (Wang, 2011) as to what constitutes STEM education. Some see STEM education as a multidisciplinary program where each discipline (science, technology, engineering, mathematics) teaches the content and skills from the individual discipline to meet a common project goal. It can be broadened to include a project approach across a range of subjects.

A developing outcome of the need for innovation and curiosity in STEM is the inclusion of the arts to foster creativity. The STEAM (science, technology, engineering, arts and mathematics) movement argues that a multidisciplinary approach including the arts can contribute significantly to the development of creative, innovative and entrepreneurial thinking in STEM education. In the following video, Larry Rosenstock, the CEO of High-Tech High argues that the emphasis on science, technology, engineering and mathematics is detrimental to arts education. He continues by asserting that engineering and the arts are integral to the conceptual design process.

Project-based learning at High-Tech High **by Association for Learning Environments (A4LE)**

An interdisciplinary approach is one that focuses on the concepts. It cuts across discipline boundaries and is based on a constructivist approach. An interdisciplinary approach is essentially project based learning where the project tasks and skills are the focus and the disciplines work together and across subject areas to achieve the project goals. Wang (2011) cites that the essential skills of an interdisciplinary approach are:

- critical thinking
- problem solving skills
- making connections with learning experiences that relate to personal meanings.

Additional skills, identified by Atkinson and Mayo (2010), are:

- inquiry
- design
- understanding and applying symbolic language.

This approach aligns with the *Quality Teaching* framework's (NSW Department of Education and Training, 2003) emphasis on student focused learning and teaching. It also has synergy with the general capabilities, embedded in the learning across the curriculum component of NSW syllabus documents, relevant to the integrations endorsed by the STEM literature.

Types of schools

The Committee on Highly Successful Schools or Programs in K–12 STEM Education (CHSS, 2011) within the National Research Council (2013) identified four school types and their roles within STEM education.

1. Selective STEM schools where students are selected to attend.
2. Inclusive STEM schools where students select to attend and are based more on the disadvantaged sectors of the student population.
3. VET or Trade schools—at present separated institutional and curriculum pathways play a modest role in NSW. There are school based apprenticeships and VET in schools' programs within academic schooling, many of which have some STEM components (Marginson, 2013 p.75).
4. Comprehensive schools, which are the majority of high schools in NSW.

The research is various as to the value of school type as an indicator of success in STEM education. Students attending specialised STEM schools, such as selective and inclusive STEM specialist schools, are more likely to actualise university goals in STEM when compared to peers from regular schools (Erdogan, 2015; Lamberg, Trzynadlowski, 2015; Scott, 2012).

Other researchers argue the case for a comprehensive school system, as the belief is that the structure of schools can divide students into academic and non-academic which leads to a lack of engagement in learning, rigor and relevance for large numbers of students. If more students are going to engage with STEM, then more students need to access an interesting STEM curriculum (Hogan, 2015). This suggests that selectivity or streaming could be detrimental to the success of a STEM education implementation.

Project based

Whether the school type influences STEM education approaches or not, another implementation type is that of considering STEM education as a short intensive project within a school. Axelson (2016) outlines a science outreach approach that uses STEM expertise from outside the school to run project based sessions for students on specific topics that may or may not fit within the current curriculum at the school.

Student perceptions of STEM

Learning is not just about accumulating knowledge, it is a process of identity development as students decide who they are and want to be (Wenger, 2000). Subject selection and career paths will not be pursued by students who do not identify themselves as interested in STEM disciplines.

Inhibitors (Kennedy, 2014) towards student enrolments in advanced mathematics and physics are:

- self-perception of ability
- perceptions of difficulty and usefulness
- previous achievement
- liking for the subject.

For the majority of students, their life aspirations are formed before the age of 14 years (Knezek, Christensen, Tyler-Wood & Periathiruvadi, 2013; Tytler, 2008), with the implication that engaging students in STEM pathways becomes increasingly difficult after the early secondary school years. Student engagement with STEM, therefore, needs to be in the early primary and early secondary years so that the students can be encouraged to be enthusiastic and open to the ideas and concepts presented in STEM fields.

Tytler (2008, p.126) and Naizer (2014) suggest that students need to be exposed to positive STEM role models, personalities, workers, professionals and projects or activities that encourage active learning engagement with STEM. An overview presented in Figure 3 provides a continuum of ideas and challenges throughout the K–12 years.

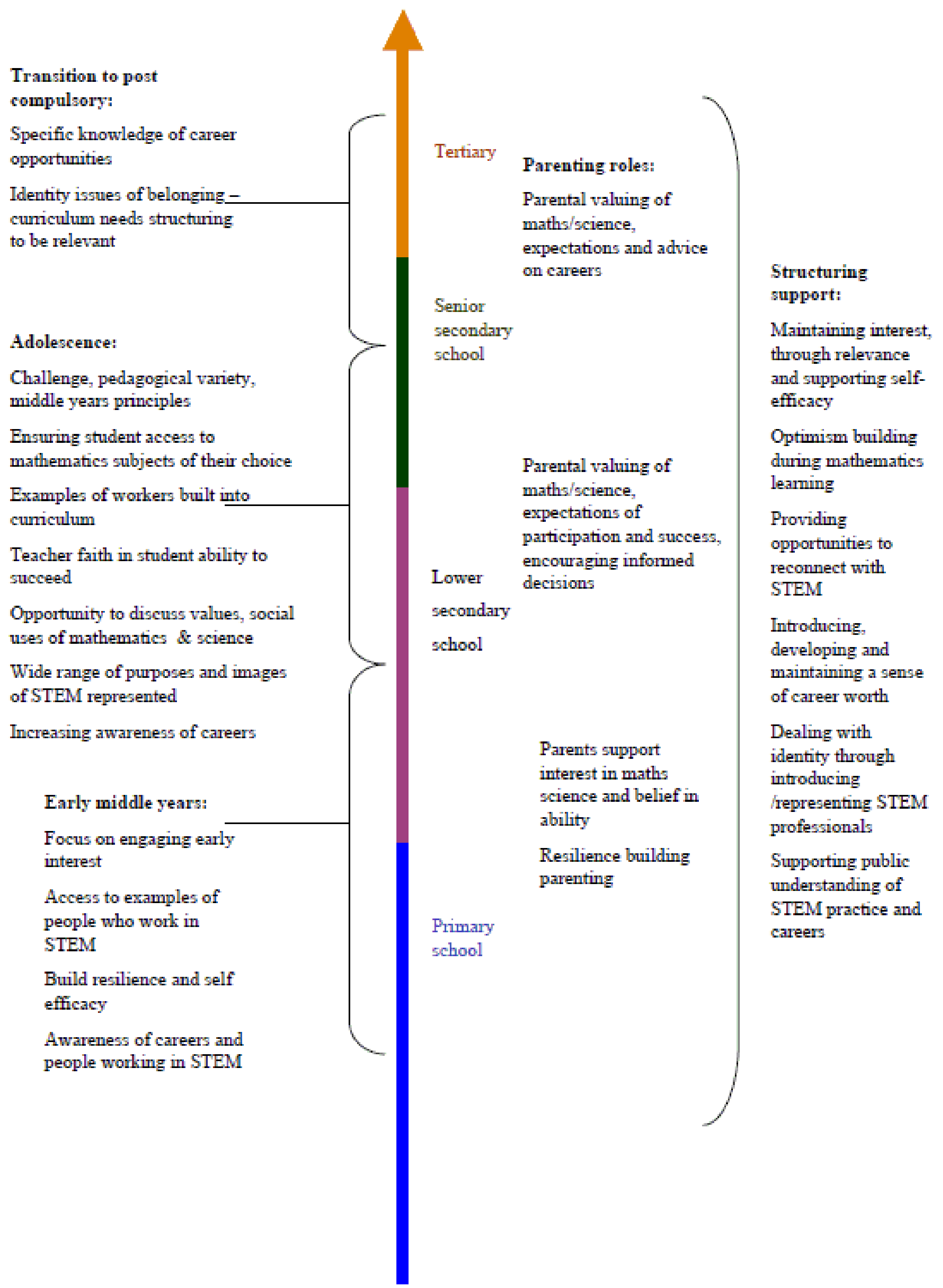


Figure 3 Factors influencing engagement with STEM at different stages of schooling (Tytler, 2008, p.132)

Internal school structures

Finegold (2012) identifies a range of school structures that are required in order to ensure a STEM education program is successful. Leadership at senior level and within the teacher cohort is needed to drive the change. This leadership should be actively committed to STEM education and drive the change within their school. The leadership also needs to communicate effectively (Johnson, 2012) and value the ideas and roles of staff within the implementation program. Rennie (2012) also noted that flexibility in timetabling and how classes are structured or accessed requires decisions by the leadership team when considering integrated STEM learning experiences.

Secondly, developing and implementing a program requires a clear action plan, stated roles, objectives, activities and timing. This needs to be managed in conjunction with considerations about how outcomes for students will be tracked and how the outcome of the STEM initiative will be evaluated.

Lastly, the role of professional learning for staff is critical to the implementation. Designated meetings and times for learning from within the staff and outside experts is needed for both planning and ongoing implementation. Ultimately the climate of the school needs to be one where innovation is valued and the benefits to students and teachers is clearly articulated (Finegold, 2012).

Pedagogical practices

The predominant approach to increasing student engagement with STEM involves enriching students' science, technology, engineering and mathematics learning experiences through local initiatives, and increasing teaching quality through coherent training and professional development. The solution is a focus on developing teachers' capacities to enact new pedagogies (Marginson, 2013). STEM education should also foster

> *inquisitiveness, cognitive skills of evidenced based reasoning, and an understanding of the process of scientific investigation*
>
> Wang, Moore, Roehrig & Park, 2011, p.3

A number of frameworks or processes have been used in STEM pedagogical practices. The core practices are:

- project/problem based learning (PBL) (Asunda & Mativo, 2016; Boaler, 2014; Wang, Moore, Roehrig & Park, 2011)
- challenge based learning
- design thinking (Stanford University, n.d.)
- inquiry learning (School Libraries and Information Literacy unit, 2007; Wang, Moore, Roehrig & Park, 2011)
- games based learning (Atkinson & Mayo, 2010; Boyle, Hainey, Connolly, Gray, et al, 2016).

Project based learning

Project based learning (PBL), and all the derivatives of this, (Larmer, 2014) is a pedagogy that allows students to design or create a product or solution for a real world issue. In PBL the question is open ended and there is a range of solutions. PBL and challenge based learning, which focuses on collaboration, global issues and innovative use of technology, use the same essential elements (Buck Institute for Education, 2015). These pedagogies must include:

- initiation by a problem or question
- research or knowledge components that require depth in the inquiry phase
- real world issue or experience
- some student control over the learning process and product
- structures in place for students to self-reflect and evaluate
- high quality work
- solution or presentation accessible outside the immediate classroom environment.

Innovative teaching and learning: lessons from High Tech High's founding principal **by Edutopia**

Slough & Milam (in Capraro, p.16) assert that there are four design principles within a PBL approach to STEM:

- Making content accessible – ensuring that the content is appropriate for students within their context
- Making thinking visible – using scientific processes to allow for visible exploration
- Helping students learn from others – grounded in constructivism and enables students to learn collaboratively
- Promote autonomy and lifelong learning – grounding the learning in inquiry and metacognitive practices leads to learner autonomy.

Design thinking is a series of activities formalised into a process to create a solution to a problem or issue. Design thinking as a process was implemented by Stanford University within their dschool (Stanford University) and has the following phases:

- empathise
- define
- ideate
- prototype
- test.

It is an iterative process that continually checks the purpose and need of the audience to create and re-create solutions until the design meets the need.

Programs for a specific purpose (project based learning combining inquiry learning) and duration that have intensive STEM knowledge have been implemented to bring in outside experts and, at the same time, encourage STEM graduates to consider teaching. One example of this is where graduate students from Berkeley mentor groups of 4–6 students once a week for six weeks. The mentors work with the students in an inquiry mode. The mentors then guide the students in designing, carrying out, and analysing experiments to determine an answer (Axelson, 2016).

Inquiry learning

Inquiry learning is a process that enables students to research or develop skills through locating, gathering, analysing, critiquing and applying information in a wide range of contexts, some of which will be within a project based learning structure. Inquiry learning structures support learners to research effectively and is an approach to information acquisition that teaches the necessary information skills (School Libraries and Information Literacy Unit, 2015). Inquiry learning underpins the Australian Curriculum (ACARA, 2012) specifically in science, technology, mathematics and history, and is an important component of effective STEM education.

In early years' classrooms, structured play has been found to use rigorous content and sustains learner engagement (Wohlwend & Peppler, 2015). Structured play is an early years approach to a guided inquiry process that allows the learner to develop curiosity and problem solving skills, important for STEM education.

The practice within curriculum integration planning is a backward design process (Wiggins & McTighe, 1998) that allows teachers to develop an integrated STEM unit and is also based in inquiry learning. Questions in this three stage process are:

- What is worthy and requiring of understanding?
- How will the teacher know that students understood the concepts of the lesson/unit?
- What activities does the teacher need to include

that will lead to the desired outcomes?

A pedagogical knowledge practice framework (Hudson, 2015, p.136) has been used to implement a STEM education program in Queensland. This framework explicitly moves the teacher as curriculum developer and deliverer through the following steps as part of an inquiry model or a project based learning methodology in a primary school:

- planning
- timetabling
- preparation
- teaching strategies
- content knowledge
- problem solving
- classroom management
- questioning skills
- implementation
- assessment
- viewpoints.

The explicit nature of these steps shows promise with supporting teachers designing and delivering in the STEM area. It provides scope for problem solving, questioning, real world experiences and inquiry research that is core to engaging students with STEM and related fields.

Additionally, the 5D instructional framework (Duschl & Bybee, 2014) has component elements of:

- deciding
- developing
- documenting
- devising
- determining.

These are noted as the type of problematic processes within an inquiry or PBL methodology that the students of K–12 might consider or encounter when engaging in STEM activities. The intent is to enable rich opportunities for discussions and engagements to take place.

Another framework or model that has been identified for use in the STEM education area is that of the Engaged to Learn model (Tytler, 2008). This model focuses on engagement and reducing apathy, anxiety and boredom which have been previously identified as barriers to student learning and engagement. Tytler (2008) states that transmissive teaching methods, traditionally encountered in mathematics and science, together with a perceived lack of relevance, have a direct correlation to the attitudes of students in these disciplines.

Co-curricular models such as MESA (Mathematics, Science and Engineering achievement) (Denson, 2015), which is an informal learning environment, can support students learning through the following strategies:

- informal mentoring
- make learning fun
- time management
- application of mathematics and science
- feelings of accomplishment
- confidence building
- camaraderie
- exposure to new opportunities.

Future learning skills (Future Workskills, 2020; Sahin & Top, 2015, Wall & Bonanno, 2014) can be developed and encouraged through using an instructional style that allows students to explore their world. STEM education in a project based and inquiry based learning framework can embed these future skills.

Teacher development

There is confusion among teachers as to the definition of STEM education (Lamberg & Trzynadlowski, 2015). Definitions and perceptions of STEM education are varied, as are teacher perceptions of integration. Most teachers also believe that the use of technology, such as a laptop, meet the requirements of integrating the T in STEM education. This lack of a clear understanding also exacerbates the difficulty of implementing a rigorous STEM program in primary schools.

Lyons and Quinn (2010 & 2012) have identified that teachers have an impact on student interests in STEM. Teachers have more influence than they realise on student perceptions, subject selection, and career choices.

STEM graduates do not consider teaching as a career (Tytler, 2008; Watt, 2009) and the encroaching retirement age of many in the STEM disciplines will increase shortages. Owing to the lack of qualified staff, the accepted practice of using teachers outside their field of expertise to teach in the STEM disciplines, influences student take up of subjects and teachers' abilities to deliver a rigorous program.

Out-of-field teachers need resources, support and mentoring. Developing teachers' skills and orientation to take this area seriously will need to go hand-in-hand (Fiengold, 2012; Morony, 2015). Primary school teachers as generalists have difficulty in improving effective engagement with science as they have a lack of confidence, competence and a proven ability to support students in their scientific investigations (Tytler, 2008). Bell's (2015) research recognised that the effectiveness of delivery of STEM education in the classroom was dependant on the knowledge and skills of teachers. If teacher knowledge is deficient then the impact on student learning is limited.

A range of professional learning approaches have been found to be of value depending on the school context and culture. These approaches include:

- external partnerships
  Teachers developing an interdisciplinary curriculum with support from university partners led to an ongoing relationship between the Australian School for Maths and Science and Flinders University (Bissaker, 2014, p.56)
- internal school structures
  There is a need to use time effectively at school and in meetings to encourage professional dialogue between teachers (Finegold, 2012).
- specialist support
  Given the aptitudes of the general education profession as outlined by Wai (2016), teachers have lower maths and spatial aptitudes in comparison to those who move into a STEM related field. Hence the need for content knowledge at primary and secondary levels (if specialist teachers are not available).

The effective implementation of STEM education in NSW schools requires the following actions:

- professional learning to inform a clear understanding by all teachers in NSW schools as to the definition and purpose of STEM education
- professional learning for teachers at all levels in the STEM fields
- consideration of teachers in the STEM subject fields and their impact on the perceptions of students about STEM related disciplines.

Findings and implications

This review has outlined the need for STEM education in K–12 schools and explored the specific factors to consider for its effective implementation in NSW schools:

- STEM education in K–12 schools
- Pedagogical practices
- Teacher development

STEM education in K–12 schools

Implementing STEM education in NSW schools requires a focus on how and who. How will the school implement STEM education? NSW schools will need to consider how an interdisciplinary approach to implementation can meet the need for curiosity and reflection. Leadership in schools will need to consider how staff skills and school structures can support the implementation of STEM education. It is also important for primary schools to implement STEM education as early as possible.

All four areas of STEM are equally important and play different roles, they may not have the same weighting in time allocation for subjects but are all necessary for STEM e.g. mathematics is applied in the science or engineering areas and technology is the tool, the vehicle through which the areas connect.

Pedagogical practices

An active learning methodology such as project based learning (PBL) underpinned by inquiry learning has been recognised as the most effective strategy for STEM education. PBL provides a process for teachers to incorporate student centred learning in real world contexts that encourage curiosity, critical thinking and reflection. The NSW Quality Teaching Framework (NSW Department of Education and Training, 2003) provides a basis to build STEM education upon as it promotes deep learning and authentic real world experiences.

Teacher development

Teachers need access to professional learning in the STEM education disciplines, in particular in the primary school. Where possible, schools should ensure that teachers involved with STEM education have the necessary qualifications or expertise to share with students.

Implications of STEM research for designing STEM education programs and initiatives for NSW schools:

System implications

- Professional learning as part of the everyday learning of teachers needs to become a part of their week or meetings
- Leadership and a commitment to STEM education at the school level is critical
- Time in schools for meetings and planning are critical
- Aligning STEM subjects with teacher expertise and passion is critical to student perceptions of the STEM field. Role models are an important factor in students selecting STEM careers.

Implications for primary schools

- STEM education is for all students, not only for selected students who may already show an interest or talent in that field
- Primary school teachers will be able to use the integrated process to make connections across subject areas and address syllabus outcomes in authentic ways
- Core knowledge in the STEM fields for primary teachers needs developing
- STEM education should focus on teaching skills not facts.

Implications for secondary schools

- STEM education is for all students, not only for selected students who may already show an interest or talent in that field
- An interdisciplinary approach is a more effective construct for delivery of STEM education, however in secondary schools this will take coordination and collaboration due to existing practices and timetables
- Core knowledge and understandings need to be better communicated across faculties particularly in secondary settings
- STEM education should focus on teaching skills not facts.

The STEM Academy Transdisciplinary Approach Year Three
by Foxbrite LLC

Conclusion

STEM education is about creating opportunities for authentic learning experiences to occur to develop critical thinking skills and problem solving through an iterative design / building or developing process that produces an end product which showcases student learning.

STEM education should be seen as an integrated component of curriculum in NSW. Both in NSW (BOS NSW, 2003; BOSTES, 2012) and nationally (ACARA, 2012), the curriculum highlights the need for inquiry learning and authentic learning using active learning methodologies such as project based learning and design thinking. Active learning includes critical thinking, problem solving and reflection, all core elements of an effective STEM education program.

The research literature in the STEM field is developing and changing, so it is important for schools and teachers to engage with STEM research literature to inform the development of an effective STEM education program.

NSW schools have a range of curriculum to link to and from in order to design and develop an effective STEM education program. Primary schools can utilise a core concept of curriculum integration and secondary schools have the expertise of teachers in the STEM fields to design a curriculum program that best meets their needs.

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Share this

Libraries for future learners conference 2016

Libraries for future learners is on again in 2016! Hosted by the NSW Department of Education, and open to all, a special program to *inspire, connect, transform*, and *share* is being developed in consultation with a Conference Advisory Group. Teacher librarians and colleagues, the conference is scheduled for Monday 17 October 2016, so reserve this date.

Want to be part of the conference team? Area teacher librarian and school library professional network Executives are welcome to nominate a representative. Email your nominee to Colleen.Foley@det.nsw.edu.au.

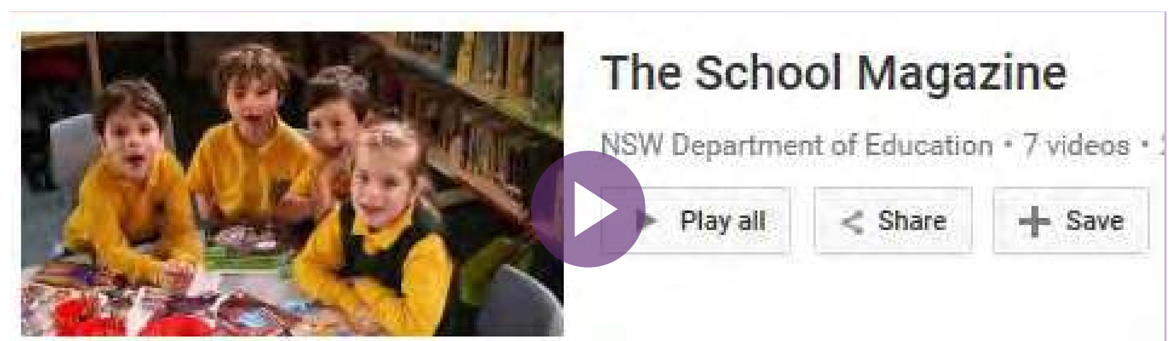
For more information, watch the School libraries support website, *Scan* tweets and internal Department social media such as Yammer.

CBCA Book Week 2016

Australia! Story Country is the theme for CBCA Book Week 2016, 20–26 August. The book of the year notables and short list have been announced. The winners will be announced on 19 August. Visit the CBCA website for more information and updates.

The School Magazine celebrates 100 years!

The School Magazine is celebrating its centenary in 2016. View the enticing celebratory videos from the ambassadors, along with teacher librarian and student perspectives. Visit the website for more information about *The School Magazine* and centenary celebrations.



STEM springboards and reviews

This issue of *Scan* includes a special focus on STEM learning. View our collection of inspiring STEM springboards and reviews, and share them with your colleagues! Additional STEM resources will be reviewed in future issues of *Scan*, so keep an eye out for the STEM icon. For additional information and background, consider also the links included in the literature review and STEM article.

Australia's great school libraries

Recently, Freedom of Access to Information and Resources (FAIR), issued a media release about their collaborative campaign to highlight great school libraries in Australia. Of 600 applicants, 213 school libraries made the honours list. The honours list includes government and non government schools from all across Australia. A report, summary and related ACER research are included in the materials available.

Vivid lights and STEM

Discover how to take STEM+ARTS into your homes or classrooms by joining us at *Vivid Ideas 2016*. Makers meet Maths in the Lumifold workshops:

LUMIFOLD: Fold your own paper lamp.
Create a beautiful lamp using a technique called Origami Sekkei (mathematical paper folding) on Saturday Tuesday 11th June,
2pm – 4pm.

The Book Bunker

The Book Bunker is a free library for patients at the Children's Hospital at Westmead NSW. It was created 19 years ago with key support from Scholastic Australia and other sponsors such as the Variety Club. It also liaises with the Department's Hospital School at Westmead Children's Hospital. The Book Bunker is a welcome haven for patients.

Recognised throughout the world, this ground-breaking library uses the latest technology and the services of qualified volunteer librarians, most of whom are retired or part time teacher librarians, to provide a wonderful service to ease the stress and boredom of children who are often in hospital for long periods of time. Ambulatory patients, or parents, visit the library to browse or read in a cosy and colourful environment. Patients who are bedbound may select from a trolley taken to the wards by librarians, or they may use their bedside telephones to ask for a selection of resources to be brought to them.

The Book Bunker's procedures cater for the special needs of patients. Those with suppressed immunity borrow from a collection of new books, which are as sterile as possible. Once returned, these resources are processed for other users. For patients with infectious diseases, a collection of extra copies of books is available and need not be returned.

Patients come to the Children's Hospital at Westmead from New Caledonia for specialist paediatric care not available in their own country. The Book Bunker's collection of French language books, contributed to by Scholastic Canada and the New Caledonia Cancer League, is well used. Recently, nurses caring for a patient from New Caledonia remarked that, when she received some French language books to read, she smiled for the first time since arriving at the hospital.

The Book Bunker's librarians and visitors look forward to celebrating its 20th anniversary next year. Visitors are welcome on weekdays between 10 am and 3 pm.

Can you help? There is presently a need for experienced librarians to join the team to assist when current voluntary library staff members are ill or on holidays. If you are interested in volunteering, please contact Jenny Katauskas, Volunteer Coordinator, The Book Bunker at: Phone: 9845 0808

Mobile: 0409 727 839

Email: jkatauskas@gmail.com

resource reviews

Contents

Resource reviews are provided for teachers to support their teaching and learning programs.

The views expressed by reviewers are their own and should not be considered as an endorsement of the material by the NSW Department of Education (NSW DoE).

Reviews are sometimes accompanied by embedded video or multimedia content, book trailers, or links to other sources. Publication of such does not imply endorsement by the NSW Government, the Department or *Scan*. Since many of these videos are sourced from YouTube, teachers in NSW DoE schools should note that these resources are accessible only by staff.

Resources are reviewed by teacher librarians, teachers and consultants across NSW. See *Who reviews?* for more information.

Access to reviews and resources

The searchable database of resource reviews includes those published in *Scan* and more!

Use *Scan* to select resources for learning, teaching and leisure. For example, use the barcodes of eresources to scan your selections into a SCIS order or go to the SCIS *Special order files* for the *Scan* Primary, Secondary and Professional website compilations. NSW DoE users can ensure ready access for teachers and students to the range of online resources through *Library*, in their portal.

Classification given in *Scan* for nonfiction material is the 14th Abridged Dewey, although when ordering SCIS cataloguing records, the 23rd may be specified.

KLA and USER LEVEL should only be used as a guide, as many resources transcend age and subject barriers.

USER LEVELS ARE GIVEN IN STAGES AS FOLLOWS:	
Early Stage 1	Preschool/kindergarten/ early childhood
Stage 1	Years 1–2
Stage 2	Years 3–4
Stage 3	Years 5–6
Stage 4	Years 7–8
Stage 5	Years 9–10
Stage 6	Years 11–12
Community	for community/parent/adult
Professional	for teachers

KEY LEARNING AREA (KLA) ABBREVIATIONS USED:	
CA	Creative Arts
English	English
HSIE	Human Society & Its Environment
Languages	Languages
Mathematics	Mathematics
PDHPE	Personal Development, Health & Physical Education
Science	Science
SciTech	Science & Technology
TAS	Technology & Applied Studies
AND	
VET	Vocational Education & Training
CEC	Content Endorsed Course

Abstract – indicates a resource is described rather than evaluated

A simple way to analyse motion. *Video physics*

Australian curriculum springboard

Physics & Mathematics

STEM

Stage 6
Years 11-12

How to use Vernier Video physics (May 2015)
by Jeffrey Hsi

Physics Stage 6

Outcome: *Moving About*

Vehicles do not typically travel at a constant speed. 8.4.1.
Students:

- present information graphically of:
  - displacement vs time
  - velocity vs time for objects with uniform and nonuniform linear velocity

Outcome: *Space*

Many factors have to be taken into account to achieve a successful rocket launch, maintain a stable orbit and return to Earth. 9.2.2.
Students:

- perform a first-hand investigation, gather information and analyse data to calculate initial and final velocity, maximum height reached, range and time of flight of a projectile for a range of situations by using simulations, data loggers and computer analysis.

Physics Stage 6 syllabus

Mathematics 2/3 Unit Stage 6

Applications of calculus to the physical world. 14.3 E. Velocity is defined as the rate of change of displacement, and acceleration as the rate of change of velocity. The notations should be introduced and used. Examples should concentrate on simple applications including physical descriptions of the motion of a particle given its distance from an origin, its velocity or its acceleration as a function of time.
Mathematics 2/3 unit syllabus

Review:

Video physics

Finding a way to analyse motion in a physics classroom has always been problematic. This iOS app offers a simple, accurate and engaging method of motion analysis for one and two dimensional events. Students can set up experiments and capture the motion using the iPad's camera. The app then can display the motion as displacement/time and velocity/time graphs for each dimension of motion. Teachers and students of Physics and Mathematics will find this particularly useful for the analysis of *projectile motion*. The app also allows for the analysis of *circular motion*. Investigations using this tool can be performed in the lab or outside using common objects such as bicycles and sporting equipment, thus making the investigations and measurements more relevant to real life experiences. Integrating the data with the free iPad app *Vernier graphical analysis* will allow more detailed analysis of data, such as calculating acceleration rates. D. Randall

USER LEVEL: Stage 6
KLA: Mathematics; Science
SYLLABUS: Mathematics 2/3 Unit Stage 6; Physics Stage 6
PUBLISHER: Vernier Software & Technology, USA
REVIEW DATE: 14/04/2016 [531]
SCIS 1756965 $7.99

Teaching and learning opportunities:

- Use *What is a projectile?* to gain a basic understanding of projectile motion
- Watch *How to use Vernier Video physics (May 2015)*
- Practice using the app by analysing one of the sample videos
- Students create their own video of projectile motion
- Using the app, analyse the data from the video for horizontal and vertical motion
- Calculate the horizontal and vertical acceleration from the graphs produced by the app
- Use *Angry birds* to view projectiles and analyse using equations.
- Incorporate *Video physics* in STEM units of work where students create catapults or bottle rockets and capture motion.

Resources:

- *How to use Vernier Video physics (May 2015)*
- *Motion in two dimensions*, $0.99
- *PhET interactive simulations: projectile motion*
- *Vectors - motion and forces in two dimensions*, The physics classroom
- *Vernier graphical analysis*, free
- *What is a projectile?*

Chemistry: Abstract concepts taught through interactive simulations. *PhET*

Australian curriculum springboard

Mathematics
Science
STEM
Stage 5
Years 9–10

Build an atom by PhET

Science K–10 (SciTech K–6)

Outcome: *Chemical World*

A student:

- explains how models, theories and laws about matter have been refined as new scientific evidence becomes available SC5-16CW

Content:

The atomic structure and properties of elements are used to organise them in the Periodic Table (ACSSU186).

Students:

- identify the atom as the smallest unit of an element and that it can be represented by a symbol
- distinguish between the atoms of some common elements by comparing information about the numbers of protons, neutrons and electrons.

These outcomes are linked to some *PhET* simulations, including *Build an atom*, *Build a molecule* and *Isotopes and atomic mass*. *PhET* simulations also cover outcomes across Physics, Chemistry, Biology, and Earth and Environmental Science, as well as Mathematics. Additionally, they support learning in the *Science K–10 (incorporating Science and Technology K-6) syllabus* across the *Earth and Space, Living World, Physical World* and *Chemical World* strands.

Advice, implementation support and resources for NSW DoE teachers: *AC – NSW syllabuses for the Australian Curriculum* [intranet].

Review:

PhET: interactive simulations for science and math

Developed and refined through careful educational research, these engaging interactive simulations for teachers and students cover a breadth of abstract Science and Mathematics concepts. Many of these concepts are too small to see, like the molecules in a chemical reaction or are too dangerous to test, like nuclear radiation. The simulations show the complexity of relationships within a concept, as in the pH scale simulation, which shows the relationship between pH, concentration of hydrogen ions and hydroxide ions and number of molecules changing in real time as the user alters one component of the system. The site is easy to navigate and the search facility conveniently groups its results by discipline. Many of the simulations have a game function for students to test their understanding. Resources are available to complement simulations. *Teaching resources* shares teacher made and tested resources and enables teachers to share how they have used the simulations. Most of the simulations are in HTML5 format, making them accessible across devices, including tablets and mobile phones. Flash videos are not compatible with iOS devices. J. Perry

USER LEVEL:	Stage 4 Stage 5 Stage 6
KLA:	Science; Mathematics
SYLLABUS:	Biology Stage 6; Chemistry Stage 6; Earth & Environmental Science Stage 6; Mathematics Extension 1; Mathematics General Stage 6; Mathematics K–10; Mathematics Stage 6; Physics Stage 6; Science K–10 (SciTech K–6)
PUBLISHER:	University of Colorado, USA
REVIEW DATE:	14/04/2016 [530.071]
SCIS 1260215	

Teaching and learning opportunities:

- Prepare a model of an atom using the computer simulation in *PhET*
- Create models of atoms using lollies, Lego or buttons, and create a collage using *PicCollage* of the elements created
- Create models of each neutral atom and each of its isotopes and compare them
- Create a digital book with information around each element using *Book creator*
- Construct a table showing the number of protons, neutrons and electrons in each element
- Research one element in regards to atomic structure, uses, chemical and physical properties and discovery. Create a presentation about the element using the *EduCreations interactive whiteboard* app
- Create a giant periodic table and include QR codes that link the user to information about each element found on the internet (e.g. *WebElements*)
- Create a timeline of discovery of elements
- Watch *The uncertain location of electrons - George Zaidan and Charles Morton* and/or *Thomson's plum pudding model of the atom* and compare different models of atoms to discuss the limitations of each model
- Write a narrative about the discovery of an element and then record it using *Adobe spark video*.

Professional resources:

- *Royal Australian Chemical Institute*
- *The Royal Society of Chemistry Data book*

How can the health and yield of a crop be measured from a photo?
Remote sensing and GIS in agriculture

Australian curriculum springboard

Agriculture

STEM — Science Technology Engineering Mathematics — NSW Department of Education

Stages 5–6
Years 9–12

Remote sensing and GIS in agriculture

Outcomes:

Agriculture Stage 6

Students evaluate a range of new technological developments that may assist agricultural industries including:
- satellite technologies, e.g. global imaging and global positioning systems

For ONE recent technological development, students learn to:

- explain the reasons for the development of the technology
- outline the historical development of the technology
- describe in detail the technological development
- evaluate the impact of the technological development in terms of: economic, environmental, social, legal and managerial factors. Elective 3 – *Farming for the 21st century*

Agriculture Stage 6 syllabus

Agricultural Technology 7–10

- Students learn about the application of current and emerging technologies to agricultural enterprises. Core B, 5.4.1

Agricultural Technology Years 7–10 syllabus

Review:

Remote sensing and GIS in agriculture

A simple tutorial on the background theory and practical applications of remote sensing technology, this website covers topics such as *Crop yield estimation, Crop identification* and *Precision agriculture*. Teachers and students should find its clear layout and concise illustrated material easy to understand. This material will be particularly relevant to students in Year 12 Agriculture who are studying the *Farming for the 21st century* elective. The site also has worksheets to allow students to engage in activities related to the information presented in the tutorial sections. D. Randall

USER LEVEL: Stage 5 Stage 6

KLA: TAS; Technology

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6

PUBLISHER: SEOS, Germany

REVIEW DATE: 14/04/2016 [630.2]

SCIS 1756983

Teaching and learning opportunities:

- Discuss the challenges facing a farmer in monitoring the health of an extensive crop
- Watch *NDVI – Normalized Difference Vegetation Index*
- Construct a light reflectance graph showing reflection and absorption of light from a plant
- Discuss the imbedded questions when working through the tutorial
- Complete the *worksheets* from *Remote sensing and GIS in agriculture*
- Research the methods which are used to collect images for NDVI calculations
- Describe examples of the use of NDVI data in Australian agriculture
- Evaluate the benefits of NVDI to Agriculture in terms of profitability, chemical use and crop management.

Professional resources:

- *Normalised Difference Vegetation Index*, Bureau of Meteorology
- *How does NDVI imaging work?*, University of Tasmania
- *NASA earth observatory*, NASA
- *Pastures from space*, Landgate
- *Rural: The high tech study using satellites to map Australia's mango, macadamia and avocado crops*, ABC

How do we know there is life on Mars? *Mars lab*

Australian curriculum springboard

Science

STEM | Science Technology Engineering Mathematics | NSW Department of Education

Stage 5
Years 9–10

[The Mars lab at MAAS, Sydney Australia](#) by Mars lab TV

Science K–10 (SciTech K–6)

Outcome: *Earth and Space*

A student:

- describes the dynamic nature of models, theories and laws in developing scientific understanding of the Earth and solar system
- describes changing ideas about the structure of the Earth and the universe to illustrate how models, theories and laws are refined over time by the scientific community SC5-12ES

Content:

Students:

- relate the formation of a range of landforms to physical and chemical weathering, erosion and deposition ES1
- outline the origins of and relationships between sedimentary, igneous and metamorphic rocks ES1
- describe some examples of how technological advances have led to discoveries and increased scientific understanding of the solar system ES2
- describe, using examples, some technological developments that have advanced scientific understanding about the universe ES1.

Review:

Mars lab

Based on the Powerhouse Museum's re-creation of the Martian surface, this website offers teachers and students a range of hands-on experiences in robotics and space exploration, with the *Mars yard simulation game* being the most accessible. Based on NASA's Opportunity rover, the *Mars yard simulation game* enables users to control a solar-powered rover on a simulated 3D Martian surface in a games based learning environment. While the main focus of this simulation is on scientific and engineering concepts within space exploration, a multitude of cross-curricular STEM learning opportunities are possible, as users seek signs of past life on Mars in a series of game-based missions. The flexibility of choosing between guided missions or roaming freely around the Mars yard enables teachers to design a range of STEM learning opportunities, from structured learning to inquiry-based learning and project-based learning supporting the *Science K–10 (incorporating Science and Technology K-6) syllabus* and *Design and Technology Years 7–10 syllabus*. A. Leung

USER LEVEL: Stage 5
KLA: Science
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: Powerhouse Museum, NSW
REVIEW DATE: 14/04/2016 [720]

SCIS 1756477

Teaching and learning opportunities:

- Design a rover to explore the Martian surface using physical materials, graphics software and 3D printing
- Create a poster to compare the types of rocks found on Mars and Earth
- Create a video to explain the evidence used to classify Martian rocks and relate this to Earth's rock cycle
- Write a comparison of the conditions of Earth and Mars
- Write a persuasive text to argue why society should support space research
- Create a timeline to show the technological advances through the history of NASA's Mars rovers.

For more on the *Mars lab* program, refer to *The Mars lab: connecting authentic science with the classroom* in *Scan* 34.1.

Professional resources:

- *The Mars lab: 60 minutes on Mars* – lesson outlines regarding the use of rovers to search for signs of life on Mars
- *The Mars lab: research* – an overview of current research projects on robotics, engineering, and education offered by *The Mars lab*.

Composing:

- *ReadWriteThink* – search for *persuasive text* for the writing task
- *SketchUp* – for design and planning. Free for K-12 students and teachers, with registration.
- *Tiki-toki* – timeline creation tool. Free and premium accounts available.

Advice, implementation support and resources for NSW DoE teachers: AC – NSW syllabuses for the Australian Curriculum [intranet].

How does genetic engineering affect us?

Genetically engineered crops

Australian curriculum springboard

Science

Stage 5
Years 9–10

Genetically engineered crops

Science K–10 (SciTech K–6)

Outcome: *Living World*

A student:

- explains how biological understanding has advanced through scientific discoveries, technological developments and the needs of society SC5-15LW

Content:

Advances in scientific understanding rely on developments in technology, and technological advances are often linked to scientific discoveries LW3.

Students:

- identify that during reproduction the transmission of heritable characteristics from one generation to the next involves DNA and genes
- identify that genetic information is transferred as genes in the DNA of chromosomes
- describe, using examples, how developments in technology have advanced biological understanding, e.g. vaccines, biotechnology, stem-cell research, in-vitro fertilisation
- discuss some advantages and disadvantages of the use and applications of biotechnology, including social and ethical considerations.

Review:

Genetically engineered crops

Featuring a comprehensive collection of digital resources on genetics and inheritance, this website is a valuable eresource for teachers to develop students' scientific content knowledge for STEM activities. Accessible via laptops and mobile devices, the site has a book-like feel and comprises videos and interactive digital activities. Suggested activities enable students to understand the complexities of the mechanisms of inheritance and the controversy in the social and ethical implications of genetic engineering. Each digital resource in the collection can be used as a standalone activity or as a series of activities, as suggested by the eresource. For this collection to be a valuable STEM resource, teachers need to use it to create activities where students incorporate maths and technology to demonstrate their scientific knowledge, as suggested in the teaching and learning opportunities. A. Leung

USER LEVEL:	Stage 5
KLA:	Science
SYLLABUS:	Science K–10 (SciTech K–6)
PUBLISHER:	Education Services Australia, Vic
REVIEW DATE:	14/04/2016 [720]
SCIS 1592627	

Teaching and learning opportunities:

- Use *5SecondsApp* to create a GIF to show the process of mitosis and meiosis
- Use *Scratch* to create an animation showing the processes of genetic engineering
- Use *Office mix* in PowerPoint to create an online lesson that explains genetic modification and genetic engineering
- Use the *Read write think: comparison and contrast guide* to compare/contrast genetic modification and genetic engineering
- Debate the impacts of genetic engineering on society.
- Use *Excel online* or *Google sheets* to devise ways to collaboratively collect, collate and evaluate public opinion on genetic engineering.

Professional resources:

- *Genetic modification*, CSIRO

Advice, implementation support and resources for NSW DoE teachers: AC – NSW syllabuses for the Australian Curriculum [intranet].

Improving everyday life with robotics. *Engibear's dream*

Australian curriculum springboard

Mathematics
Science

STEM | Science Technology Engineering Mathematics
NSW Department of Education

Stage 2
Years 3–4

The robot factory by Tinybop

Science K–10 (SciTech K–6)

Outcome: *Products*

A student:

- describes how products are designed and produced, and the ways people use them ST2-16P.

Content:

There are various processes involved in the ways products are designed and produced.
Students:

- examine the process used to produce an existing product by creating a flowchart from design to producing the finished product

People use products in a variety of ways.
Students:

- explore the ways existing products can be reused and recycled to incorporate environmental considerations, e.g. products designed from recycled PET bottles
- examine how people use applications of science and technology in their work, e.g. builders, farmers and graphic designers.

Working Scientifically

ST2-4WS: investigates their questions and predictions by analysing collected data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken.

Working Technologically

ST2-5WT: applies a design process and uses a range of tools, equipment, materials and techniques to produce solutions that address specific design criteria.

Mathematics K–10

Outcome: *Data*

A student:

- selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs MA2-18SP

Content:

Students:

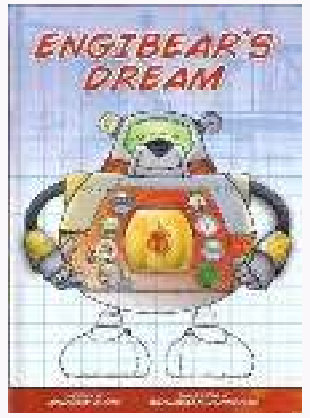
- collect data, organise it into categories, and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies
  - use computer software to create a table to organise collected data
  - use graphing software to enter data and create column graphs that represent data
  - choose an appropriate picture or symbol for a picture graph and state the key used
- interpret and compare data displays
  - describe and interpret information presented in simple tables, column graphs and picture graphs
  - make conclusions about data presented in different data displays.

Advice, implementation support and resources for NSW DoE teachers: AC – NSW syllabuses for the Australian Curriculum [intranet].

Review:

Engibear's dream

KING, Andrew & JOHNSTON, Benjamin
Little Steps, NSW, 2012
ISBN 9781921928901 [A821]



Engibear's dream follows Engibear in his journey to create a robot to help him get his work done. Through a delightful literary experience catering for early primary aged children, readers are exposed via rhyme to an array of technical vocabulary that lends itself to STEM learning. As Engibear modifies Bearbot through a series of prototypes in his quest for perfection, the focus is on concepts of product planning and design. Detailed design blueprints provide a visual stimulus to support understanding and encourage rich discussions. The book aligns strongly with content from the *Products* substrand in Stage 2 in the *Science K–10 (incorporating Science and Technology K-6) syllabus*. In the *Mathematics K-10 syllabus*, opportunities to link to the *Number*, *Two-Dimensional Space* and *Data* substrands are also present. A. Lee

USER LEVEL:	Stage 2
KLA:	Mathematics; SciTech
SYLLABUS:	Mathematics K–10; Science K–10 (SciTech K–6)
SCIS 1574925	$24.95

Teaching and learning opportunities:

- Investigate household/school objects and their uses
- Discuss which objects could be replaced by a robot
- Watch *If I could build a robot*
- Identify a scenario where a robot could make life simpler
- Design a robot. Use the *Dreaming* activity paper to sketch initial designs
- Test the suitability of materials and display data in a table or graph using computer software to show the pros and cons of each material tested
- Using recycled materials, construct a robot to serve a purpose
- Design a robot with *The robot factory* app
- Invite an inventor in for a class discussion
- Investigate the different uses of robots in various fields, e.g. medical, agricultural, corporate
- Visit a factory and use *Popplet* to document the production of a product.

Is soil living?
Soil biology

Australian curriculum springboard

Science & Agriculture

Stages 5–6
Years 9–12

Living soils

Outcomes & content:

Science K–10 (SciTech K–6)

***Living World:* Stage 4**

A student relates the structure and function of living things to their classification, survival and reproduction SC4-14LW.
Students:

- construct and interpret food chains and food webs, including examples from Australian ecosystems
- describe interactions between organisms in food chains and food webs, including producers, consumers and decomposers
- describe examples of beneficial and harmful effects that micro-organisms can have on living things and the environment
- predict how human activities can affect interactions in food chains and food webs, including examples from Australian land or marine ecosystems LW5
  Science K–10 (incorporating Science and Technology K–10) syllabus

Agricultural Technology 7–10

Core A

A student:

- explains and evaluates the impact of management decisions on plant production enterprises 5.3.3
- evaluates the impact of past and current agricultural practices on agricultural sustainability 5.4.1

Students learn:

- to examine soil texture, structure, pH and profiles
- about relationships between resource usage and sustainability of agricultural practices
- about the impact of agricultural practices on sustainability
  Agricultural Technology 7–10 syllabus

Core B

A student:

- explains the interactions within and between agricultural enterprises and systems 5.1.2

Students learn to:

- investigate the effect of beneficial and harmful micro-organisms and invertebrates on plant and/or animal production
  Agricultural Technology 7–10 syllabus

Agriculture Stage 6: *9.1 Plant/animal production*

Students learn to:

- research using secondary sources the importance of microbes and invertebrates in decomposition and nutrient cycling
  Agriculture Stage 6 syllabus

Review:

Soil biology basics

ABSTRACT
Soil is home to many living things.The opening line of this learning module sets the scene for a rich learning experience. An examination of soil biology is an excellent vehicle to understand ecology, food chains or nutrient cycling. The site explains the living things in soils, food webs in soils and how soil organisms are affected by natural events and management. Students and teachers of Stage 5 Science can utilise this resource to examine food chains and nutrient cycling. Agriculture students can examine the management of soils for productive agricultural production.

USER LEVEL: Stage 5 Stage 6

KLA: Science; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: NSW Primary Industries, Agriculture, NSW

REVIEW DATE: 14/04/2016 [631.4]

SCIS 1756919

Teaching and learning opportunities:

- Watch *Going underground: understanding soil biology*
- Explore *Living soils*
- Watch the activity of earthworms in a small scale earthworm farm
- Compare the rates of decomposition of different organic materials
- Analyse soil samples using the techniques outlined in Activity 3 of *Soil biology classroom activities*
- Create a food web based on the findings of your investigations.

Professional resources:

- *OzSoils*
- *Soil biological fertility*, Soil Quality
- *Soil biology*, University of New England

Our social environment: meeting the needs of users. *Kid architects and sustainable design*

Australian curriculum springboard

Science

STEM

Stage 3
Years 5–6

Kid architects and sustainable design by ABC splash

Science K–10 (SciTech K–6)

Outcome: *Built Environments*

A student:

- describes systems in built environments and how social and environmental factors influence their design ST3-14BE

Content:

Systems in built environments are designed to meet the needs of people.
Students:

- identify elements that work together as a system to serve and support built environments and how they are designed to meet the needs of people.

Social and environmental factors influence the design of built environments.
Students:

- consider ways that the design or use of places and spaces have changed over time and the social and/or environmental factors that have influenced these changes, e.g. changes in the design and use of a library due to technological developments or the design of buildings after an earthquake
- develop designs and solutions to meet specific social or environmental needs of users, e.g. an energy efficient building or high traffic airport terminal/train station.

Working Scientifically

ST3-4WS: investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations.

Working Technologically

ST3-5WT: plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints.

Review:

Kid architects and sustainable design

One of a large collection of STEM resources gathered by *ABC splash*, this short, engaging video looks at the way buildings are designed for specific purposes. The program includes interviews with primary students about solutions they have designed and prototyped to address local issues, and lends itself beautifully to the *Built Environments* strand of the Science and Technology K–6 syllabus. Below the video are useful additional tabs for teachers. In particular, *Things to think about* offers some great questions for classroom discussions. While the resource has not been directly aligned to NSW syllabus outcomes, the Australian Curriculum mapping in the *For teachers* section gives teachers a head start by outlining its suitability for Stage 3 students and describing links to learning. A. Lee

USER LEVEL: Stage 3
KLA: SciTech
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: ABC, NSW
REVIEW DATE: 14/04/2016 [720]

SCIS 1760443

Teaching and learning opportunities:

- Read Nadia Wheatley's *My Place* to discuss how a community changes and adapts over time in response to emerging needs
- Go on a community walk to identify buildings or structures that have been put in place to support local need. Use *PicCollage* to document findings
- Collect qualitative and quantitative data within the school community to identify an aspect of the school or local community that users would like to see improved, changed or adapted for better use. Teachers may find *Building the future* useful for helping students to build a case for change
- Redesign an area of the school to better meet the needs of users. Use *Google forms*, to collect data from users
- Invite an architect/town planner/landscaper/builder in to discuss their role with students
- Examine the *Ecospace* resource to support an integrated approach to learning and teaching about the built environment, energy and sustainability

Advice, implementation support and resources for NSW DoE teachers: AC – NSW syllabuses for the Australian Curriculum [intranet].

Surviving natural disasters. *Cyclone*

Australian curriculum springboard

Mathematics
Science

STEM Science Technology Engineering Mathematics NSW Department of Education

Stage 3
Years 5–6

Cyclone tube tornado in a bottle
by Incredible science

Science K–10 (SciTech K–6)

Outcome: *Earth and Space*

A student:

- explains rapid change at the Earth's surface caused by natural events, using evidence provided by advances in technology and scientific understanding ST3-9ES

Content:

Sudden geological changes or extreme weather conditions can affect Earth's surface.
Students:

- investigate a recent Australian example of the effect on the Earth's surface of extreme weather conditions, e.g. cyclones, droughts or floods
- identify ways that advances in science and technology have assisted people to plan for and manage natural disasters to minimise their effects, e.g. detection systems for tsunamis, floods and bush fires.

Working Scientifically

ST3-4WS: investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations.

Working Technologically

ST3-5WT: plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints.

Mathematics K–10

Outcome: *Data 1*

A student:

- uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables MA3-18SP

Content:

Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies.
Students:

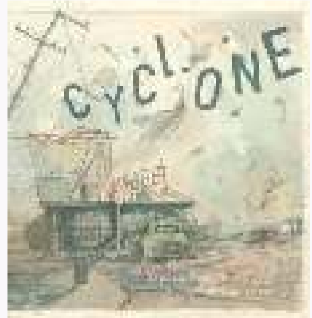
- tabulate collected data, including numerical data, with and without the use of digital technologies such as spreadsheets
- consider the data type to determine and draw the most appropriate display(s), such as column graphs, dot plots and line graphs
- discuss and justify the choice of data display used
- recognise that line graphs are used to represent data that demonstrates continuous change, e.g. hourly temperature
- recognise which types of data display are most appropriate to represent categorical data

Advice, implementation support and resources for NSW DoE teachers: AC – NSW syllabuses for the Australian Curriculum [intranet].

Review:

Cyclone

FRENCH, Jackie & WHATLEY, Bruce
Scholastic Australia, NSW, 2016
ISBN 9781743623596 [A821]



Straight to the point, French's poetic yet blunt rhyming text tells the story of a city's stubborn spirit, while Whatley's magnificent illustrations reawaken the formidable storm that took place on Christmas Eve 1974. As a picture book, this resource is suitable for all primary Stages. Stage 3 students will find it a rich and engaging resource for a unit or project centred on natural disasters and engineering advancements in that field, with its capacity to demonstrate the powerful force of the storm. The book would also be accompanied beautifully by previous titles from French, *Fire* and *Flood*. A comprehensive list of classroom activities Scholastic, supporting the book, can be found on French's website. A. Lee

USER LEVEL: Stage 3

KLA: Mathematics; SciTech

SYLLABUS: Mathematics K–10; Science K–10 (SciTech K–6)

SCIS 1744663 $24.99

Teaching and learning opportunities:

- Research a significant Australian natural disaster
- Investigate an area of Australia prone to a specific natural disaster and explore how structures are modified to withstand its elements
- Recreate a mini-landslide to see the effects of urbanisation, and devise solutions to solve this problem
- Keep a weather journal to observe patterns/trends/changes and plan ahead to prepare
- Investigate the weather patterns of Cyclone Tracy. Select the most appropriate method to display findings and interpret the data
- Create a cyclone in a bottle to observe, record and plan for cyclone behaviour in populated areas
- Invite the RFS or another organisation to talk about natural disaster prevention
- Investigate building materials and test their suitability for protection against a chosen natural disaster
- Research products that have been created to minimise the effects of a natural disaster
- Design and construct a prototype of a new building product to withstand a natural disaster common in Australia
- Construct a building and test its ability to withstand a natural disaster, selecting the most appropriate method to display results

Footpath flowers

Using quality literature springboard

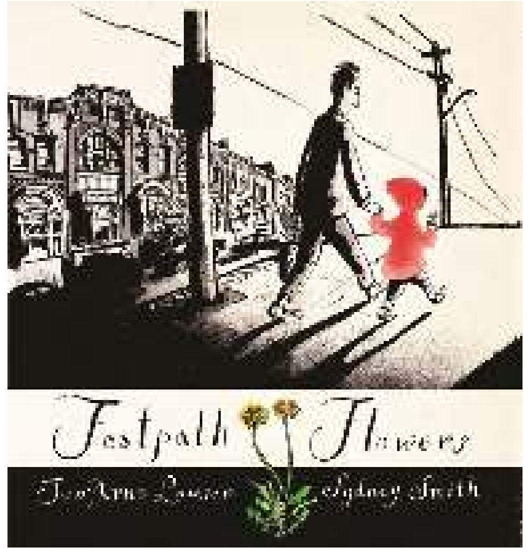
English

Stage 3
Years 5–6

Review:

Footpath flowers

LAWSON, JonArno & SMITH, Sydney
Walker Books, UK, 2015
ISBN 9781406362084



USER LEVEL:	Early Stage 1 Stage 1 Stage 2 Stage 3
KLA:	English
SYLLABUS:	English K–10
SCIS 1695674	$24.95

What is it about?

The picture book's title, *Footpath flowers*, refers to the flowers that a girl collects from cracks in the footpath and walls in the city streets. These are the symbols that link the events in the story. They are symbolic of her joy in discovering beauty in the everyday, moments of connection and colour, her way of communicating, and they represent the ways in which small gestures can have big impact. *Footpath flowers* is a visual representation of the importance of small things, small people, small gestures and the mutual value of giving. This book is ideal for a Stage 3 exploration of visual techniques, narrative structure, and symbolism.

Why is this important? Why does it matter?

Footpath flowers is a deceptively simple story of a young girl's trip home from the shops with her father. The story is represented in mainly black and white but the girl is depicted in colour to orient the reader to her as the focaliser of the action. Colour is used to emphasise what the girl is interested in and represents her world, focussing the reader on what she values. For instance, as she gets closer to home, the colour on the pages increases. The visual techniques are interesting and varied. Landscape views alternate with close ups from differing angles, focusing on the girl and what she sees, and exemplifying her curiosity.

We learn about the little girl's character through her actions. Instead of hoarding her collection of flowers, she gives them all away to animals (a small dead bird and a friendly dog) and people (a man sleeping on a park bench). Upon arriving home, she puts a few in mum's hair and has just enough left to give some to her siblings.

The author and illustrator construct a limited point of view so that the reader shares the child's perspective through colour and framing techniques. The 'adult' world that exists outside the limited point of view of the child is rendered in monotone to emphasise whose view of the world we have been invited to adopt. The story may be read once to enjoy this child's view of the world and again to experience what is happening around her during her father's trip home from the shop. Visual techniques enable the girl's perspective on the world to be realised through sequential framing, colour and symbols. These techniques borrow from comics, graphic novels and film, and may be a good introduction to these textual forms.

Related texts:

- *Luke's way of looking* by Nadia Wheatley & Matt Ottley
- *Mrs Millie's painting* by Matt Ottley
- *The red tree* by Shaun Tan
- *When Henry caught imaginitis* by Nick Bland

Resources:

- *The bottom of the box* (author's blog), JonArno Lawson
- *Sidewalk flowers trailer*, House of Anansi
- *Sidewalk flowers – writing a story without words*, House of Anansi Press and Groundwood Books
- *Visual rhetoric/visual literacy: writing about comics and graphic novels* (a guide to composing sequential art), Duke University

Learning and teaching activities in this springboard are centred on outcomes and content from the *NSW syllabus for the Australian curriculum English K–10 syllabus* and the *English textual concepts* [intranet] resource.

See next page for teaching ideas.

Footpath flowers continued

Using quality literature springboard

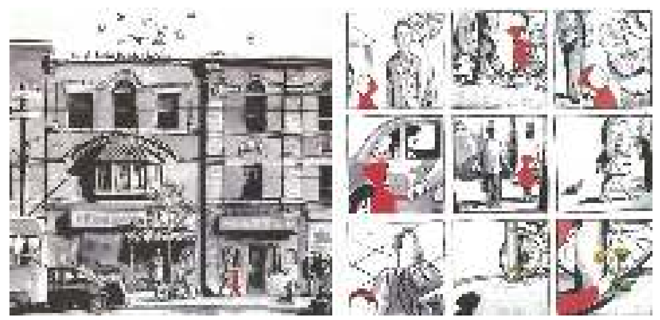
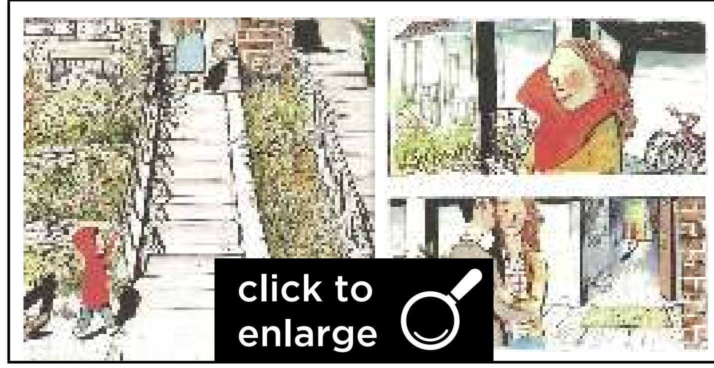
English

Stage 3
Years 5–6

Sidewalk flowers trailer by House of Anansi

How do I use the text to teach the textual concepts of representation, point of view, perspective, character and narrative?

EN3-3A,EN3-5B, EN3-7C

	*Why is this establishing shot mainly black and white?* *Why has the illustrator used a wide long shot first?* *How do the images in multiple panels represent the quick passing of time?* *How do the camera angles used in multiple panels help to represent the little girl's mood? What is her mood?* *What is the little girl's perspective on this part of her world?*
	*Why has this establishing shot been coloured in?* *Why has the illustrator used a wide long shot in the first image?* *How do these multiple panels help to represent time?* *Which frame has the richest colours and why?* *Why has the illustrator used a close up shot in the multiple panels?* *Why is the inside of the house coloured in shades of grey?* *What is the little girl's perspective on this part of her world?*

In order for students to understand how the illustrator has used colour to represent the little girl's perspective of the world, students could compare two double page spreads from the text where colour is used quite obviously to represent this perspective. With a partner, students discuss their ideas and interpretation of the pages, and then share their ideas with the group. They will use comprehension strategies to interpret and analyse the ideas represented in the text, comparing the content to understand how the illustrator has used colour to represent the girl's perspective of the world. Students will learn how to interpret events, situations and characters in texts.

EN3-7C, EN3-8D

Students could then experiment with representing a part of the story through dad's eyes. What would they colour? How would they change the point of view? A close examination of camera shot distances (close, medium, long and birds-eye-view) and angles (low, high, eye level, frontal and oblique) and how they are used to position the reader would be the required scaffolding before students can fully engage with camera shots and angles to represent point of view. Students could look at the double page of the event with the bird in the park and suggest dad's point of view of that event. Perhaps they could sketch a few frames of the event, suggesting different shot distances and angles and selecting what they would colour from dad's point of view.

EN3-7C

Footpath flowers provides a great opportunity for students to investigate colour symbolism. Once they have a sound understanding about how colours can impact a viewer or reader emotionally, students can then experiment with representing a different emotion through colour. They could use the same child or create a short story of their own. Provide students with photocopied pages from *Footpath flowers* in black and white and ask them to re-colour these to represent a new mood. As a group, students can then reflect on the effectiveness of their use of colour to symbolise a change in mood.

EN3-2A, EN3-7C, EN3-8D

A DAY IN THE LIFE OF…			
ME		MUM OR DAD	
TEXT	IMAGE	TEXT	IMAGE
	• *Number of panels* • *Camera angle* • *Colour*		• *Number of panels* • *Camera angle* • *Colour*

Students can then develop a story of their day (from waking up to getting to school) through a limited point of view, emphasising only the things that interest them – this is their normal state! In another column they could write what their parents do at the same time… a dual narrative in a simple form. They could even try to tell both stories together as the third person omniscient narrator who knows the thoughts and feelings of all the characters.

Students could then use their design and layout knowledge of camera shots, angles and colour to visually represent their narrative. Some scaffolding may be required to help students understand the conventions of the narrative form and how they can engage readers through recognisable characters, events and places, plot development, mood, narrative voice and evocative images.

Students may want to explore characterisation that arises out of the actions, feelings and ideas of the people or characters in their story.

EN3-1A, EN3-7C

Using the *Sidewalk flowers digital narration* video as a model, students could record a new digital narration or write the text for *Footpath flowers* in prose or short personal narrative. Students could incorporate spoken dialogue from the point of view of the child, even using childish language!

eresources

Resources are listed in Dewey order

Sites may not be permanent or structured as they were when reviewed. Reviews indicate fees, registration or devices as needed.

Icons used:

- app for iPad/iPhone/iPod touch; app for Android
- digital authoring tool; learning platform software
- ebook; ejournal; online database
- interactive; e.g. game; learning object
- media presentation; e.g. podcast; slide show; digital story; video; audio
- website
- supports STEM learning and teaching
- must be purchased
- scan selected eresources into SCIS *Create orders* or check SCIS *Special order files*

Icons for eresources are from Office clip art and media and Open Clip Art Library.

Peg + cat

Targeting the preschool and early primary years, *Peg + cat* delightfully engages students in an inquiry-based approach to solving mathematical problems through entertaining stories and comedy. The lighthearted animated series focuses on teaching a range of concepts and skills including shapes, measurement, patterns and algebra. The two stories in each episode provide introductory and more advanced applications, with visuals and repetition utilised to reinforce key concepts. The show's format encourages students to develop an understanding of a range of mathematical strategies to solve open-ended problems, providing a fantastic link to the *Working Mathematically* concepts of the *Mathematics K–10 syllabus*. Peg highlights the importance of identifying the problem and setting clear goals, asking questions, drawing a simple picture, brainstorming, and experimenting and persisting. Full episodes can be found on ABC kids and additional resources, including games and adventures reinforcing key concepts, are available at PBS kids. A. Lee

USER LEVEL: Early Stage 1 Stage 1
KLA: Mathematics
SYLLABUS: Mathematics K–10
PUBLISHER: ABC Kids, NSW
REVIEW DATE: 14/04/2016 [F PEG]

SCIS 1756148

Peg + cat: The doohickey problem **by ABC kids**

Hopscotch

Hopscotch is a free coding app for iOS, developed for children between the ages of eight and 12. Through the intuitive interface, users are empowered to create programs from the design stage through to programming, with almost unlimited possibilities. While students do need to be independent readers to follow instructions and commands, and to write their code, the user-friendly drag and drop format allows them to focus on developing their product, without worrying about syntax or spelling errors. Students can view programs created by others or upload their own programs to the community. While additional tutorials would enable concepts to be grasped more quickly, each control is defined in the help section and the app is sufficiently simple that most students will pick it up straight away. A. Lee

USER LEVEL: Stage 3
KLA: SciTech
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: Hopscotch Technologies, USA
REVIEW DATE: 14/04/2016 [005.13]

SCIS 1733802

Hopscotch app tutorial **by Paul Hamilton**

Appsbar

With over 30 app templates, this website allows users to create their own apps with ease and is suitable for all subject areas, particularly STEM subjects. While templates range from cooking apps to photography apps, STEM teachers will likely find the information app the most useful for their students to create an app to teach others a concept area they have explored in class. A graphic user interface with simple drag and drop actions enables users to create and publish apps without any knowledge of coding. For students who are learning to code, this website facilitates a visual representation of an app in the initial planning stages. While it is free to create apps via this website, publishing them will incur a cost, depending on the chosen publishing store. A. Leung

USER LEVEL: Stage 4 Stage 5 Stage 6

KLA: CA; English; HSIE; Languages; Mathematics; PDHPE; Science; TAS

PUBLISHER: Appsbar, USA

REVIEW DATE: 14/04/2016 [005.3]

SCIS 1756456

Appsbar tutorial **by Matthew Perekupka**

Tackk

Tackk is a free web-based application that can be used to create professional looking content without the user having any technical or design skills. Promoted as a place to connect, collaborate and have interactive discussions, the simplicity and ease of website creation makes this an excellent classroom tool. *Tackk for the classroom* includes many ideas and examples for teachers and students. Preparing lessons, sharing assignment tasks, collecting students' assignments and adding feedback can be set up via class boards. *Tackk* offers a wide range of functions including photos, videos, music, audio, maps, buttons, lists and forms. This resource would be excellent for making newsletters, flyers, publicising events or for sharing photo and video creations. Free accounts can be set up through Google, Facebook or Edmodo and websites can be shared on various social networks. L. Pfister

USER LEVEL: Stage 4 Stage 5 Stage 6 Professional

KLA: CA; English; HSIE; Languages; Mathematics; PDHPE; Science; TAS

PUBLISHER: TacKK Inc, USA

REVIEW DATE: 14/04/2016 [302.3]

SCIS 1756350

Tackk how to video **by AISLyle**

Scan the SCIS barcodes to select eresources for your collection.

Cool Australia

Providing original units of work and inquiry based learning activities that align with the general capabilities in the Australian curriculum, this site aims to educate students about the importance of the natural world. Teachers can search for and access curriculum materials such as *Little scientists – making clouds – Early learning*. These come with additional links to stimulus videos and suggestions for differentiated learning and extension activities. Students can use the online worksheets and submit them electronically through a teacher dashboard function. Teachers are required to sign up before sharing the worksheets with students. Many of the resources contain a strong focus on the environment and sustainability and strongly lend themselves to the teaching of STEM subjects. J. Perry

USER LEVEL: Stage 1 Stage 2 Stage 3 Stage 4 Stage 5

KLA: HSIE; Science; SciTech

SYLLABUS: Geography K–10; Science K–10 (SciTech K–6)

PUBLISHER: Cool Australia, Vic

REVIEW DATE 14/04/2016 [333.7207]

SCIS 1595941

The story of Cool Australia by cool melbournevideo

Primezone. School reresources: the place for all your primary industry resources

This site is an initiative of the *Primary Industries Education Foundation* and is supported by a wide range of food and fibre industry bodies. All the resources sourced through this site are designed to be used in schools and have direct relevance to agricultural production in Australia. Students and teachers, working in metropolitan and urban schools, will find materials to inform students about the source, production and processing of their food. The website contains in excess of 120 resources including posters, videos, units of work, fact sheets and websites. Topics include careers, conservation and production in a diverse range of agricultural, horticultural, livestock, timber and fishing industries. D. Randall

USER LEVEL: Stage 3 Stage 4 Stage 5 Stage 6

KLA: Science; SciTech; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Science K–10 (SciTech K–6); Technology (Mandatory) 7–8

PUBLISHER: Primary Industries Education Foundation Limited, ACT

REVIEW DATE: 14/04/2016 [338]

SCIS 1756786

Farm diaries by Primary Industries Education Foundation

The everyday lifesaver app: transforming the way we teach safety education

Gamification teaches users about water safety, emergency response and CPR in this free app. The activities provide a useful supplemental tool when teaching students the acronym, DRSABCD, and can be used as a reinforcement for practical lessons. Teachers will need to check each activity to gauge whether it is suitable for their specific class cohort. The app provides a *Student everyday lifsaver knowledge quiz* and a *Certificate of participation*. The *Email an everyday lifesaver story* allows users to tell *Life Saving Victoria* about their own life saving story. Students should be encouraged to play the games more than once to increase their knowledge and reinforce important safety messages. L. Pfister

USER LEVEL: Stage 3 Stage 4 Community Professional

KLA: PDHPE

SYLLABUS: PDHPE K–6; PDHPE 7–10

PUBLISHER: Life Saving Victoria, Vic

REVIEW DATE: 14/04/2016 [363.14]

SCIS 1756382

LSV Everyday lifesaver app by LifeSavingVic

ABC splash

An online repository of over 2000 free educational resources, *ABC splash* now also includes around 400 items curated for STEM. This incredibly useful collection includes videos, audio clips, games and interactive tools that have been sourced locally and internationally from organisations including NASA, the CSIRO and Australian universities. Resources are easy to find due to the site's instinctive navigational design, and searches can be refined by STEM topic and education level. A colour coded symbol system enables users to quickly identify the format of each resource. Each resource is accompanied by a *For teachers* tab, which sometimes contains questions to promote classroom discussion. While not directly linked to the NSW syllabuses, teachers will still find this section beneficial, as it outlines age suitability and provides a brief description of the resource. Registering for a free account enables items to be added as favourites for easy retrieval, and teachers can also sign up to the STEM newsletter for updates and new content. A. Lee

USER LEVEL: Early Stage 1 Stage 1 Stage 2 Stage 3

KLA: English; HSIE; Languages; Mathematics; PDHPE; SciTech; TAS

SYLLABUS: Mathematics K-10; Science K–10 (SciTech K–6)

PUBLISHER: Education Services Australia, Vic

REVIEW DATE: 14/04/2016 [371.33]

SCIS 1586147

Learn about artificial intelligence with an industrial robot **by ABC splash**

Safe schools hub

ABSTRACT

With sections for schools, parents and students, this website reaches out to the whole community. Staff are assisted in implementing the *National Safe Schools Framework* as the nine elements and guiding principles of the framework are explained and unpacked on the site. The *School audit tool* enables each school community *…to make informed decisions about the extent to which they have created and maintained a safe and supportive learning environment*. *Professional learning* includes three professional learning modules for teachers and school leaders, specialist professionals and pre-service teachers. A wide range of resources are available, including those that explore controversial issues, supporting social and emotional well-being across school communities.

USER LEVEL: Early Stage 1 Stage 1 Stage 2 Stage 3 Stage 4 Stage 5 Stage 6 Community Professional

KLA: PDHPE

SYLLABUS: PDHPE K–6; PDHPE 7–10; PDHPE Stage 6

PUBLISHER: Department of Education and Training, ACT

REVIEW DATE: 14/04/2016 [371.7]

SCIS 1753673

Exploratorium: explore

This website forms the online component of San Francisco's Exploratorium, a museum of science, art and human perception which creates *inquiry-based experiences that transform learning*. Featuring thousands of pages of content, the site curates simple, low cost STEM related activities, which have been proven in a classroom environment by teachers. The interactive games and apps are well designed, with support material covering the full range of STEM technologies. The website provides useful teaching and learning strategies for educators to build capacity to teach and deliver STEM education through digital media, podcasts and *snacks* (miniature versions of some of the most popular exhibits at the Exploratorium). The site's tactile activities will engage students through project based learning. D. Monte

USER LEVEL: Stage 4 Stage 5 Stage 6

KLA: Mathematics; Science; TAS

SYLLABUS: Design & Technology 7–10; Design & Technology Stage 6; Engineering Studies Stage 6; Industrial Technology 7–10; Mathematics K–10; Science K–10 (SciTech K–6); Visual Design 7–10

PUBLISHER: Exploratorium, USA

REVIEW DATE: 14/04/2016 [500]

SCIS 1509705

San Francisco's new Exploratorium at pier 15 **by TechCrunch**

Planning learning activities using YouTube videos embedded in *Scan*? Note that a teacher log in is required to view YouTube videos in the NSW DoE online environment. Stage 6 students also have access.

RiAus: Australia's science channel

Focusing on topical issues in Science, teachers can access a variety of *downloadable resources* from Australia's national Science channel. Resource packs cover such topics as *PDplus: Organ and tissue donation, the gift of life* and *RiAus PDplus: Wind technology*, and are designed to engage students through inquiry based learning. Each pack comes with two components, downloadable teacher notes, including student activities, background information and lesson plans, and live streaming or videos with experts in the related field. A focus on careers in Science is evident throughout the site. Cross curriculum links with PDHPE are evident in *PDplus: Driven to distraction: understanding the impact* in uncovering the psychology of mobile phone obsession and safe driving by teenagers. Teacher discretion is advised when dealing with topics such as organ donation that may evoke an emotional response from students. S. Crawford

USER LEVEL: Stage 4 Stage 5 Stage 6

KLA: PDHPE; Science

SYLLABUS: Biology Stage 6; Crossroads Stage 6; PDHPE 7–10; Physics Stage 6; Science K–10 (SciTech K–6); Senior Science Stage 6

PUBLISHER: Ri Aus, SA

REVIEW DATE: 14/04/2016 [500]

SCIS 1732948

Driven to distraction – the mobile addiction with Dr Shari Walsh **by RiAus TV**

Planning learning activities using apps? Note that the NSW DoE web filter currently only permits app downloads by staff.

Exploriments: simulation-based interactive learning units

Simulation-based interactive learning is the key focus of this free program. Users are encouraged to learn by actively participating in a virtual environment that can be altered (for example, by adjusting the temperature or pressure) to influence the outcome of measurements and make otherwise hypothetical scenarios become testable. The website is divided into *Physics*, *Chemistry* and *Mathematics*, and the range of virtual experiments on the app and the website seems endless. Great opportunities exist for extension and assignment work within the Science and Mathematics curriculums using these digital investigations. S. Crawford

USER LEVEL: Stage 3 Stage 4 Stage 5 Stage 6

KLA: Mathematics; Science; SciTech

SYLLABUS: Chemistry Stage 6; Mathematics K–10; Physics Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: IL&FS Education & Technology Services Ltd, India

REVIEW DATE: 14/04/2016 [507]

SCIS 1756332

Archimedes Principle – verification of Archimedes Principle **by Exploriments**

Math ref free

An extensive collection of over 700 helpful formulae, definitions, graphs, examples and tips can be accessed on this free app. Further topics and features are available in the full version of *Math ref* for $3. A multitude of topics including Algebra, Geometry, Trigonometry and Physics are broken down into further subtopics and a browse feature enables easy and quick navigation. A clean layout with descriptions and tips gives the user a wealth of information. A range of helpful tools, such as interactive solvers for projectile motion, quadratics and triangles, allow the user to perform common calculations and conversions. While relevant to all STEM subjects, due to the algebraic notation used in the definitions, this reference resource is best suited for students studying the senior Mathematics, Chemistry, Physics and Engineering Studies courses. J. Amos

USER LEVEL: Stage 5 Stage 6 Professional

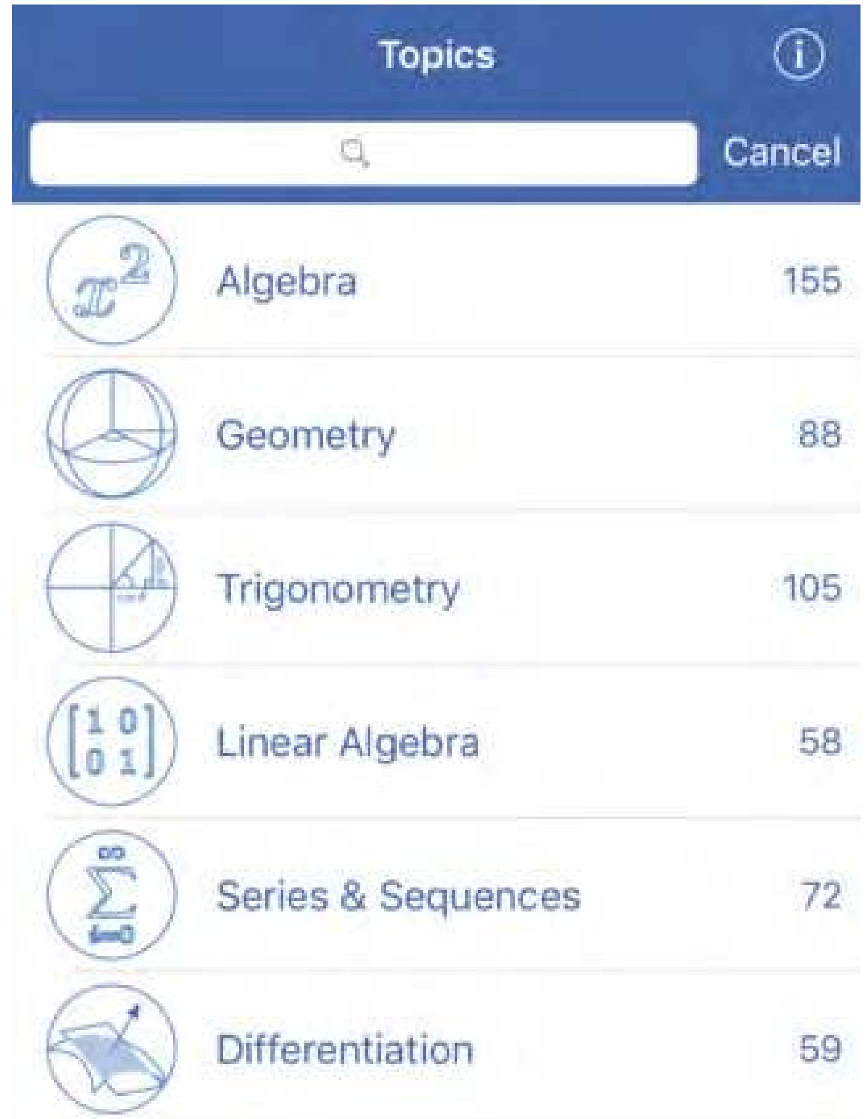
KLA: Mathematics; Science; TAS

SYLLABUS: Chemistry Stage 6; Engineering Studies Stage 6; Mathematics Extension 1; Mathematics Extension 2; Mathematics General Stage 6; Mathematics K–10; Mathematics Stage 6; Physics Stage 6

PUBLISHER: Happy Maau, USA

REVIEW DATE: 14/04/2016 [510.7]

SCIS 1756273



STEM collaborative: real life math

This American website engages students with technology rich tasks focusing on geometry, algebra and proportional reasoning. Aimed at students aged 11-14, the tasks are best suited for Stage 3 students. The site takes users on four interactive learning adventures (hosted on other websites), ranging from architecture to reasoning in an amusement park. While the connection to mathematics is the main focus, links to other areas of STEM are also outlined, and teachers will find opportunities in some tasks to address content from the *Science K–10 (incorporating Science and Technology K–6) syllabus*. There is also a comprehensive page of *Additional STEM resources* appropriate for all primary levels. Teachers should be mindful that these materials are categorised according to American grades and subjects. A. Lee

USER LEVEL: Stage 3

KLA: Mathematics; SciTech

SYLLABUS: Mathematics K-10; Science K–10 (SciTech K–6)

PUBLISHER: Corporation for Public Broadcasting, USA

REVIEW DATE: 14/04/2016 [510.76]

SCIS 1756115

Freddy fraction

Identifying equivalent fractions, decimals and percentages is the aim of this free, interactive app. Basic instructions explain the aim of the game: to guide Freddy the bee across the honeycomb from one fraction to another by dragging him onto the fraction that is equivalent to the decimal or percentage in the upper right hand corner of the screen. The game is limited to the same goal of reaching the honeypot on each level. As the user progresses through the levels, the path becomes longer and includes a combination of decimals and percentages. A status bar gives the user immediate feedback on each move and repeated errors deplete Freddy's health. When his health falls to 0%, the user is returned to the main menu to start again from level 1. This app would be a suitable resource to review the concept of equivalent *Fractions, Decimals and Percentages*. J. Amos

USER LEVEL: Stage 3 Stage 4

KLA: Mathematics

SYLLABUS: Mathematics K–10

PUBLISHER: GAMeS Lab at RU, USA

REVIEW DATE: 14/04/2016 [513.2]

SCIS 1756281

PhET: interactive simulations for science and math

Developed and refined through careful educational research, these engaging interactive simulations for teachers and students cover a breadth of abstract Science and Mathematics concepts. Many of these concepts are too small to see, like the molecules in a chemical reaction or are too dangerous to test, like nuclear radiation. The simulations show the complexity of relationships within a concept, as in the pH scale simulation, which shows the relationship between pH, concentration of hydrogen ions and hydroxide ions and number of molecules changing in real time as the user alters one component of the system. The site is easy to navigate and the search facility conveniently groups its results by discipline. Many of the simulations have a game function for students to test their understanding. Resources are available to complement simulations. *Teaching resources* shares teacher made and tested resources and enables teachers to share how they have used the simulations. Most of the simulations are in HTML5 format, making them accessible across devices, including tablets and mobile phones. Flash videos are not compatible with iOS devices. J. Perry

USER LEVEL: Stage 4 Stage 5 Stage 6

KLA: Science; Mathematics

SYLLABUS: Biology Stage 6; Chemistry Stage 6; Earth & Environmental Science Stage 6; Mathematics Extension 1; Mathematics General Stage 6; Mathematics K–10; Mathematics Stage 6; Physics Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: University of Colorado, USA

REVIEW DATE: 14/04/2016 [530.071]

SCIS 1260215

A brief introduction to PhET Sims
by PhET Sims

Video physics

Finding a way to analyse motion in a physics classroom has always been problematic. This iOS app offers a simple, accurate and engaging method of motion analysis for one and two dimensional events. Students can set up experiments and capture the motion using the iPad's camera. The app then can display the motion as displacement/time and velocity/time graphs for each dimension of motion. Teachers and students of Physics and Mathematics will find this particularly useful for the analysis of *projectile motion*. The app also allows for the analysis of *circular motion*. Experiments using this tool can be performed in the lab or outside using common objects such as bicycles and sporting equipment, thus making the experiments and measurements more relevant to real life experiences. Integrating the data with the free iPad app *Vernier graphical analysis* will allow more detailed analysis of data, such as calculating acceleration rates. D. Randall

USER LEVEL: Stage 6

KLA: Mathematics; Science

SYLLABUS: Mathematics 2/3 Unit Stage 6; Physics Stage 6

PUBLISHER: Vernier Software & Technology, USA

REVIEW DATE: 14/04/2016 [531]

SCIS 1756965 $7.99

How to use Vernier Video physics (May 2015)
by Jeffrey Hsi

$ must be purchased

Tactillium: chemistry, redefined

Virtual experiments and visualisations of chemical compounds make this free online interactive object and app a useful tool to support the *Science K–10 (incorporating Science and Technology K-6) syllabus* and *Chemistry Stage 6 syllabus*. The more useful of the two choices of virtual experiments allows users to mix a wide range of chemicals to see whether a reaction can occur and, if so, reveals the products that are formed with the limiting reagent identified. This feature will support the Chemical World strand of the *Science K–10 (incorporating Science and Technology K-6) syllabus*. A valuable feature for HSC Chemistry students is the ability for users to decide on the mass of the chemicals involved in the reactions and use the tool to practise molar calculations. While still in beta mode, the chemical geometry component of this interactive resource is a powerful visualisation tool for covalent compounds. Users can enter any covalent compound to view a 3D representation of its geometry. The app is available for iOS and Android, or can be accessed online using a browser which supports the Unity Web Player plugin, a third party download for Internet Explorer, Firefox or Opera. A. Leung

USER LEVEL: Stage 5 Stage 6
KLA: Science
SYLLABUS: Chemistry Stage 6; Science K–10 (SciTech K–6)
PUBLISHER: Tactillium, USA
REVIEW DATE: 14/04/2016 [540.72]

SCIS 1757778

Tactillium: chemistry. Redefined **by Tactilium**

Earth rocks

With a strong focus on abstract concepts associated with geology that are often difficult for students to grasp, this website features short video clips that develops students' understanding of fossils, the age of the Earth, types of rocks and composition of rocks. Combined with suggested interactive activities from *Scootle*, teacher-led and student-centred activities, including assessment for learning strategies, this site supports teachers designing learning experiences for the Earth and Space strand of the *Science K–10 (incorporating Science and Technology K-6) syllabus*. The teacher-led activities are particularly detailed, offering examples and scenarios for teachers to explain abstract geological concepts. A. Leung

USER LEVEL: Stage 4 Professional
KLA: Science
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: ABC, NSW
REVIEW DATE: 14/04/2016 [551.41]

SCIS 1757847

Formation of sedimentary rock **by Our Earth, ABC**

Cells and the molecules of life. Teachers

Although officially categorised to support the Stage 4 Living World strand of the *Science K–10 (incorporating Science and Technology K-6) syllabus*, this collection of teacher resources more effectively supports the Preliminary component of the Biology Stage 6 syllabus, particularly the module, *Life on Earth*. A useful aspect is the ability for students to visualise the evidence used to speculate about the origin of life on Earth through a series of short video clips. This online resource features brief outlines of teaching and learning activities ranging from literacy activities, hands-on experiences and online interactive objects, which make it a valuable resource to support educators in designing learning experiences for the Stage 6 Preliminary Biology course. There is also a strong focus on formative assessment, but the resource only lists the outcomes that students should demonstrate and falls short of providing suggested formative assessment strategies. A. Leung

USER LEVEL: Stage 6 Professional
KLA: Science
SYLLABUS: Biology Stage 6
PUBLISHER: ABC, NSW

REVIEW DATE: 14/04/2016 [571.6]

SCIS 1756466

Introduction to cells by Atoms Alive, ABC

Australian Native Plants Society (Australia)

Including a comprehensive guide to methods of propagating Australian native plants, this clearly set out site gives the theoretical background of plant propagation, along with the practical methods which can be used to produce new native plants from seed, cuttings, division and grafting. The techniques outlined include simple and economical methods which would be suitable to schools with limited plant propagation facilities. The focus on Australian native plants is useful to teachers and students interested in environmental and re-vegetation projects at their school or in the local area. The site contains links to suppliers of native plant seed to allow easy access to propagation material. D. Randall

USER LEVEL: Stage 4 Stage 5 Stage 6

KLA: TAS

SYLLABUS: Agriculture Stage 6; Agriculture/Agricultural Technology 7–10

PUBLISHER: ANPSA

REVIEW DATE: 14/04/2016 [581.994]

SCIS 1290470

Howstuffworks

Easy to navigate, with a range of comprehensive topics, this website allows access to information encompassing the full range of STEM subjects. Hyperlinked words within the fact sheets lead to additional diagrams, videos and text for further understanding and exploration. Plain English, examples and explanations will appeal and support student learning. Students requiring additional literacy support may find this a challenging site for independent research. Differentiated instruction, peer tutoring and explanations of keywords used in the text may be of assistance to some students. With such a diverse range of technologies explored, backed up by clear explanations using simple scientific and mathematical concepts, this site is invaluable for the successful delivery of STEM education in secondary schools. D. Monte

USER LEVEL: Stage 3 Stage 4 Stage 5 Stage 6

KLA: Science; SciTech; TAS

SYLLABUS: Design & Technology 7–10; Design & Technology Stage 6; Engineering Studies Stage 6; Industrial Technology 7–10; Physics Stage 6; Science K–10 (SciTech K–6); Technology (Mandatory) 7–10

PUBLISHER: HowStuffWorks, USA

REVIEW DATE: 14/04/2016 [600]

SCIS 986942

EngQuest

The *EngQuest* website takes a collaborative approach to encourage students to work in teams to design, construct and test engineering products, making it a useful resource when teaching the *Products* strand of the Science and Technology K–6 Syllabus. An initiative of Engineers Australia, *EngQuest* is delivered free of charge to Australian schools through a registration process. The program is suitable for Stages 2 and 3, and covers a range of topics such as publishing a book, constructing a toy and humanitarian engineering. Every project includes instructions, background information and lesson ideas with activity sheets, scaffolding opportunities for STEM learning. The lesson information outlines broad learning outcomes and includes suggestions for linking *EngQuest* content with subjects, although Science and Technology have been separated and other subject area connections may not be relevant to NSW syllabuses. *Students* explains the projects, which have been divided into lower primary and middle years categories. There is also a comprehensive *Glossary* and *Games and quizzes*, which could be well suited for early finishers or quick lesson warm ups. A. Lee

USER LEVEL: Stage 2 Stage 3

KLA: Mathematics; SciTech

SYLLABUS: Mathematics K–10; Science K–10 (SciTech K–6)

PUBLISHER: Engineers Australia, ACT

REVIEW DATE: 14/04/2016 [620.0076]

SCIS 1370605

Lesson plans for Stage 6 Chemistry and Biology: Preliminary and HSC science

ABSTRACT

Lesson plans that support *Chemical Monitoring and Management* in the *Chemistry Stage 6 syllabus* and *The Search for Better Health* in the *Biology Stage 6 syllabus* are provided on this water quality website. Providing links to investigations that replicate the work of chemists and biologists in ensuring clean, safe drinking water, the lesson plans also include downloadable results tables, as well as information that students can read through, followed by an interactive quiz to assess learning. Teacher instructions for preparing water samples for testing are also available.

USER LEVEL: Stage 6

KLA: Science

SYLLABUS: Biology Stage 6; Chemistry Stage 6

PUBLISHER: Sydney Water, NSW

REVIEW DATE 14/04/2016 [628.1]

SCIS 1756336

Robotics & Automation Lab

The Robotics and Automation Laboratory is a website showcasing the University of Western Australia's research on mobile robots, embedded systems, automotive systems, simulation and parallel processing. Although the research is pitched at a university level, the work of the laboratory will extend and motivate students with an interest in robotics. The site highlights all areas of STEM education, showing clear links between subjects as it explores the challenges in the design and construction of autonomous mobile robots. It is a well presented resource that informs senior students of possible pathways in the fields of Science, Technology, Engineering and Mathematics. D. Monte

USER LEVEL: Stage 4 Stage 6

KLA: Science; TAS

SYLLABUS: Design & Technology Stage 6; Engineering Studies Stage 6; Physics Stage 6; Technology (Mandatory) 7–8

PUBLISHER: Robotics & Automation Lab, WA

REVIEW DATE: 14/04/2016 [629.8]

SCIS 1412870

Remote sensing and GIS in agriculture

A simple tutorial on the background theory and practical applications of remote sensing technology, this website covers topics such as *Crop yield estimation*, *Crop identification* and *Precision agriculture*. Teachers and students should find its clear layout and concise illustrated material easy to understand. This material will be particularly relevant to students in Year 12 Agriculture who are studying the *Farming for the 21st century* elective. The site also has worksheets to allow students to engage in activities related to the information presented in the tutorial sections. D. Randall

USER LEVEL: Stage 5 Stage 6

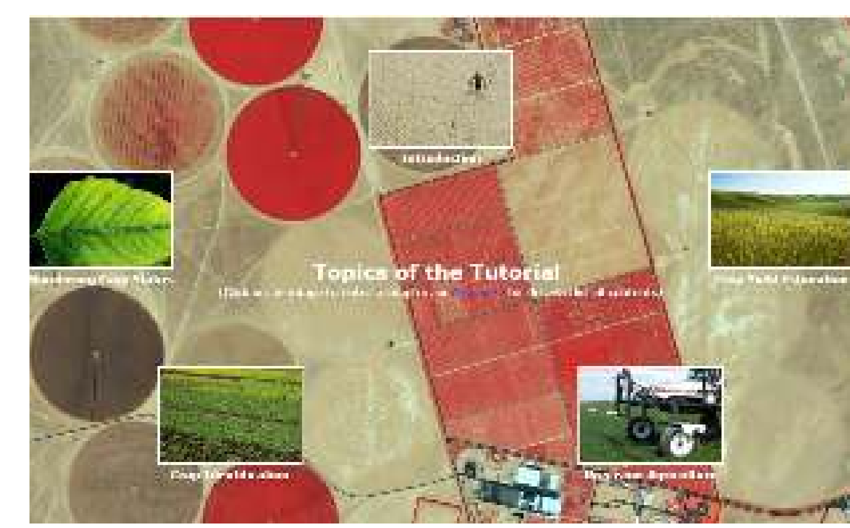
KLA: TAS; Technology

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6

PUBLISHER: SEOS, Germany

REVIEW DATE: 14/04/2016 [630.2]

SCIS 1756983



Remote sensing and GIS in agriculture

NSW Department of Primary Industries: Agriculture

Presenting a comprehensive source of current information on a broad range of Agricultural industries, this large site supports many science and technology topics. *Primefacts and other factsheets* are available on a selection of animal, crop and pasture production systems. Within each of these production systems, there are resources on management, diseases, equipment and finance. All of these resources are up to date and outline current practices in Australian agriculture. Some functions are interactive, such as the *Feed cost calculator*, though most are PDF fact sheets. Teachers and students will appreciate the easy access to relevant information from this site. The school education program, *LandLearn*, may be of particular interest to teachers of junior students. D. Randall

USER LEVEL: Stage 3 Stage 5 Stage 6

KLA: Science; SciTech; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Primary Industries Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: NSW Department of Primary Industries, NSW

REVIEW DATE: 14/04/2016 [630.9944]

SCIS 1702957

Where does our food come from? Tomatoes
by nswpiweb

Soil biology basics

ABSTRACT
Soil is home to many living things. The opening line of this learning module sets the scene for a rich learning experience. An examination of soil biology is an excellent vehicle to understand ecology, food chains or nutrient cycling. The site explains the living things in soils, food webs in soils and how soil organisms are affected by natural events and management. Students and teachers of Stage 5 Science can utilise this resource to examine food chains and nutrient cycling. Agriculture students can examine the management of soils for productive agricultural production.

USER LEVEL: Stage 5 Stage 6

KLA: Science; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: NSW Primary Industries, Agriculture, NSW

REVIEW DATE: 14/04/2016 [631.4]

SCIS 1756919

Plants in agriculture

ABSTRACT
Explaining and demonstrating up to date plant breeding techniques, this website is particularly relevant to students exploring the areas of plant breeding systems, *integrated pest management*, *Experimental design and research*, and *the role of research* in the *Agriculture Stage 6 syllabus*. Videos of experts showing and explaining plant breeding techniques in a straightforward and understandable manner are a major feature of this excellent website. Plant anatomy and physiology, plant breeding, genetic conservation and research methodology are featured. Text and video, as well as focus questions, are included in each section. Links are available to assist with the understanding of terms and background scientific principles. The information is also applicable to students and teachers of the *Biology Stage 6 syllabus* and the *Science K–10 (incorporating Science and Technology K-6) syllabus* when studying biotechnology.

USER LEVEL: Stage 5 Stage 6

KLA: Science; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Biology Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: NSW Department of Education and Communities, NSW

REVIEW DATE: 14/04/2016 [631.5]

SCIS 1756799

Anatomy and physiology of the wheat plant
by Learning Systems NSW DoE

Insect ID

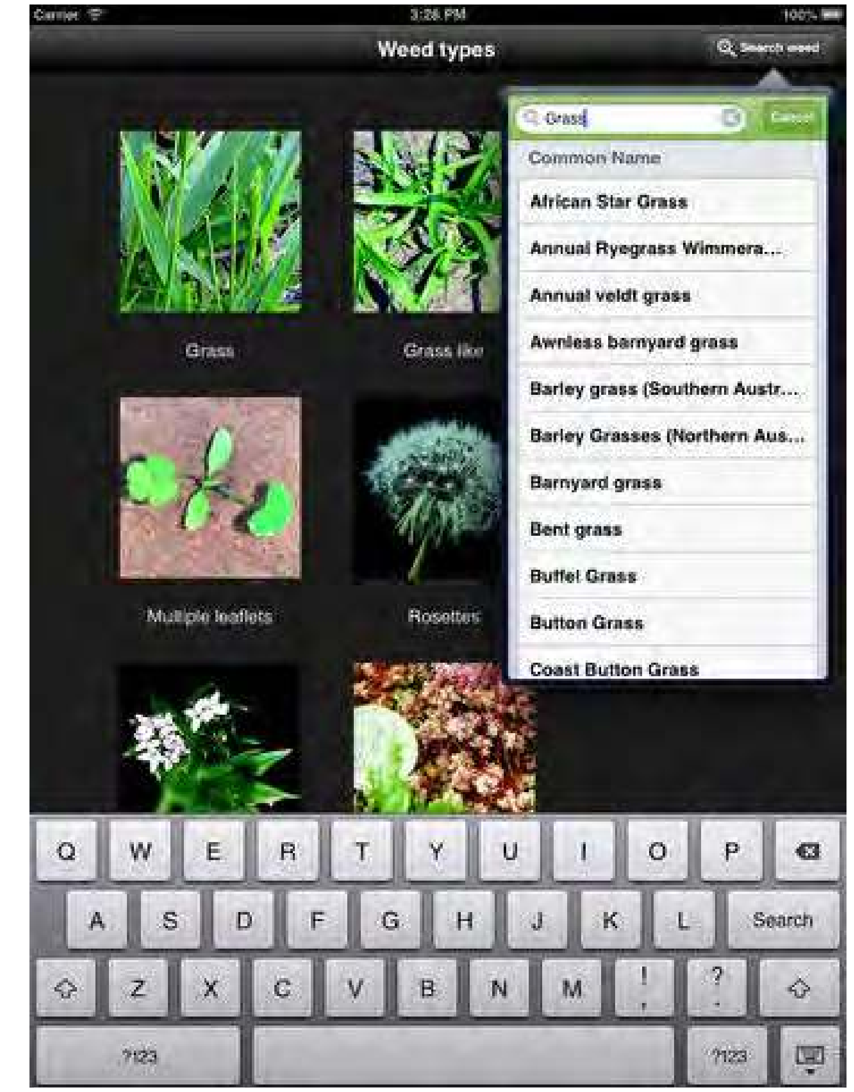
Although produced for grain farmers by the *Grains Research and Development Corporation*, this free app would be a helpful tool for Agriculture students studying crop production systems. The photographic identification of insect pests allows students to compare insects side-by-side, search by scientific and common names of insects, identify beneficial predators and parasites of insect pests, and be aware of international bio-security pests. For each insect pest, there is an accompanying section which describes the pest and identifies which crops it affects and the damage it causes. A useful comparison tool allows users to send their pest photos by email for identification. D. Randall

USER LEVEL: Stage 5 Stage 6
KLA: TAS
SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6
PUBLISHER: GRDC, ACT
REVIEW DATE: 14/04/2016 [632]
SCIS 1756864

Weed ID

Identification of weeds in cropping situations can be a difficult task. This free app is designed to assist users to identify the most common weeds found in paddocks throughout Australia. Identification is based on simple morphological features and provides photographs, where possible, of each stage of the weed's lifecycle from seeds and seedlings through to mature and flowering plants. Agriculture students studying cropping production systems will find this tool helpful. Students and teachers of the *Agriculture Stage 6 syllabus* could utilise this app when studying *competition in plant communities*. D. Randall

USER LEVEL: Stage 5 Stage 6
KLA: TAS
SYLLABUS: Agriculture Stage 6; Agricultural Technology 7–10
PUBLISHER: GRDC, ACT
REVIEW DATE: 14/04/2016 [632]
SCIS 1756869



Cotton Australia

Recently updated with a strong emphasis on educational resources, this site includes fact sheets, posters and videos. *Cotton classroom* has education kits, lessons and units of work with information relevant to a wide range of subjects. *Fact sheets* encompass a wide range of topics, such as how cotton is grown, the environmental considerations, uses of cotton and the products derived from it, and the marketing and economics of the Australian cotton crop. Education kits include samples of cotton, seeds to allow students to grow cotton plants, and contact information for excursions to cotton farms and processing facilities. Information is available through this website about some innovative and challenging competitions supported by the cotton industry. Details about scholarships for students and teachers, and work experience opportunities for students can be found at Scholarships available. Sections for commercial cotton growers may be useful for Stage 6 Agriculture students studying cotton as a *Farm product study*. D. Randall

USER LEVEL: Stage 3 Stage 4 Stage 5 Stage 6

KLA: HSIE; Science; SciTech; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Design and Technology Stage 6; Earth and Environmental Science Stage 6; Geography Stage 6; Primary Industries Curriculum Framework Stage 6; Science K–10 (SciTech K–6); Senior Science Stage 6; Technology (Mandatory) 7–8; Textiles and Design Stage 6

PUBLISHER: Cotton Australia, NSW

REVIEW DATE: 14/04/2016 [633.5]

SCIS 1034151

I love Australian cotton # aussiecotton **by Cotton Australia**

Poultry hub

Reliable and current, this Australian site is valuable for teachers and students studying poultry production for meat or eggs. Information in *Education* would support school communities which raise chickens and the free *Teacher's resource kit* for Australian schools includes books, CDs, DVDs, worksheets, presentations and posters. The website has pages on types of poultry and poultry breeds, anatomy and physiology of poultry, poultry production systems, nutrition, health, research on poultry production and support for education. D. Randall

USER LEVEL: Stage 3 Stage 4 Stage 5 Stage 6

KLA: SciTech; TAS

SYLLABUS: Agricultural Technology 7–10; Agriculture Stage 6; Science K–10 (SciTech K–6); Technology (Mandatory) 7–8

PUBLISHER: Poultry CRC, NSW

REVIEW DATE: 14/04/2016 [636.5]

SCIS 1756861

Poultry hub **by Poultry CRC**

STEMware

Students are required to collect evidence, read information about potential suspects, perform a DNA extraction and a Southern blot, and use the *polymerase chain reaction* (PCR) to ultimately solve a crime in game-based learning programs on this site. Users are unable to move through the game unless each forensic technique is completed with the correct safety equipment, following the correct steps. Students are supported through the use of a lab manual accessed within the game. Relevant to the *Chemistry Stage 6 syllabus* option, *Forensic Chemistry*, and the *Biology Stage 6 syllabus* option, *Biotechnology*, or as an extension in the *Science K–10 (incorporating Science and Technology K–6) syllabus*: *Living World* content strand, this fantasy world approach to inquiry learning is innovative and effective. The strong focus on careers in STEM provides an additional layer of interest to students and could be used as a springboard for student research and/or a focused discussion. J. Perry

USER LEVEL: Stage 5 Stage 6

KLA: Science

SYLLABUS: Biology Stage 6; Chemistry Stage 6; Science K–10 (SciTech K–6)

PUBLISHER: Partnership for Biotechnology and Genomics Education, USA
REVIEW DATE: 14/04/2016 [660.6076]
SCIS 1756339

Virtual DNA fingerprinting lab (free)
by Wesley Fryer

STEMware: Zombie plague

An interactive game-based learning program, in which players create their own avatar and solve a zombie plague in a fictional town called New Cleo Tides, begins on the user's first day working at Beta Helix Laboratories. Completing challenges and speaking to a variety of scientists to discover more about the zombie plague facilitates learning about alternate careers in science. After speaking with each scientist, users are asked questions and, when answered correctly, are awarded career points. There is a robust focus on careers in STEM and how they interconnect with each other in order to provide solutions to problems. Playing this simulation, students are provided with enough information to make informed judgements about the details and breadth of STEM careers. Stage 5 Science students, working through outcomes in *Living World*, may gain a deeper understanding of pathogens as they interact with this program. J. Perry

USER LEVEL: Stage 5
KLA: Science
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: Partnership for Biotechnology and Genomics Education, USA
REVIEW DATE: 14/04/2016 [660.6076]
SCIS 1756339

Serious Game – STEMware: Zombie plague
by ucdsoots

Genetically engineered crops

Featuring a comprehensive collection of digital resources on genetics and inheritance, this website is a valuable eresource for teachers to develop students' scientific content knowledge for STEM activities. Accessible via laptops and mobile devices, the site has a book-like feel and comprises videos and interactive digital activities. Suggested activities enable students to understand the complexities of the mechanisms of inheritance and the controversy in the social and ethical implications of genetic engineering. Each digital resource in the collection can be used as a standalone activity or as a series of activities, as suggested by the eresource. For this collection to be a valuable STEM resource, teachers need to use it to create activities where students incorporate maths and technology to demonstrate their scientific knowledge, as suggested in the teaching and learning opportunities. A. Leung

USER LEVEL: Stage 5
KLA: Science
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: Education Services Australia, Vic
REVIEW DATE: 14/04/2016 [720]
SCIS 1592627

Genetically engineered crops

Kid architects and sutainable design

One of a large collection of STEM resources gathered by *ABC splash*, this short, engaging video looks at the way buildings are designed for specific purposes. The program includes interviews with primary students about solutions they have designed and prototyped to address local issues, and lends itself beautifully to the *Built Environments* strand of the Science and Technology K–6 syllabus. Below the video are useful additional tabs for teachers. In particular, *Things to think about* offers some great questions for classroom discussions. While the resource has not been directly aligned to NSW syllabus outcomes, the Australian Curriculum mapping in the *For teachers* section gives teachers a head start by outlining its suitability for Stage 3 students and describing links to learning. A. Lee

USER LEVEL: Stage 3
KLA: SciTech
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: ABC, NSW
REVIEW DATE: 14/04/2016 [720]

SCIS 1760443

Kid architects and sustainable design
by ABS splash

Mars lab

Based on the Powerhouse Museum's re-creation of the Martian surface, this website offers teachers and students a range of hands-on experiences in robotics and space exploration, with the *Mars yard simulation game* being the most accessible. Based on NASA's Opportunity rover, the *Mars yard simulation game* enables users to control a solar-powered rover on a simulated 3D Martian surface in a games based learning environment. While the main focus of this simulation is on scientific and engineering concepts within space exploration, a multitude of cross-curricular STEM learning opportunities are possible, as users seek signs of past life on Mars in a series of game-based missions. The flexibility of choosing between guided missions or roaming freely around the Mars yard enables teachers to design a range of STEM learning opportunities, from structured learning to inquiry-based learning and project-based learning supporting the *Science K–10 (incorporating Science and Technology K-6) syllabus* and *Design and Technology Years 7–10 syllabus*. A. Leung

USER LEVEL: Stage 5
KLA: Science
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: Powerhouse Museum, NSW
REVIEW DATE: 14/04/2016 [720]

SCIS 1756477

The Mars lab at MAAS, Sydney Australia **by Mars lab TV**

Design squad global

The *Design squad global* website is an online community that grew out of the American *Design squad* television series. The program's goal is to give children a stronger understanding of the design process and the connection between engineering and everyday life. Targeting students from Stage 2 onwards, the site features creative activities, engaging videos, interactive games and exciting contests. The site is easy to navigate, with a helpful *Parents, educators and engineers* section that lists resources by topic. Although these resources do not align directly with NSW syllabuses, it is still simple to discover material relevant to the BOS Science and Mathematics syllabuses. Perhaps the most enticing area of the site is the *Global challenge*, in which open-ended design tasks are set for students to contribute their solutions. Free to join, the website allows students to contribute to a global conversation about real world issues, which are easily adapted for engaging students in STEM in the classroom. A. Lee

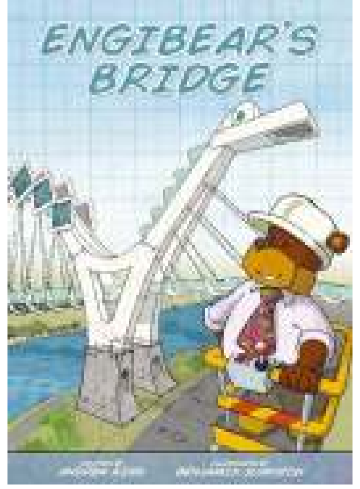
USER LEVEL: Stage 2 Stage 3
KLA: Mathematics; SciTech
SYLLABUS: Mathematics K–10; Science K–10 (SciTech K–6)

PUBLISHER: WGBH, USA
REVIEW DATE: 14/04/2016 [745.2076]
SCIS 1756122

Kid engineer: the design process by Design squad global

Engibear's bridge

KING, Andrew & JOHNSTON, Benjamin



Enhancing students' understanding and appreciation of the design of places and spaces, this ebook reintroduces Engibear and Bearbot in a yearlong bridge building project. Arising from a perceived need for students to reach their school more quickly, the mayor agrees to their request for a footbridge to be constructed. The building process is explained through detailed engineering plans and diagrams, overlayed on a background of architect's graph paper. Problems and solutions are illustrated with careful regard for Work, Health and Safety aspects as the students test and consider all aspects of the build, working through the *Bridge Building Games* with Bearbot. The inclusion of a female mayor and a high-heel wearing chief engineer debunks any stereotypical notion that civil engineering and construction are occupations that are specifically for males. The positive messages and realism portrayed in *Engibear's bridge* make it a valuable addition to the study of *Built Environments*. Available for download with iBooks on a Mac or iOS device, this ebook can be further explored on the Engibear website. The book could support STEM learning by providing a jumping off point for students to investigate, design and build their own bridges. S. Rasaiah

USER LEVEL: Stage 1 Stage 2
KLA: SciTech
SYLLABUS: Science K–10 (SciTech K–6)
PUBLISHER: Little Steps Publishing, NSW
REVIEW DATE: 04/04/2016 [A821]
SCIS 1753627 $4.99

Timelines.tv: history, documentary and video online

Multifaceted, this site includes visual and written historical sources which allow users to come to a deeper understanding of the cause and effect of history, through the tying together of timelines at the bottom of the screen. Covering topics such as the history of smallpox, the American West and the British Empire, the interactive timelines take the user to a specific date or topic, combining videos, photographs and links to external sources. History teachers may use this feature to open up class discussions about interpretation and contestability. This engaging, valuable resource includes fascinating explorations and audio guides through the *British Museum*. A. Ellis

USER LEVEL: Stage 4 Stage 5 Stage 6
KLA: HSIE
SYLLABUS: History K–10; Modern History Stage 6
PUBLISHER: Timelines.tv, UK
REVIEW DATE: 14/04/2016 [902]
SCIS 1751616

Medieval minds – Timelines.tv History of Britain A02 by Timelines.tv

STEM SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS

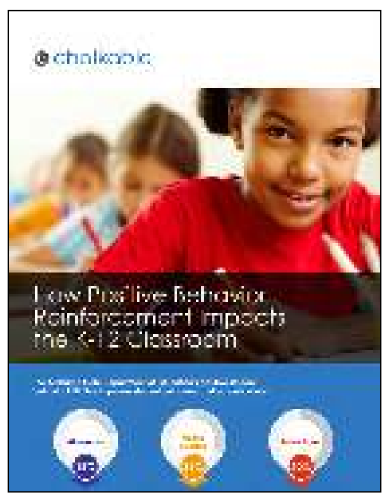
Looking for more STEM resources? Try these links:

- *AAO Knowledge Centre*, Australian Astronomical Observatory
- *ANSTO*
- *Building teacher capacity*, CSIRO
- *Geoscience classroom resources*, Geoscience Australia
- *MDBA Education*, Murray-Darling Basin Authority
- *Questacon teacher workshops*, The National Science and Technology Centre
- *Sustainable futures*, CSIRO

professional reading

Resources are listed in Dewey order.

The impact of positive behaviour solutions in the K–12 classroom: a 30K student data study in Alabama



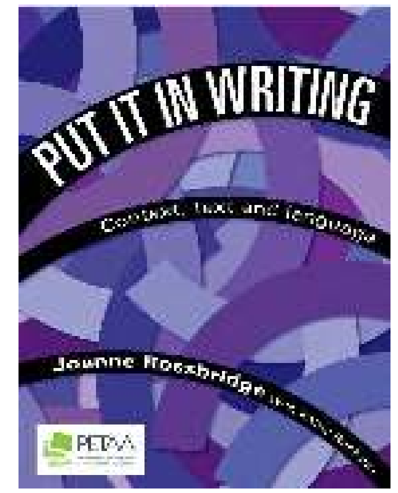
A US research study in 2014-15 was designed to measure how effective a positive reinforcement program could be in improving truancy, discipline infractions and failing grades. Their analysis identified four key outcomes: increased attendance, increased learning gains, fewer discipline infractions, and significant achievement gains among sub groups. Implementation of the positive behaviour reinforcement program is based on a motivational rewards system is documented in the downloadable report. A video overview is presented by US teachers who have implemented the motivational rewards system. The program is based on the premise that to be more effective, classroom management methods must not only set student expectations, promote active learning, and identify student behaviours, but they must also be measured and supported by administration through embedded professional learning, a *Learning Earnings* system and a data tracking system. While the report provides insights into the program's design, implementation and findings, to view the rewards tracking program, teachers would need to set up a free account via the *Learning earnings* homepage. F. Whalan

USER LEVEL: Professional
PUBLISHER: Chalkable, USA
REVIEW DATE: 14/04/2016 [370.15]

SCIS 1750791

Put it in writing: context, text and language

ROSSBRIDGE, Joanne & RUSHTON, Kathy
Primary English Teaching Association Australia (PETAA), NSW, 2015
ISBN 9781925132212 [808]



Following on from Beverly Derewianka's *Exploring how texts work,* this book provides structures for teachers and students to compose a variety of types of texts. Current, relevant and diverse text examples across the primary years and multiple curriculum areas, accompanied by comprehensive analysis, will assist teachers scaffolding students' own writing. Section one is devoted to *Writing in the imaginative world* with three models - *Writing to interact with an audience, Writing to recount imaginatively* and *Writing to evoke feelings*. Section two focuses on *Writing in the informative world* modelling *Writing to recount scientifically, Writing to compare entities* and *Writing to recount historical perspectives*. The final section covers *Writing in the persuasive world,* demonstrating *Writing to evaluate behaviour, Writing to persuade the community* and *Writing to define a perspective*. The two appendices, *Developing knowledge about grammar across the grades* and *Planning for teaching writing* have whole school application in supporting multiple outcomes within the *English K–10 syllabus*. A sample chapter. S. Morton

USER LEVEL: Professional
KLA: English
SYLLABUS: English K–10
SCIS 1731593 Paper $39.95

Meet the author: Joanne Rossbridge
by PETAA Primary English

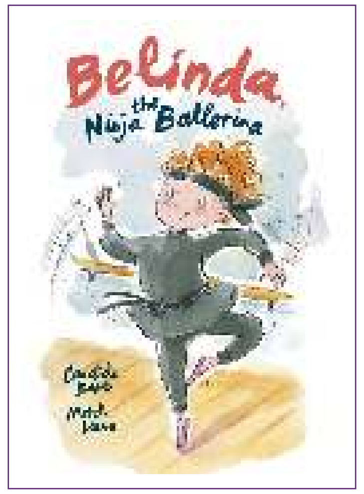
picture books

Resources are arranged alphabetically by author.

Some books in this section are nonfiction or have relevance to a particular KLA.

Belinda, the ninja ballerina

BAKER, Candida & VANE, Mitch
Ford Street Publishing, Vic, 2015
ISBN 9781925272048

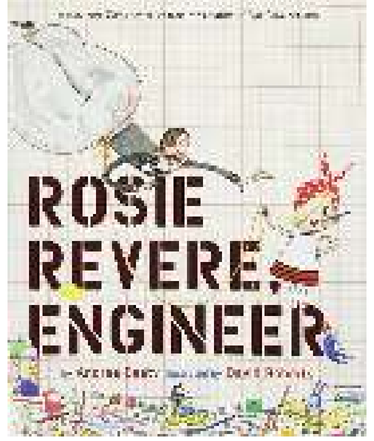


Belinda's idea of creative pursuits is being a ninja, not a ballerina, a conundrum that Belinda's dance teacher solves brilliantly in the ballet concert. This creative picture book highlights diversity and individualism and could support outcomes in the *Growth and Development* strand of the [PDHPE K–6 syllabus](). Mitch Vane's dramatic and energetic illustrations of Belinda's character are created using squiggly pen and ink line with splashes of colour wash which reflect the character's personality and the tone of the story perfectly. [Teaching notes]() are available. C. Emin

USER LEVEL:	Early Stage 1 Stage 1
KLA:	PDHPE
SYLLABUS:	PDHPE K–6
SCIS 1725468	Paper $15.95

Rosie Revere, engineer

BEATY, Andrea & ROBERTS, David
Abrams Books for Young Readers, USA, 2013
ISBN 9781419708459 [811]

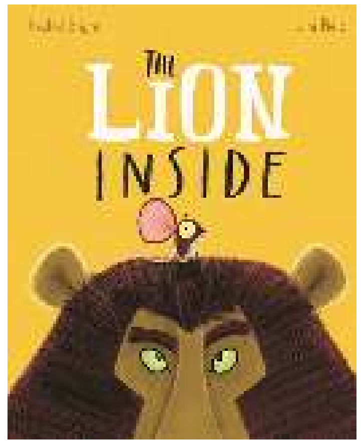


Told through rhymed couplets, *Rosie Revere, engineer* is a strikingly illustrated picture book of a girl and her dream to become an engineer. Rosie may seem quiet during the day, but at night she's a brilliant inventor, who sees inspiration in the rubbish and fragments she finds. However, afraid of failure, Rosie hides them in her attic room to work on at night. A momentous stopover from her great-great-aunt Rose shows her the importance of celebrating disappointments along with triumphs. Most suitable for children in Stage 1, but an engaging read for any primary Stage, it is a great choice for educators wanting to encourage students to experiment, design, engineer and build. Furthermore, Great Aunt Rose, who is visibly modelled on Rosie the Riveter, the iconic, red bandanna-wearing poster woman from World War II, provides students with the opportunity to delve into significant accounts of engineering throughout history. [Teaching resources]() are available. A. Lee

USER LEVEL:	Early Stage 1 Stage 1 Stage 2 Stage 3
KLA:	Mathematics; SciTech
SYLLABUS:	Mathematics K–10; Science K–10 (SciTech K–6)
SCIS 1629123	$19.95

The lion inside

BRIGHT, Rachel & FIELD, Tim
Orchard, UK, 2015
ISBN 9781408331590 [821]

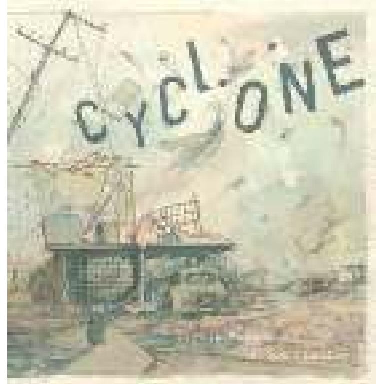


When a mouse lives in an environment filled with other bigger animals he tends to feel very small and insignificant. This picture book embraces courage and friendship with a message that no matter your size, we all have a mouse and a lion inside. The creative word play in this delightful book is packed with activity, from the rhyming words to the emphasised text. The inclusion of onomatopoeia makes this an appropriate resource for teaching *Grammar, punctuation and vocabulary* in outcome [EN1-9B]() of the *English K–10 syllabu*s. The process of creating the emotive characters is described on the [illustrator's website](). C. Emin

USER LEVEL:	Early Stage 1 Stage 1
KLA:	English
SYLLABUS:	English K–10
SCIS 1731289	$24.99

Cyclone

FRENCH, Jackie & WHATLEY, Bruce
Scholastic Australia, NSW, 2016
ISBN 9781743623596 [A821]



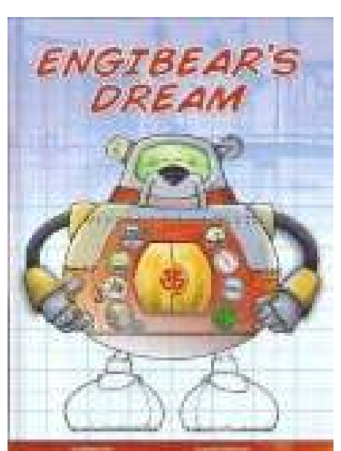
Straight to the point, French's poetic yet blunt rhyming text tells the story of a city's stubborn spirit, while Whatley's magnificent illustrations reawaken the formidable storm that took place on Christmas Eve 1974. As a picture book, this resource is suitable for all primary

Stages. Stage 3 students will find it a rich and engaging resource for a unit or project centred on natural disasters and engineering advancements in that field, with its capacity to demonstrate the powerful force of the storm. The book would also be accompanied beautifully by previous titles from French, *Fire* and *Flood*. A comprehensive list of classroom activities from Scholastic, supporting the book, can be found on French's website. A. Lee

USER LEVEL:	Stage 3
KLA:	Mathematics; SciTech
SYLLABUS:	Mathematics K–10; Science K–10 (SciTech K–6)
SCIS 1744663	$24.99

Engibear's dream

KING, Andrew & JOHNSTON, Benjamin
Little Steps, NSW, 2012
ISBN 9781921928901 [A821]



Engibear's dream follows Engibear in his journey to create a robot to help him get his work done. Through a delightful literary experience catering for early primary aged children, readers are exposed via rhyme to an array of technical vocabulary that lends itself to STEM learning. As Engibear modifies Bearbot through a series of prototypes in his quest for perfection, the focus is on concepts of product planning and design. Detailed design blueprints provide a visual stimulus to support understanding and encourage rich discussions. The book aligns strongly with content from the *Products* substrand in Stage 2 in the *Science K–10 (incorporating Science and Technology K-6) syllabus*. In the *Mathematics K-10 syllabus*, opportunities to link to the *Number, Two-Dimensional Space* and *Data substrands* are also present. A. Lee

USER LEVEL:	Stage 2
KLA:	Mathematics; SciTech
SYLLABUS:	Mathematics K–10; Science K–10 (SciTech K–6)
SCIS 1574925	$24.95

Only fish fall from the sky

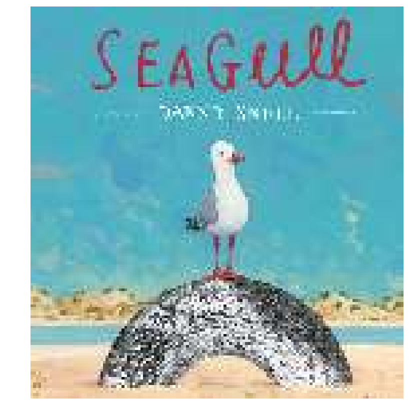
PARSONS, Leif
POW!, USA, 2015
ISBN 9781576877579

Lewis Carroll would probably feel at home reading this quirky picture book. Like Alice, the main character experiences a topsy turvy world in which fish fall from the sky, people sleep outdoors with animals and everyone eats while dancing. These imaginative illustrations and events will add to students' understandings of the concept of intertextuality; recognising these connections will enrich the reading experience. The author has added a twist by including a dream within a dream, and images of the boy wearing his blue and white striped pyjama top is a clue for observant readers. Pages of humorous, detailed illustrations will appeal and promote conversation between paired readers. Students wishing to explore the phenomenon of raining fish could access *Can it rain fish?* or view the Science Channel video *Raining fish in London – world's strangest* for interesting explanations. C. Keane

USER LEVEL:	Early Stage 1 Stage 1 Stage 2 Community
KLA:	English
SYLLABUS:	English K–10
SCIS 1727030	$32.99

Seagull

SNELL, Danny
Working Title Press, SA, 2015
ISBN 9781921504815

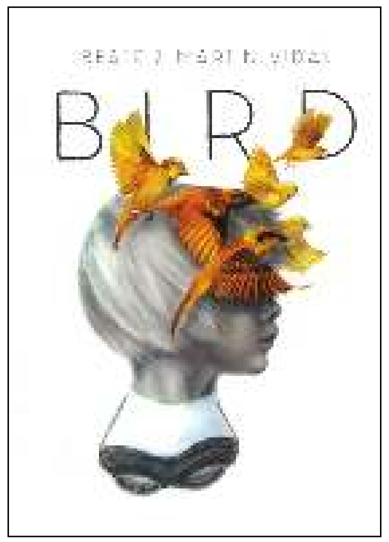


Seagulls have become successful scavengers and can become entangled in human refuse. In this picture book, Seagull is caught in fishing line and other rubbish on the beach. She elicits help from coastal creatures but is unsuccessful in breaking free until a kind child saves her life. This powerful, positive environmental message about the conservation of our environment and the preservation of our wildlife may also alert readers to the serious repercussions of littering. The theme of this story may assist students to express their own views of the world and deepen understanding of outcomes in the *Geography K–10 syllabus*. Teaching notes are available from the publisher's website. C. Emin

USER LEVEL:	Early Stage 1 Stage 1
KLA:	HSIE
SYLLABUS:	Geography K–10
SCIS 1725118	$24.99

Bird

VIDAL, Betriz Martin
Simply Read Books, Canada, 2015
ISBN 9781927018644



The words *Let your imagination fly* appear on the back cover of this evocative picture book. Vidal's intricately drawn greyscale images zoom in and out as they dominate pages of stark white backgrounds, with occasional bursts of gold and yellow. The wordless narrative unfolds in the style of a stop-motion video as a bird in flight transforms into a boy, who transforms into a girl, who transforms into a bird. The images tell the story, or do they? Is it about a child watching and imitating birds in flight? Is it merely a flight of fancy? Is it a tale of migration or transformation or freedom? Readers/viewers can make their own connections. The open-ended story allows different readings of the abstract experiences conveyed, while the fusion of dissonant images create layers of meaning. It is suitable for studying the English textual concepts of *Connotation, Imagery and Symbol, Perspective* and *Representation*. C. Keane

USER LEVEL: Stage 2 Stage 3
KLA: English
SYLLABUS: English K–10
SCIS 1742514 $27.99

Flight

SHORT LIST 2016

WHEATLEY, Nadia & GREDER, Armin
Windy Hollow Books, Vic, 2015
ISBN 9781922081483

Capturing the harrowing plight of displaced persons and alluding to the biblical story of Joseph and Mary, this haunting picture book offers many opportunities for readers to delve into a multifarious contemporary issue. The muted illustrations are a perfect complement to the beautifully touching narrative that documents a family's difficult journey as they seek refuge from violence and persecution in their homeland. As the poetic language is effortless, the text is accessible to a wide audience. Following a discussion of the concepts in this resource, students could explore the reasons why people leave their homes, and examine the humanitarian implications of displacement and the meaning of global citizenship. H. Gardiner

USER LEVEL: Stage 3
KLA: English; HSIE
SYLLABUS: English K–10; History K–10
SCIS 1712436 $25.99

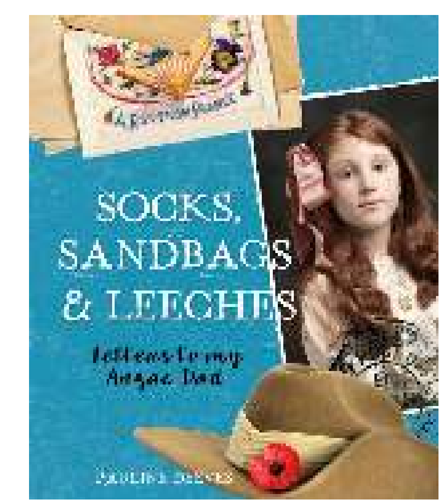
fiction for younger readers

Resources are arranged alphabetically by author. See also eresources.

Some of these books are also suitable for lower secondary students.

Socks, sandbags and leeches: letters to my Anzac dad

DEEVES, Pauline
NLA Publishing, ACT, 2016
ISBN 9780642278845



Presented as a scrapbook of memories, this quarto publication will make a refreshingly different addition to a resource collection to support the teaching of military and community sacrifices in a meaningful way for The Centenary of the Commemoration of the

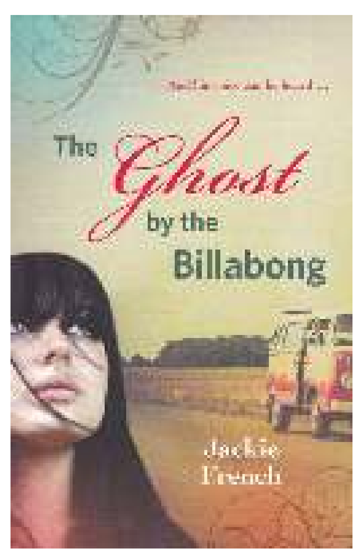
First World War: Bringing communities together (*Scan* 33.1). The text is narrated by 11 year old Ivy who lives with her mother and her aunt in a tiny flat. With little money, life is difficult for the family. Honest and optimistic, Ivy keeps her father informed of life at home and about reports of the war effort. Posters, postcards, newspaper clippings and maps are interspersed among the 20 letters written by Ivy to her dad, a soldier serving overseas in WWI. The book's conversational tone and images of memorabilia will engage students while supporting the History syllabus concepts of *Continuity and change, Perspectives, Empathetic understanding* and *Significance*. Teaching notes and an exploration of the *Australian War Memorial* website would assist students' understanding of life for many Australians during 1914–1918. Students could also view clips and episodes about this time at *My place* to develop historical skills of chronological comprehension, perspectives and interpretations, and empathetic understanding. C. Keane

USER LEVEL:	Stage 2 Stage 3
KLA:	HSIE
SYLLABUS:	History K–10
SCIS 1744666	$24.99

On 'tick' [Episode 10: 1918 Bertie] **by My Place for teachers**

The ghost by the billabong

FRENCH, Jackie
Angus & Robertson, NSW, 2015 (Matilda saga)
ISBN 9780732295295



Spanning five books, to date, this engaging series presents significant events in Australia's history, across multiple generations. This latest book introduces Jed, a strong female teenage runaway, having suffered abuse and neglect as a child, fending as best she can. Arriving at the Drinkwater billabong at the time of Apollo 11's lunar landing, a possible ruse to access some money becomes a passion shared with ailing Tommy. Nicholas, the reclusive Vietnam veteran, reappears with the medical advancements assisting war amputees and sufferers of polio and thalidomide alike. Copious notes detail the author's research and add further enlightenment to the story. Each title in the series can be read as a standalone, though reading in order aids understanding of the multiple storylines and characters. Background reading of historical fiction can assist students to place Australia's history in a global context, as is required in the *History K–10 syllabus*. S. Morton

USER LEVEL:	Stage 3 Stage 4
KLA:	History
SYLLABUS:	History K–10
SCIS 1738379	Paper $19.99

Sian: a new Australian

LUCKETT, Dave
Omnibus, SA, 2015 (New Australian)
ISBN 9781742990392

Historic narratives of child migration can be a valuable adjunct to studies of Australia's history. In this novel, Welsh girl, Sian, voyages to Australia in search of a better life. Sian, the youngest of 13 children in a coalminer's family, has a difficult relationship with her father

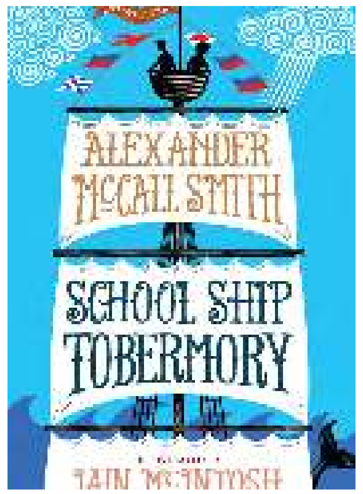
since Sian's mother died giving birth to her. Reprieve comes when Sian goes to live with her sister, Olive, and her sister's new husband, Ellis, who decide to relocate to Australia and settle in Darwin. Life in Darwin in 1910 presents a new set of challenges for the family. Some of the stories of Britain's child migrants are retold in an exhibition at the *V&A Museum of childhood*. Based on historic facts, this text would support outcomes HT2-2 and HT3-2 in the *History K–10 syllabus*. The historical language used in this novel would support the study of topic, audience and language in *Objective A* of the *English K–10 syllabus*. C. Emin

USER LEVEL:	Stage 2 Stage 3
KLA:	English; HSIE
SYLLABUS:	English K–10; History K–10
SCIS 1723783	Paper $15.99

Planning learning activities using YouTube videos embedded in *Scan*? Note that a teacher log in is required to view YouTube videos in the NSW DoE online environment. Stage 6 students also have access.

School Ship Tobermory

McCALL SMITH, Alexander &
McINTOSH, Iain
BC, UK, 2015
ISBN 9781780273334



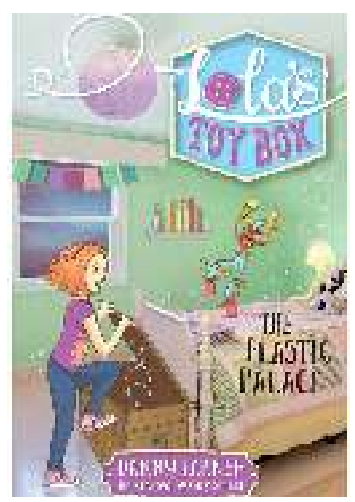
Twins Ben and Fee MacTavish are off to boarding school while their marine researcher parents explore the seas in their small submarine. Theirs is not a traditional boarding school; rather it's a training sailing ship off the coast of Scotland, with seamanship high on the curriculum. As with all schools there are rules to learn, friends to make and bullies to avoid. Even in such small confines, mystery and intrigue find a place with a stowaway, a suspect film crew and rare animal trading making appearances. On occasion, the writing felt ponderous, perhaps even a little condescending, with many details being overly explained. Throughout the novel, small sections of the text are repeated with matching illustrations, giving readers exposure to the graphic novel format. S. Morton

USER LEVEL: Stage 2 Stage 3
SCIS 1737193 $22.99

Alexander McCall Smith reads an extract from his new book School Ship Tobermory
by Booktopia TV

Lola's toy box [series]

PARKER, Danny
Hardie Grant Egmont, Vic, 2015



The ongoing stories about Lola and her favourite clown toy, Buddy, take the emergent reader to a magical kingdom where toys live when they are not being played with. The old toy box transports the characters to the Kingdom where Lola's real world problems are resolved. This series transitions readers into chapter books. Supported by brief sentences, short chapters, oversized font and illustrations, students are encouraged to complete the whole book in order to resolve the current adventure. Teachers may reference this series as examples of simple sentences and the effect on fluidity when there is an over-reliance on compound sentences using coordinating conjunctions. The use of present tense and dialogue characterise the narrative writing throughout this series. S. Rasaiah

USER LEVEL: Stage 1
KLA: English
SYLLABUS: English K–10
Paper $12.95 each

Reviewed titles in this series:

The patchwork picnic
SCIS 1724988

The plastic palace
SCIS 1726364

The treasure trove
SCIS 1726671

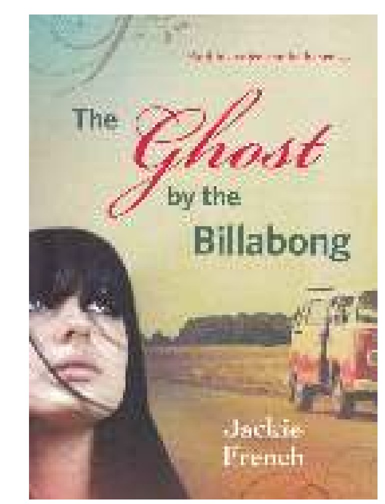
fiction for older readers

Resources are arranged alphabetically by author. See also *eresources*.

Some of these items are also suitable for upper primary students.

The ghost by the billabong

FRENCH, Jackie
Angus & Robertson, NSW, 2015 (Matilda saga)
ISBN 9780732295295



Spanning five books, to date, this engaging series presents significant events in Australia's history, across multiple generations. This latest book introduces Jed, a strong female teenage runaway, having suffered abuse and neglect as a child, fending as best she can. Arriving at the Drinkwater billabong at the time of

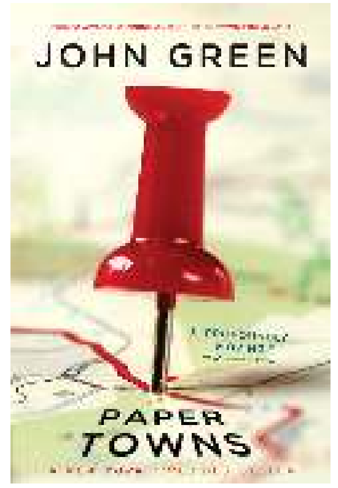
Apollo 11's lunar landing, a possible ruse to access some money becomes a passion shared with ailing Tommy. Nicholas, the reclusive Vietnam veteran, reappears with the medical advancements assisting war amputees and sufferers of polio and thalidomide alike. Copious notes detail the author's research and add further enlightenment to the story. Each title in the series can be read as a standalone, though reading in order aids understanding of the multiple storylines and characters. Background reading of historical fiction can assist students to place Australia's history in a global context, as is required in the *History K–10 syllabus*. S. Morton

USER LEVEL: Stage 3 Stage 4
KLA: History
SYLLABUS: History K–10
SCIS 1738379 Paper $19.99

Paper towns

GREEN, John
Angus & Robertson, NSW, 2015
ISBN 9781460750568

'Q' Jacobsen, longs to connect with and understand Margo Roth Spiegelman in this coming of age romantic novel. The plot is part mystery and part adventure, crafted with humour as the adolescent relationship drama plays out. Q seeks



Margo after she disappears from school just before graduation. She leaves cryptic clues for Q who follows her trail, attempting to appreciate the world through her eyes. The explanation of Margo's disappearance is profoundly moving, appealing to astute readers who can decipher deeper meanings and follow the psychological profiling of characters. The language choices and writing style are appropriate for the time and the age of the protagonists and readers need to be aware that this novel is more suitable for senior students. S. Pollard

USER LEVEL: Stage 6
SCIS 1715575 Paper $19.99

Paper Towns | Official Trailer **by 20th Century Fox**

You're the kind of girl I write songs about

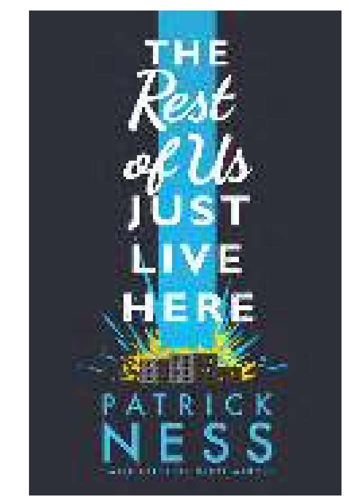
HERBORN, Daniel
Angus & Robertson, NSW, 2015
ISBN 9780732299507

By day, Tim is attempting his Higher School Certificate for a second time. By night, he plays gigs in Sydney's inner west where he can showcase his own songs. In contrast, Mandy is taking a break from her studies. She spends her days drinking tea with her best friend, Alice, and watching daytime television. It is a shared passion for music that eventually brings the pair together. With two different narrative viewpoints, readers are able to follow the teenagers as they search for greater meaning to life. The internal monologues, utilised within the first person narrative, are rich in symbolism. Flashbacks also draw the reader into Mandy's tough childhood. If contemplating using this engaging novel within the classroom, downloadable teaching notes are available. In exploring the tumultuous transition to adulthood where individuals seek to find their place in the world, this novel proves to be a satisfying read. H. Gardiner

USER LEVEL: Stage 5
KLA: English
SYLLABUS: English K–10
SCIS 1711785 Paper $17.99

The rest of us just live here

NESS, Patrick
Walker Books, UK, 2015
ISBN 9781406331165



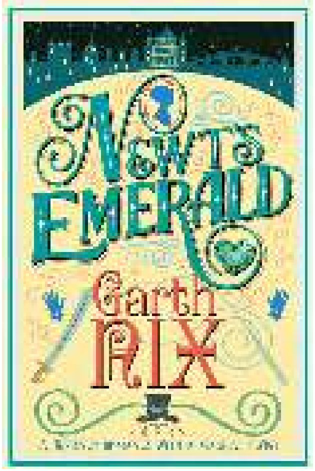
Ness is a writer who seems to like playing with form, as much as he does with style. Here he uses chapter summaries to explore a story happening concurrently with the events of each chapter, in which Mikey, his sister and friends are looking forward to graduation while only peripherally aware that rather strange events are occurring in their town. Through the summaries, Ness offers us a world of *Immortals*, *Messengers* and *indie kids* participating in events to decide the fate of the world, while the protagonists try to come to terms with their own life changing events of school ending and moving into the next phase of their lives. This formatting technique reminds readers that modern speculative fiction tends to happen beside a human world which remains oblivious to the events in question. Issues of sexuality, attempted suicide and obsessive-compulsive disorder make this novel suitable for senior students. S. Pollard

USER LEVEL: Stage 6
SCIS 1729648 $24.95

Patrick Ness on The rest of us just live here by Walker Books

Newt's emerald

NIX, Garth
Allen and Unwin, NSW, 2015
ISBN 9781760112653



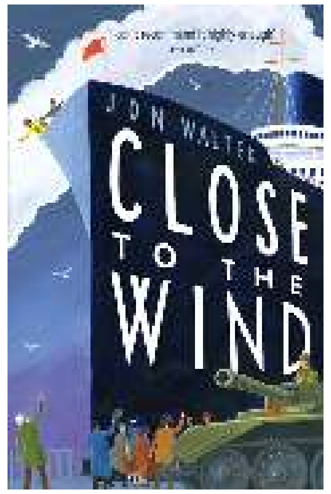
Inspired by the works of Georgette Heyer and Jane Austen, this novel is a regency romance with a fantasy twist. Written in the time where a lady's reputation must remain above reproach and where ladies of moral repute are launched into London society, this story introduces Lady Truthful Newington, the daughter and heir of a wealthy country gentleman. She is also the heir to the fabulous Newington Emerald. The emerald is on display at Lady Truthful's private dinner party when it disappears. Garth Nix is a talented fantasy writer with the skill to weave a compelling tale and engross the reader. In this piece of historical fiction, there is plenty of suspense, drama and discovery. Truthful is a satisfying heroine, rescuing at least as often as she is rescued. Fans of the author and of fantasy or regency romance will enjoy this tale immensely. C. Emin

USER LEVEL: Stage 4 Stage 5
SCIS 1730358 Paper $18.99

Garth Nix on his new novel Newt's emerald by Booktopia TV

Close to the wind

WALTER, Jon
David Fickling Books, UK, 2015
ISBN 9781910200179



Malik and his grandfather are apparently trapped in a country torn apart by war, trying to find Malik's mother and escape. The country is unnamed, highlighting a universal experience, and the events are equally common. The characters have seen violence, experienced hunger, traveled without many belongings and, at night, hidden in abandoned buildings to avoid detection. The establishment of danger and secrecy is vivid; as is the protagonists' meeting with two men whom the grandfather knows, who steal from them. When Malik is tricked on to the departing boat, which takes him to safety, he determines to return one day to find his family. While not entirely satisfying, as some of the plot becomes contrived, especially aboard the boat, Walter has created a story familiar to many and so deserving of being told. This novel is worth reading for those who want to understand the refugee plight from a personal perspective. S. Pollard

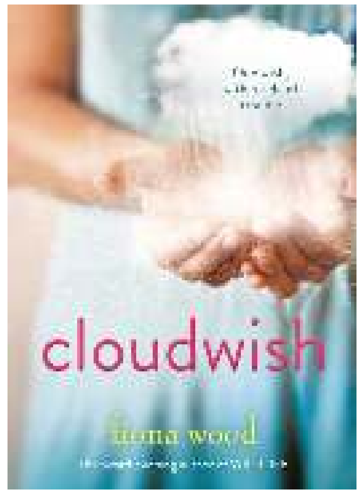
USER LEVEL: Stage 4 Stage 5
SCIS 1700575 Paper $16.99

Jon Walter on Close to the wind by David Fickling Books

Cloudwish

SHORT LIST 2016

WOOD, Fiona
Macmillan, NSW, 2015
ISBN 9781743533123



Vân Úóc Phan has a scholarship to her local Grammar school, which places this child of refugees in a world of middle class privilege. Her life experiences are so much a contrast to theirs that the author appears to be making a statement about the dubious benefits of private education for outsiders. This story is also a romantic one, in which Vân Úóc longs for the attentions of Billy Gardiner, a school symbol of male success. That he pays attention to her leaves her vulnerable and doubtful, but in a positive twist, Wood does not fall into the cliché of turning such attraction into a joke. Rather she explores the question of dissimilarity through a lens which enables the reader to see what these two have in common, as surely as we see what could keep them apart. This is a positive story of human relationships and overcoming difference. S. Pollard

USER LEVEL: Stage 5 Stage 6

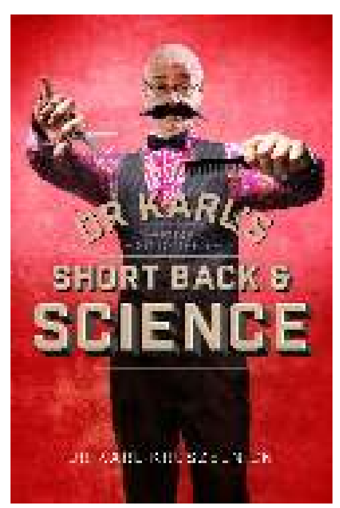
SCIS 1728999 Paper $19.99

information, poetry and drama

Resources are in Dewey order.

Dr Karl's short back & science

KRUSZELNICKI, Karl Karl
Pan Macmillan Australia, 2015
ISBN 9781743533345 [500]



Never failing to disappoint, science commentator, Dr Karl Kruszelnicki covers 37 highly intriguing science conundrums in his latest book. The chapter, *Breathe in space*, references the International Space Station, while *Anti-oxidents & snake oil* dispels popular beliefs. Reading this book would provide teachers and students with the perfect opportunity to discuss how scientific and technological knowledge is applied in daily lives. Opportunistically placed statistics may intrigue and inspire inquiry in STEM lessons. Teachers would have little difficulty relating the contents of this book to a range of subjects. S. Crawford

USER LEVEL: Stage 4 Stage 5

KLA: Mathematics; Science; TAS

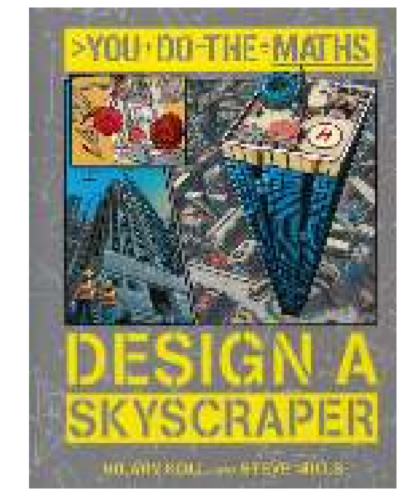
SYLLABUS: Design & Technology 7–10; Mathematics K–10; Science K–10

SCIS 1745880 $32.99

Dr Karl Kruszelnicki on Short back and science! **by Booktopia TV**

Design a skyscraper

KOLL, Hilary, MILLS, Steve & ALEKSIC, Vladimir
QED Publishing, UK, 2014 (You do the maths)
ISBN 9781781716878 [510.16]

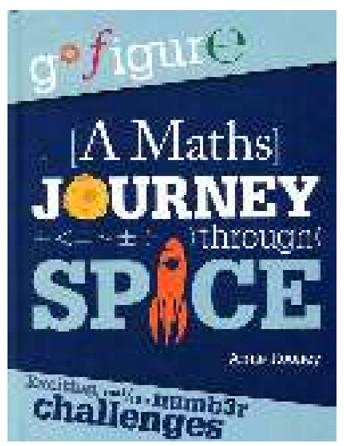


Taking on the role of an architect to design a skyscraper is the challenge set in this resource. Featuring well known skyscrapers, the book provides opportunities for students to use mathematical and design skills to choose a site and comply with the safety, structural and social needs of the brief. Students predict and gather data to solve a series of problems using skills to achieve outcomes from all content strands of the *Mathematics K–10 syllabus*. Teachers need to ensure that correct terminology, such as 2D shapes and 3D objects, is used. This resource may also support the achievement of outcomes ST2-14BE, ST3-14BE, ST2-16P and ST3-16P in the *Science K–10 (incorporating Science and Technology K–6) syllabus*. It could be a springboard for students to investigate the use of mathematics, science and technology in the real world. C. Keane

USER LEVEL: Stage 2 Stage 3 Community
KLA: Mathematics; SciTech
SYLLABUS: Mathematics K–10; Science K–10 (SciTech K–6)
SCIS 1700308 $24.99

A maths journey through space

ROONEY, Anne
Wayland, UK, 2015 (Go figure)
ISBN 9780750289153 [510.76]

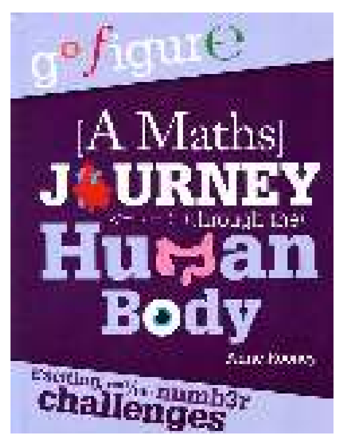


Colourful infographics are used to provide data, from which students solve problems about angles, distance, ratio, position, fractions and decimals, time and probability, as they lead a space mission to navigate a rocket through space and land on Mars. With some appropriate tweaking, teachers could use the ideas to create a similar adventure for students in the classroom. This resource is sure to challenge students who enjoy unravelling mathematical puzzles and have an interest in space travel and the solar system. A glossary of mathematical terms and answers to each challenge are provided at the end of the book. C. Keane

USER LEVEL: Stage 3 Community
KLA: Mathematics; SciTech
SYLLABUS: Mathematics K–10; Science K–10 (SciTech K–6)
SCIS 1737962 Paper $17.99

A maths journey through the human body

ROONEY, Anne
Wayland, UK, 2015 (Go figure)
ISBN 9780750289184 [510.76]

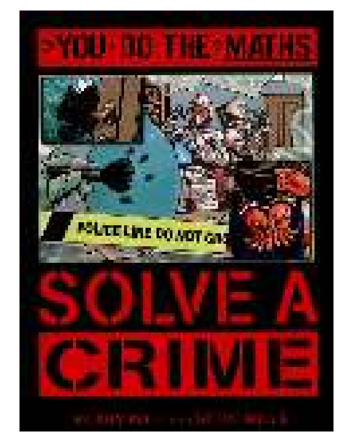


This journey of discovery uncovers mysteries of bone, tissue and skin in a human body using mathematical principles to solve puzzles and build confidence in Mathematics. Challenges include calculating skin surface area, using decimals and fractions, counting and measuring bones, and learning about using expressions and equations. A combination of imperial and metric units is adopted throughout the resource, and answers and explanations are provided at the end of the book. C. Emin

USER LEVEL: Stage 2 Stage 3
KLA: Mathematics
SYLLABUS: Mathematics K–10
SCIS 1737955 Paper $17.99

Solve a crime

KOLL, Hilary, MILLS, Steve & ALEKSIC, Vladimir
QED, UK, 2014 (You do the maths)
ISBN 9781781716953 [510.76]



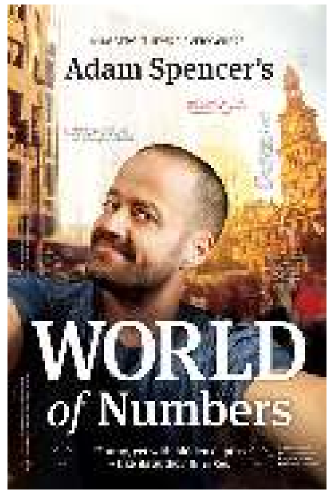
Reminiscent of the NSW Department of Education's Murder under the Microscope, this resource provides a crime, and clues for students to use reasoning and problem solving skills to identify the villain. Although designed to complement the British Mathematics Curriculum, and with some differences in terminology, the book offers opportunities for Australian students to achieve *Working Mathematically* outcomes. Taking on the roles of investigative detectives, students use crime scene, forensic and DNA evidence to analyse, interpret and evaluate data to achieve Statistics and Probability outcomes in the *Mathematics K–10 syllabus*. They describe position on grid-references and analyse timelines for Measurement and Geometry. Camera footage, surveillance and profiling add to the realism of the investigation as students explore data from tables, maps and charts to connect mathematical concepts, solve the crime and catch the burglar. A comic strip format, descriptions of each stage of the investigation and progressive questions support and encourage students to stay on task. C. Keane

USER LEVEL: Stage 3 Community
KLA: Mathematics
SYLLABUS: Mathematics K–10
SCIS 1737458 Paper $9.95

Adam Spencer's world of numbers: numbers, they're everywhere

SPENCER, Adam
Xoum Publishing, NSW, 2015
ISBN 9781921134869 [513.2]

Students and teachers could easily pick any page in this interesting resource and find a stimulus for use in a Science or Mathematics lesson. All content strands are covered and numerical data is displayed through a variety of visual tools including graphical representations and tables. Information is detailed and presented in short snapshots to keep readers fascinated. The book dedicates



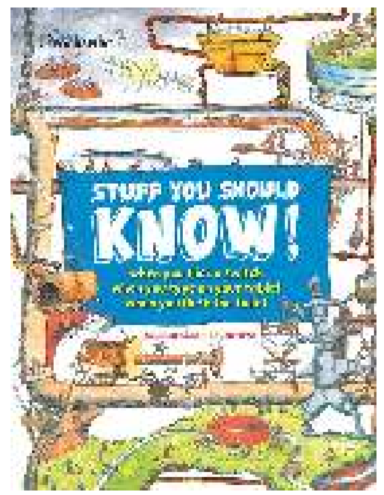
one page per number, from one through to 366, with many pages having mathematical questions. The answers are in the back of the book. Snippets from this book could easily be used as a starting point for a STEM lesson as the anecdotes range from the structure of different atoms, through to the ratio of colours used in M&M's and the average temperature on different planets. J. Perry

USER LEVEL: Stage 4 Stage 5
KLA: Mathematics; Science
SYLLABUS: Mathematics K–10; Science K–10
SCIS 1742831 $34.99

[*Adam Spencer: Why I fell in love with monster prime numbers*](#) **by TED**

Stuff you should know!: when you tweet on Twitter? when you recycle your soda can? When you charge your iPad?

FARNDON, John & BEATTIE, Rob
Australian Geographic, NSW, 2014
ISBN 9781742456362 [600]

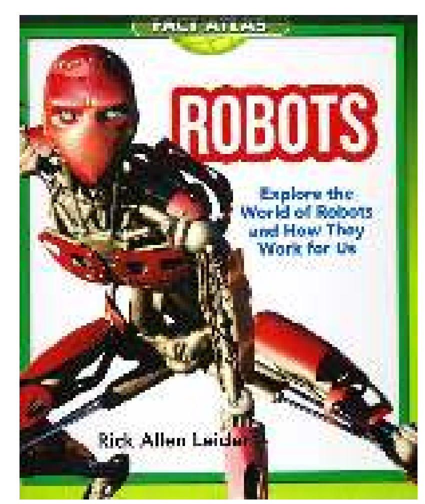


Stuff you should know contains a comprehensive collection of everyday technology and processes, with delightfully illustrated diagrams. Most suitable for Stages 2 and 3, this book details how each household item, such as a hairdryer, works and how a process, like rubbish disposal, is performed. Written from an Australian perspective, students will be engaged by the labelled diagrams that seem to make the explanation easier to grasp with the humorous addition of small human workers that assist with anything from adding the flour and salt to pizza dough to building tiny sandcastles in a water filtration tank. While the book does not focus on any particular area of STEM, it is a useful addition in the classroom to support learning in product and process development, and is relevant to several sub-strands of the *Built Environments* strand within the *Science K–10 (incorporating Science and Technology K–6) syllabus*. A. Lee

USER LEVEL: Stage 2 Stage 3
KLA: SciTech
SYLLABUS: Science K–10 (SciTech K–6)
SCIS 1694345 $19.95

Robots: explore the world of robots and how they work for us

LEIDER, Rick Allen
Sky Pony Press, USA, 2015
ISBN 9781632204394 [629.8]

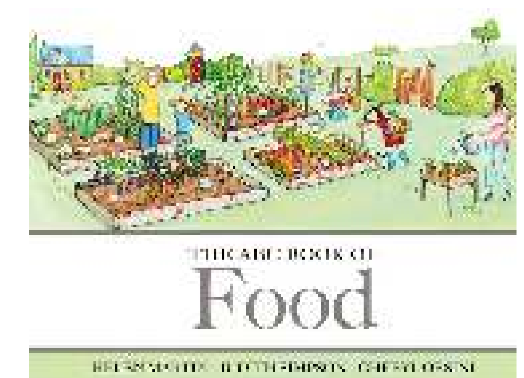


From a humanoid robot that can feel pain to robots exploring Mars, this comprehensive book explains and illustrates examples of robots used for a wide range of applications. Fascinating images show the diversity of robots used in areas such as industry, medicine, military operations, space research and underwater explorations. The development process is also examined, providing real-life examples of the *Working Technologically* process. Readers are also challenged to consider robotic futures for our world. This resource supports inquiry learning in STEM subjects. G. Braiding

USER LEVEL: Stage 2 Stage 3
KLA: SciTech
SYLLABUS: Science K–10
SCIS 1725811 $18.99

The ABC book of food

MARTIN, Helen, SIMPSON, Judith & ORSINI, Cheryl
HarperCollins Publishers Australia, NSW, 2016
ISBN 9780733334269 [641.3]

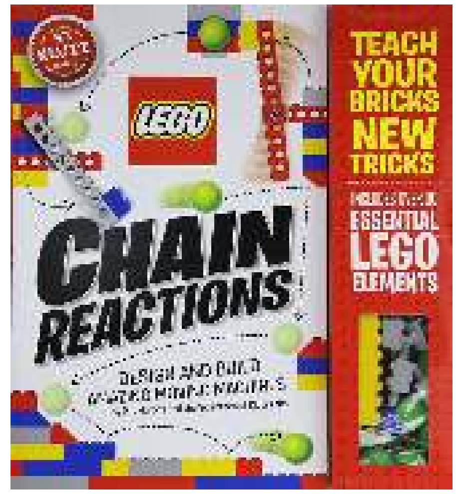


One of a series of books from the authors and written for children aged between 5 and 8, this beautifully illustrated non-fiction title takes students on a journey from paddock, orchard and garden to the kitchen table. The challenge of sustainably feeding the world will require innovation and this book provides a fabulous introduction to food production, which ties in well with outcomes from the *Natural Environment* strand in Early Stage 1. Through cleverly written rhyme, the reader starts their journey at the beginning of the day and eats their way through breakfast, lunch and dinner. Lessons of food production are interwoven into the story with the simple text and accompanying images allowing students to follow the process of preparing milk, honey, eggs, fruit and vegetables to various locations, such as the farmers market, supermarket and finally the kitchen. A brief encounter with a few machines and factories allow for deeper classroom discussion if desired. A. Lee

USER LEVEL:	Early Stage 1 Stage 1
KLA:	SciTech
SYLLABUS:	Science K–10 (SciTech K–6)
SCIS 1752671	$24.99

Lego chain reactions

MURPHY, Pat
Klutz, USA, 2014
ISBN 9780545703307 [688.7]

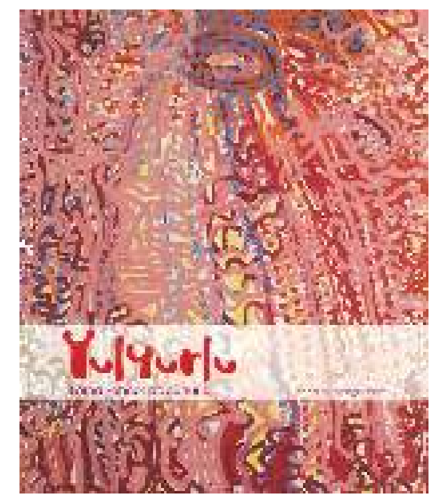


Lego chain reactions is overflowing with ideas, instructions, and inspiration for 10 Lego machines that spin, swing, pivot, roll, lift, and drop. The kit, aimed at children from 7 to 15 years, is a brilliant addition to any classroom delving into machines and engineering. Each project in the book gives students easy to follow instructions on how to build the machines and a rating scale of difficulty. A brief explanation on why the stage works the way it does is also included, along with repair instructions to help troubleshoot if something goes wrong. A QR code is included for each machine so students are able to see how the machine works. The stages can be assembled in many ways, allowing plenty of room for design innovation. The book is excellent, however one downfall is the small set of Lego pieces that is included in the kit. For all but one project, users are instructed to get most of the pieces from their personal collection. Therefore, in order to gain maximum benefit from the kit, teachers need to ensure they have lots of spare Lego pieces; otherwise students may become frustrated with the inability to complete a project. A. Lee

USER LEVEL:	Stage 2 Stage 3 Stage 4
KLA:	Science; SciTech
SYLLABUS:	Science K–10 (SciTech K–6)
SCIS 1709575	$29.99

Yulyurlu: Lorna Fencer Napurrurla

Edited by Margie West.
Wakefield Press, SA, 2011
ISBN 9781743050095 [759.994]

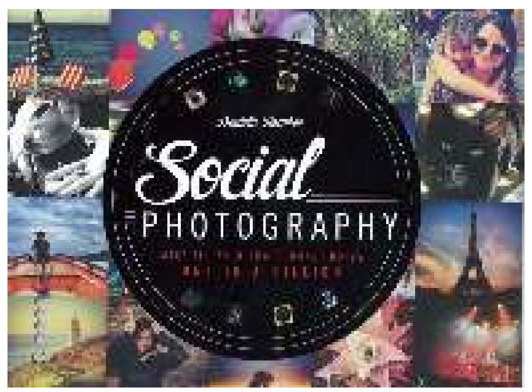


Illuminating the life and practice of Warlpiri artist Yulyurlu Lorna Fencer Napurrurla, this publication profiles the development of her innovative painting style, distinctive aesthetic and pioneering roles in the Central Desert art movement and contemporary Australian art. Candid accounts reveal the resourceful and independent nature of the artist's practice, focusing on her utilisation of the vibrancy and flexibility of the acrylic palette, involvement with community art centres and forging of productive relationships with public and private collectors. Insights into Napurrurla's artmaking process, including her experimentation with colour, gestural brushwork, layering of pigments and abstraction of natural forms, offer informative starting points for practical and critical classroom investigations. Emphasis on how the artist visually explored her ancestral stories through plant and animal motifs, repeated elements and the mapping of growth patterns, provides strong material and conceptual connections for students and teachers. High quality plates of Napurrurla's small and large-scale works, ranging from paintings on paper and canvas to etchings, objects and body paintings, accompanied by a glossary of Warlpiri terms, map and translations of traditional narratives make content accessible. Indigenous people are advised that names and images of deceased people appear in the publication. H. Yip

USER LEVEL:	Stage 4 Stage 5 Stage 6 Professional
KLA:	CA
SYLLABUS:	Photographic & Digital Media 7–10; Photography, Video & Digital Imaging CEC Stage 6; Visual Arts 7–10; Visual Arts Stage 6; Visual Design 7–10; Visual Design CEC Stage 6
SCIS 1531310	$34.95

Social photography: make all your smartphone photos one in a billion

BOWKER, Daniela
ILEX, UK, 2014
ISBN 9781781579817 [771]



The best camera is the one you have with you. iPhones and smartphones enable users to capture and share millions of photographs daily. This handy, A5-sized guide to social photography examines this phenomenon of *Smartphoneography* and how it has radically altered the ways that we take, look at, exchange and use photographs. The accessible layout and diagrams, up-to-date advice, graphic flowcharts, glossary and example photographs provide informative tools for practical investigations and classroom discussions. Topics covered include cloud storage and sharing, approaches to composition, shooting for a look, privacy and licensing issues and suggestions on useful apps and accessories. Profiles on international photographers offer opportunities for students to analyse a diversity of artists' strategies and build on their own practice. Teachers and students will find inspiration for initiating blogs, collective albums, online exhibitions and projects on citizen journalism, informed by the candid break down of the pros and cons of social networking platforms such as *Facebook*, *Twitter*, *Flickr*, *Google+*, *Instagram* and *Pinterest*. Snapping and sharing your next image will prove that there is nothing in this world, real or online, that does not have a decisive moment. H. Yip

USER LEVEL: Stage 4 Stage 5 Stage 6 Professional

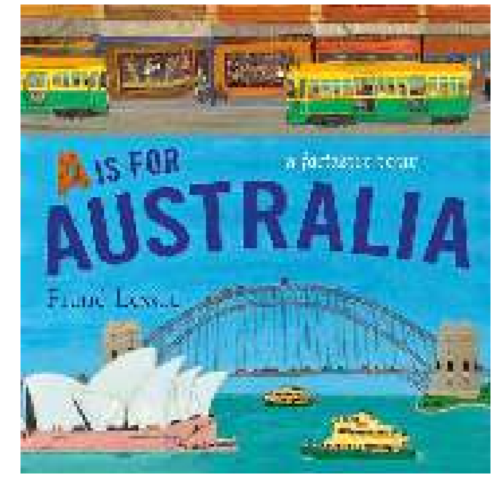
KLA: CA

SYLLABUS: Photographic & Digital Media 7–10; Photography, Video & Digital Imaging CEC Stage 6; Visual Arts 7–10; Visual Arts Stage 6; Visual Design 7–10; Visual Design CEC Stage 6

SCIS 1666606 Paper $19.95

A is for Australia: a factastic tour

LESSAC, Frané
Walker Books Australia, NSW, 2015
ISBN 9781922179760 [994]



Lessac takes the reader through the alphabet to showcase some of Australia's famous landmarks and lesser known locations. Her colourful, detailed illustrations will appeal to younger readers and entice them into reading the interesting and quirky facts, which are presented as short labels on each picture. The A page, at the beginning of the book, is a map of Australia, showing every featured location, so that children can refer back to find where they are. The short paragraphs provide interesting information that fosters an appreciation for Australia's unique and diverse natural environment and the ways that people interact with it. Aboriginal perspectives are meaningfully embedded throughout the text. This engaging book would be an ideal base for Geography activities about people and places. D. Jameson

USER LEVEL: Early Stage 1 Stage 1 Stage 2

KLA: English; HSIE

SYLLABUS: English K–10; Geography K–10

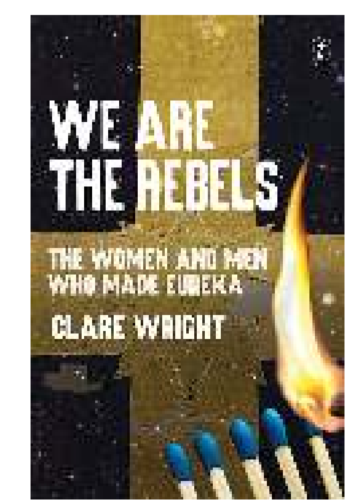
SCIS 1693887 $24.95

A is for Australia, by Frané Lessac (Walker Books) **by writingwa**

We are the rebels: the women and men who made Eureka

SHORT LIST 2016

WRIGHT, Clare
Text Publishing, Vic, 2015
ISBN 9781922182784 [994.5]



December 3, 1854 saw bloodshed and sorrow mix with the allure of gold and military power on a battlefront that defined the political, social power and recognition in Australia's history. Wright's book on the Eureka Stockade is written for students and takes a complex and contested aspect and creates an engaging historical narrative. Wright's purpose is to demonstrate the role women played in forging the ideals within our national history, and her work is episodic in its approach, allowing teachers to engage with parts or all of the text. There are also short asides to delve deeper into facets, such as Chartism, and short biographies of the main players. By using firsthand accounts, the book demonstrates that women are not passive observers of history, but are active players in creating our story. A. Ellis

USER LEVEL: Stage 3 Stage 5
KLA: English; HSIE
SYLLABUS: English; History K–10
SCIS 1723790 Paper $19.99

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