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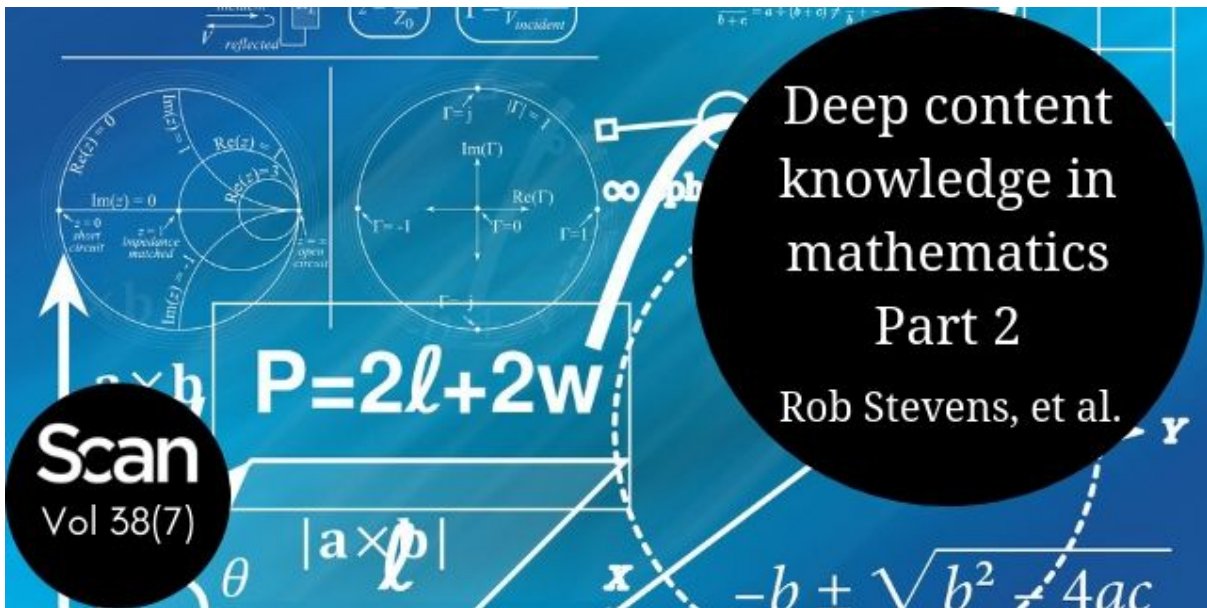
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## Deep content knowledge in mathematics - Part 2

**Stevens, R., Liyanage, S., Liondos, N., Woo, E., Ali Kan, A., Blue, J., De Marcellis, L., Birungi, A., Brady, K., Tregoning, M. & Coupland, M.**

Deep content knowledge in mathematics is philosophical knowledge, that is, the problematic and the controversial.

Deep content knowledge in mathematics can be cultivated by a stronger emphasis on dialogic instruction and hands on learning (the use of manipulatives to help render abstract mathematical concepts more tangible). This is because deep content knowledge in mathematics is philosophical and abstract. Mathematical reasoning, in common with all reasoning, is rooted in dialogue.

Deep content knowledge can be cultivated by encouraging a slower, more collaborative and reflective approach to learning mathematics.

### Why give emphasis to dialogue?

*Mathematical reasoning and dialogue*

Why is a dialogic approach combined with hands on learning most appropriate for students learning deep content knowledge in mathematics? Deep content knowledge is philosophical knowledge – the essentially contestable concepts that lie at the heart of a discipline. In mathematics these include:

- concepts of infinity – different orders of infinity – infinity comes in different sizes – Aleph null, Aleph one and so on (Matson, 2007)

- concepts of the infinitesimal - the assumption that any line (for example, a piece of string) or stretch of time is infinitely divisible generates paradoxes such as Zeno's paradoxes that are deep philosophical problems without agreed answers (Huggett, 2018)
- concepts of zero. Zero is a deep philosophical concept as reflected in divergent answers to the question – what is zero to the power of zero? Some mathematicians argue it is zero, others argue it is one, while others claim it is indeterminate. The indeterminacy of a number is an interesting philosophical idea in itself
- concepts of mathematical sequences in the living world - The Fibonacci Sequence - the series of numbers 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ... The next number is found by adding up the two numbers before it. This is a recurring pattern in the geometry of living systems (for example, the arrangement of petals on flowers, the patterns of spines on pineapples, patterns on a pine cone, breeding patterns of rabbits) (du Sautoy, 2008)
- concepts of space - the question of whether space is a relationship between objects or has properties of its own is another philosophical issue at the heart of geometry. Is space Euclidian (flat) or Riemannian (curved)?
- concepts of topology – for example, one sided objects such as the Moebius Strip (Lamb, 2016).

There are numerous mathematical problems and conjectures that mathematicians explore and disagree about. These philosophical concepts lie at the heart of mathematics. The best way to understand these concepts and the philosophical issues they embody, is through dialogue, using a dialogic pedagogy.

The idea that deep content knowledge is higher order knowledge in terms of the SOLO taxonomy is complementary to its being philosophical knowledge. The stages of the SOLO taxonomy (Biggs & Collis, 1991, p. 65) well describe systematic philosophical thinking, bringing to bear and integrating an increasing range of considerations relevant to an issue.

**'Introducing SOLO Taxonomy'** (2mins 35 secs) by Pam Hook (2017) from HookED provides a brief introduction to SOLO Taxonomy.

An argument in favour of a dialogic approach to teach deep content knowledge in mathematics is that the paradigm of mathematical reasoning itself – the proof – is not an internal mental operation but has its roots in dialogue. The technique of mathematical proofs emerged in the context of political debates in Athenian democracy. For example, in Plato's 'Meno', Socrates shows a slave boy how to double the area of a square – a mathematical proof. The dialogue might have gone 'If you agree with this then this other thing follows. Do you agree? – Yes, I agree Socrates'.

With the move from orality to writing it became a much more regimented technique. Diagrams become important. On the other hand, many dialogical features of proof remain in place, even in the written medium. The main purpose of a mathematical proof is to produce explanatory persuasion. Proof is the end product of a dialogue where there is an audience receiving the proof but when there is nothing to object to the audience remains silent. There is just tacit agreement with all the steps of the proof.

Two participants in fictive dialogue are the prover and skeptic. The job of the prover is of formulating the proof. The role of the skeptic is to ensure the proof is correct, that it is explanatory and that the steps are clear.

In contemporary mathematical practice, the role of skeptic is filled by referees of articles to a journal. This is a dialogical structure. Proof is always going to be a triadic notion – the prover, the proof itself, the receiver (to whom the proof is intended) (Novaca, 2018).

Mathematical proof was born of dialogue and still retains implicit dialogical features.

In their recent book ‘The Enigma of Reason’, Mercier and Sperber argue that human reason is first and foremost a social competence. Reason can bring huge intellectual benefits, but it does this through interaction with others (Mercier, 2017). Reasoning, including mathematical reasoning occurs in interaction with others – in a community of inquiry. It is the explicitly social context of these pedagogies that contributes to their effectiveness in cultivating critical and creative thinking. The practice of critical and creative thinking is deeply embedded in these pedagogies.

Considering how to best enable students to develop skills in reasoning is closely related to the notion of how knowledge is classified. In mathematics education, some scholars propose that knowledge accords with two types. With a research interest in how children develop concepts in mathematics, Bethany Rittle-Johnson proposes that two forms of knowledge relate to the acquisition of mathematical knowledge, these being conceptual knowledge and procedural knowledge.

Conceptual knowledge is referred to as ‘knowledge of concepts, which are abstract and general principles’ (Rittle-Johnson, 2017, p. 184) and procedural knowledge is described as ‘knowledge of procedures – what steps or actions to take to accomplish a goal’ (Rittle-Johnson, 2017, p. 184).

In defining these types of knowledge for learning about mathematics, Rittle-Johnson is concerned with how relations might be developed between knowledge types. Developmental relations between these knowledge types are explored through the employment of the concept of procedural flexibility. Procedural flexibility is defined as ‘knowing more than one type of procedure for solving a particular type of problem and applying them adaptively to a range of situations’ (Rittle-Johnson, 2017, p. 184).

Types of reasoning used by students in mathematics are positioned by Rittle-Johnson in terms of flexibility in the application of skills. One might expect, however, that there are other modes of reasoning that come into play in mathematics besides agility in conceptual reasoning, that contribute evidence towards gauging student understanding.

### Pedagogies and student identities

Dialogic pedagogy is associated with identities as students of mathematics that contribute to deep content knowledge.

Jo Boaler suggests that knowledge is inextricably linked to the manner in which it is learned and the practices in which it is embedded. Students' knowledge is constituted by the pedagogical practices in which they are engaged. Practices such as working through textbook exercises or discussing and using mathematical ideas shape the forms of knowledge produced (Boaler, 2002).

Besides learning knowledge in mathematics classrooms, students learn a set of practices. These come to define their knowledge and even who they are – their identities - as learners.

The following table contrasts student identities associated with different pedagogies in mathematics.

<b>Differing student identities associated with different pedagogies in mathematics</b>	
<b>working through textbook exercises</b>	<b>discussing and using mathematical ideas</b>
Competitive	Collaborative
Fast	Slow
Receptive	Reflective, deliberative
Algorithmic	Systematic
Received knowers	Knowledge producers
Receiving questions and ideas	Generating questions and ideas
Risk averse	Risk taking (Sharma, 2015)
Fixed mindset	Growth mindset

Philippa Foot suggests that 'in doing philosophy one should not try to banish or tidy up a ludicrously crude but troubling thought, but rather give it its day, its week, its month, in court... It chimes, of course, with Wittgenstein's idea that in philosophy it is very difficult to work as slowly as one should' (Foot, 2001, p. 2.). The same applies to deep learning in any discipline.

Boaler (2013) notes that students with these differing identities achieved at similar levels on tests, but 'they were developing very different relationships with the knowledge they encountered'. If we assume that timed tests tend to measure surface knowledge and that developing surface knowledge is a condition for developing deep knowledge, students engaged in the dialogic classrooms are likely to develop a more creative and critical relationship with mathematics than students receiving direct instruction. Their consequent differing identities as learners of mathematics contribute to students in the dialogic classroom developing deep (philosophical) content knowledge in mathematics as well as surface knowledge.

Researching on mistakes and mathematics, Boaler suggests that teacher's practice concerns the ways in which they treat mistakes in mathematics classrooms. Mistakes are important opportunities for learning and growth, but students routinely regard mistakes as indicators of their own low ability (Boaler, 2013).

If as a system, we aim to cultivate deep content knowledge (in mathematics for example), we will need to develop structures to facilitate students who pride themselves as being strong collaborative, slow, reflective, systematic, creative and critical thinkers. The current system, the pinnacle of which is a three-hour exam at the end of 12 years of schooling, appears to privilege learners who are who can remember the 'right answers', or algorithms to reach them and reproduce them quickly in a competitive test. Collaboration in an exam is cheating. They are timed and most questions have one right answer. There is little scope in a timed exam for slow, systematic reflection. Critical, creative and systematic thinking typically take time.

It is significant to note that machines are capable of applying algorithms in making mathematical calculations at a speed far faster than humans. Machines are less proficient in answering more open-ended questions. Should we be encouraging students to focus the bulk of their efforts in mathematics on making calculations and applying algorithms that machines can do with greater speed and accuracy?

It is a common practice in schools for mathematics students to be streamed in accordance with ability. Boaler argues that streaming is informed by and encourages a fixed mindset where students see their performance as related to fixed ability rather than as something they have some control over (Boaler, 2013).

Streaming fosters competitive identities in mathematics. Streaming is inimical to dialogic pedagogies involving students collaborating in a community of inquiry, since a community of inquiry thrives on diversity of participants rather than grouping participants according to a common perceived ability. As we have seen, dialogic instruction facilitates the cultivation of deep content knowledge in mathematics.

### What spaces best support these pedagogies?

Futurist David Thornburg identifies three archetypal learning spaces – the campfire, cave and watering hole – that schools can use as physical spaces and virtual spaces for student and adult learning (Davis & Kappler-Hewitt, 2013, p. 25).

Stephen Collis, Director of Innovation at the Sydney Centre of Innovation in Learning, explains David Thornburg's learning spaces in '[Learning spaces – Different spaces and their purposes](#)' (3mins 38 secs.) (CORE Ministry Video, 2016).

The 'campfire' is a space where people gather to learn from an expert and suits more teacher centred and explicit instruction. The experts are not only teachers and guest speakers, but also students who are empowered to share their learning with peers and other teachers.

The 'watering hole' is an informal space where people can share information and discoveries, acting as both learner and teacher simultaneously. This shared space can serve as an incubator for ideas and can promote a sense of shared culture. This sort of space supports dialogic approaches.

The 'cave' is a private space where an individual can think, reflect and transform learning from external knowledge to internal belief. It also acknowledges the need for privacy and to be by ourselves sometimes. Most learners need some time to themselves and some need more time alone than others.

With flexible furnishings, for example, chairs and tables that can be readily moved around the room or up and down, a campfire can be transformed into a watering hole, or into a series of caves.

We would add other metaphors to Thornburg's by including the:

- 'sand pit' for creative interactive pedagogies with access to manipulatives
- 'yarning circle', a seating arrangement for a community of inquiry - usually a circle or an inner and outer circle and
- 'amphitheatre', a seating arrangement for a large presentation.

Direct Instruction is best supported by the amphitheatre for larger groups and by the campfire for smaller groups.

Dialogical Instruction is best supported by the watering hole and the yarning circle.

Hands on learning is best supported by a sand pit.

The cave is a vital space to support each of these pedagogies. It is a space where students can reflect or practice a skill.

### What technologies best support these pedagogies?

Technologies facilitating Direct Instruction include microphones. Lectures can be videoed to reach a wider audience (for example, TED talks). Worked examples can be developed on computer software that can provide immediate feedback on responses.

No special technology is required for the implementation of Dialogic Instruction. Whilst technology is not required or essential in this model of pedagogy, the addition of online

collaborative communities could enable the process to continue post the formal lesson and also provide opportunities for students who lack the confidence to contribute to the verbal component of the lesson to express their views.

No special technology is required for hands on learning. However, an object to think with may well be an artefact and a piece of technology. Papert would suggest that a computer, or a computer-generated object, might be a useful object to think with – a tangible representation of an abstract idea.

### What curriculum best supports these pedagogies?

A curriculum that best supports these pedagogies would emphasise the philosophical aspects of mathematics - essentially contestable concepts that lie at the heart of the subject. What kinds of considerations should be brought to bear in justifying a mathematical truth? Emphasis should be given to students giving reasons for their mathematical ideas. The curriculum should facilitate student dialogue about topics such as the nature of numbers (are they real or invented?), why does mathematics apply to the world if it is known about a priori? What is the nature of a mathematical proof? Is it a mental operation or the product of dialogue? Has Euclidian Geometry been replaced by Riemannian Geometry? Is any line or stretch of time infinitely divisible? If so, how do we avoid the paradox of all lines therefore being the same length? Or the indeterminacy of a finite line having no last divisor? (Zeno's paradoxes).

Mickael Launay describes the Mandelbrot set as one of the most dazzling mathematical gems of the 20<sup>th</sup> century (Launay, 2018). The Mandelbrot set is a set of sequences generated by starting with 0 and in which every term is equal to the square of the previous term. Some of these sequences are unbounded – they fly off towards infinity - and others are bounded and include no number greater than 2. If for example we choose 2, the sequence would be: 0, 2, 6, 38, 1446... [ $2=0 \times 0 + 2$ ,  $6=2 \times 2 + 2$ ,  $38=6 \times 6 + 2$ ,  $1446=38 \times 38 + 2$ ...] On the other hand, if we choose -1 then the sequence would be 0, -1, 0, -1... 0 would be 0,0,0,0... The Mandelbrot set is the set of real numbers that generates a bounded sequence. If we map this by placing real numbers on the horizontal axis and the imaginary numbers on the vertical axis we get an intricate pattern of fractals. Fractals are prevalent patterns in nature, for example coastlines and fern leaves.

The Mandelbrot set, while not included in NSW Mathematics Syllabuses, could be used to teach complex numbers, imaginary numbers, fractal geometry, even infinity, since many of the bounded sequences are infinite without repetition. Good teaching may not involve going through the syllabus lock step, but rather developing rich tasks that involve using a range of different outcomes.

**'The Mandelbrot Set – The only video you need to see!'** (21 mins 18 secs) by TheBITK (2016) describes the incredible mathematical formula explaining fractals and geometry.

If the syllabus is seen as something that the teacher interprets rather than sequentially delivers, then the current mathematics syllabus is rich enough to support the range of



pedagogies necessary to cultivate deep content knowledge, such as inquiry based pedagogies.

Mathematics can be taught as a component of an integrated course in Science, Technology, Engineering and Mathematics (STEM) (Education Council, 2015). Teaching mathematics in the context of a STEM integrated course may encourage a greater breadth of knowledge in mathematics, and facilitate connections between mathematics, science and technology. On the other hand, it may not encourage greater depth in mathematical knowledge. Indeed, the mathematical component of a STEM course may be diluted, depending on whether it is taught by a mathematics teacher. An integrated STEM course may not be the best context for philosophical reflection on the big ideas that are at the heart of the discipline.

### How can deep content knowledge be best assessed?

To support the cultivation of deep content knowledge in mathematics, it would be helpful to place less emphasis on timed tests and allow students more time to think through mathematical/philosophical problems. More emphasis could be placed on mathematical reasoning in assessments. The SOLO model could be used here as a framework for assessing the quality of the reasons students provide.

Deep content knowledge in mathematics, is philosophical knowledge - the problematic and the controversial.

Deep content knowledge in mathematics can be cultivated by a stronger emphasis on dialogic instruction and hands on learning (the use of manipulatives to help render abstract mathematical concepts more tangible). This is because deep content knowledge in mathematics is philosophical and abstract. Mathematical reasoning, in common with all reasoning, is rooted in dialogue.

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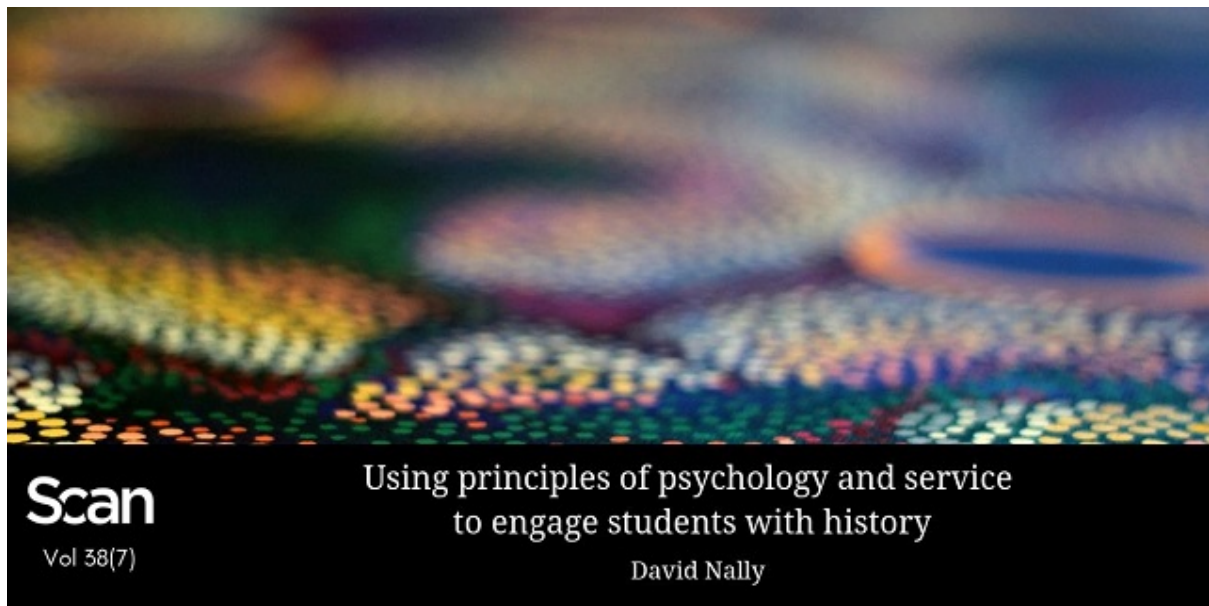
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## Research - Using principles of psychology and service to engage students with history

**David Nally** - Assistant Head of HSIE and is an Acting G&T Coordinator at Marist Sisters College, Woolwich

This article documents the evolution of how history was taught in a Stage 5 Mandatory History unit, 'Rights and Freedoms'. During 2016-2018, the pedagogy shifted from being focused on project based learning and using case studies of human rights, to allowing students the opportunity to understand how their own relationships, preferences and prejudices are somewhat influenced by principles of group psychology. This personal focus was used as the starting point for inquiry to connect with the anti-racism messages embedded in the unit of work. The impact of this latter approach allowed students to connect more effectively with the motives and impacts of activists who they studied, and develop deep knowledge about dynamics of exclusion and inclusion.

### Australians and democracy

During late 2009, a discussion paper commissioned by the Whitlam Institute found that voters between 18-29 were dissatisfied with Australian democracy, perceiving that formal political structures involved a culture of 'conflict, cynicism and distrust' (Arvanitakis & Marren, 2009). Later, in 2016, a survey was conducted by the Australian National University, which revealed that more than 40% of all respondents surveyed indicated they were 'not satisfied with democracy' (McAllister et al., 2016). The Lowy Institute recorded that in the age group between 18-29, only 39% felt that democracy was the most preferable form of government, with more than 50% selecting that the form of government 'doesn't matter' (Oliver, 2014). Notably, these findings are largely applicable to Australians between 18-29 who do not actively participate in formal political structures, such as by being a member of a political party. Yet in spite of this attitude, a study published in 2016 by Clive Hamilton concluded that participation in local community

groups has drastically increased in the last decade (Hamilton, 2016). Where all four studies agreed, was on the point that tangible and immediate results at a local level empowered the local community. In this sense, the positive impact that community groups had, ranging from environmentally focused ones, to community heritage groups, extended beyond their membership group to those who lived in the general area.

Similar to these sociological observations, there has been a groundswell in educational research which argues that student wellbeing issues can be partly resolved by empowering them in society. Since Conrad and Hedin's 1991 study, authors in the United States, such as Shelley Billig, have surveyed a wide variety of schools, with the finding that linking activities in school environments with ways to tangibly address social issues resulted in a higher completion rate of homework as well as an increased level of engagement in the classroom (Billig, 2000). The influence of such studies has begun to seep into Australia, where academics such as Dorothy Bottrell, Kerry Freebody and Susan Goodwin have described how 'service learning' can be a possible outlet for refocusing the energies of students experiencing mental issues, such as depression and anxiety, by providing a tangible way to contribute to positive change in their environment or other peoples' lives (Bottrell, Freebody & Goodwin, 2011). Their conclusion is that this form of student engagement functions most effectively where a school's purpose is envisioned as a community hub, rather than chiefly as an educational facility (Sanders, Allen-Jones & Abel, 2002). Moreover, this message must be taken on board by all staff and students to reach its optimum potential. This 'service' in an Australian context must also be directed by a coherent policy with tangible and projected benefits, which are clear to all participants from the outset.

### A case study in Rights and Freedoms

This case study began with an attempt to teach one of the core Stage 5 units (Rights and Freedoms) in a way that empowered both Indigenous (first nation) and non-Indigenous students, to see the value of civics education and apply it to the way they participated in democracy in the future. This approach was driven by an intent to create literacy activities that would embody how standards of assessment, such as NAPLAN, could enable students' academic performance as well as respond to the recent decrease of youth engagement with democratic processes, by showing that their participation in these processes can bring about equitable and positive social change.

To bring these aims to fruition, the unit structure focused on psychological theories that inspired activists to mobilise community groups with a highly localised political impact, so they were a part of a larger body of interest groups that, together, produced macro-level political change. The focus began with looking at the trends in how change in students' relationships took place within the classroom, which was discussed as a microcosm of how society works as a whole. Figure 1 demonstrates each process that is involved in a sustained effort in creating social and political change.

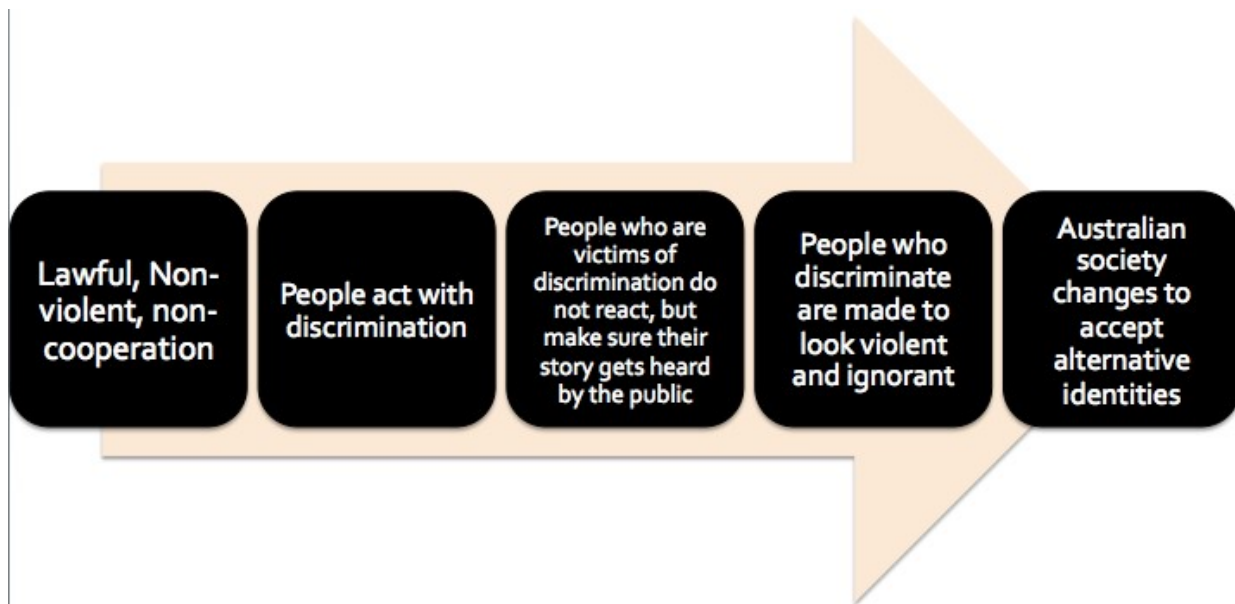


Figure 1: Stages of social change that are instigated by activist groups.

In a classroom context, these five steps were outlined as being applicable to acquaintances who enter a new school: they participate non-violently, encounter some degree of acceptance and rejection, before being accepted by either certain groups in a grade, or many. It was noted in the delivery in the classroom however, that such processes that can eventually foster inclusion must be balanced with efforts to reduce behaviours of social exclusion. Without this combined effort, the inclusion that any student experiences within their social groups would not eventuate. This approach therefore puts the student's own experiences as a starting point, for connecting macro-issues, such as forms of discrimination that are experienced by Australian Indigenous groups.

Such personalised experiences lie in comparison with Figure 1, which propose that political relationships have the capacity to evolve over time to focus on inclusion, similar to students' own experiences of building respect and trust, as well as their experiences of exclusion. Thus, Figure 1 can be used to show students that democratic processes are in a sense, driven by human relationships, since they empower many citizens who understand how to participate in them effectively. Therefore, the message students will likely take away is they must be familiar with the way activists of various backgrounds have worked successfully to advocate for themselves as well as for interest groups they represent. Furthermore, the figure can be used to set classroom behavioural expectations. It provides a clear end goal: that students stand to gain by building a micro-community based on restorative justice. In this environment the impact is to show the negative impacts of exclusionary behaviours (such as the racism that is at the forefront of 'Rights and Freedoms') which are exemplified by sense of privilege and hierarchy that developed amongst many of Australia's non-Indigenous peoples. A case in point is the Assimilation policies which were deployed against Indigenous peoples as well as any migrants who were not considered able to fit with an Anglocentric 'Australian' image that persisted into the late-1960s and early 1970s (Jordens, 1995). As a result, this starting point for teaching history makes the subject more personalised for all students, since it is not dependent on

cultural backgrounds or barriers, while also showing how students' wellbeing can benefit within the context of a school.

What this case study will attempt to show is that students are capable of producing tangible suggestions for how to address issues, that they see within their local context, by using the psychology underpinning racism as a starting point. The intended impact of this approach was to reduce the amount of negative discourse and increase the amount of solutions-focused thinking. In the teaching of the unit, 'Rights and Freedoms', the program was split into three parts, each of which featured short project-based learning activities:

Background and issues	Mobilisation and psychology	'Reconciliation'(?)
Account for the development of Indigenous and Civil Rights from 1788-1938.	How did activist strategies develop, based on knowledge about group psychology?	Evaluate recent 'attempts' by one human rights activist in advocating solutions to specific human rights issues (1965-present).

During 2016-2018, the approach worked to help students see their own friendship groups, families and communities as part of a broader Australian society. Initially, the students from these Year 10 cohorts filled in a survey with one question: 'How much are your actions influenced by your groups?' Before learning about psychological processes and activism, students' responses included shorter writing extracts, such as those listed in Sample 1 below. The following were taken from the 2018 cohort:

**Sample 1: Student responses to 'How much are your actions influenced by your groups?' in October, 2018.**

'My actions are influenced by the people that I surround myself around and learn from. Such as family and friends. When they teach you, you learn new life lessons and values which impact upon the way you think and the things you do. This is because you believe that what you are doing is right as you may have seen someone like a role model do it.'

'Actions of an individual vary depending on who they are with. Most of my actions do vary around who I am with, if I am with someone who I am close with I will usually act normal and more open. But if I am with someone who I know, but not too well I will act more quiet and shy.'

'My group doesn't influence my actions, however, sometimes I may follow them for reasons. An example could be my friends going to the library at lunch to work on assessments. I may not need to go to the library but I will still go with my group so I'm not left alone.'

These responses demonstrate that student motivations for behaviours include a desire to belong, to not be left out, a motivation for 'doing right', as well as fit in with the attitudes of those around them at any given time. They were selected due to their representing the sentiments of the class, as well as being from the low-B/high-C range of academic achievement. In terms of length, these responses were on-par with the students who scored an A in their previous assessments. The discriminating factor was that the degree to which the answer focused on their own experiences, with the A-level demonstrating slightly more abstract reasoning. Moreover, the samples ranged from those students who did not watch or read news articles, to those who were able to demonstrate a knowledge of current events.

After these responses were gathered, students watched the 1985 CBS recording of Jane Eliot's 'A Class Divided', which was, in turn, based on a 1963 thought experiment that was designed to combat racism. The purpose of this viewing was to demonstrate how effective group psychology can be at shaping perspectives, particularly with regard to how privileges and forms of hierarchical control directed forms of discrimination even amongst students who were eight-nine years old. In the post-viewing discussion, there was a focus on how Eliot's experiment demonstrated that discriminatory behaviours became more prevalent in her pupils when there were privileges for students who did wear collars and a clear depreciation of self-worth in those who did not.

In the classes following this survey, students were encouraged to reflect how each activist group they studied in 'Rights and Freedoms' took cues from researchers of group psychology, which mainly focused on psychologists contemporary with the 'Rights and Freedoms' time period, such as B.F. Skinner and Mary Ainsworth, to construct thought experiments to show the impact of perceptions on race. This programming choice was made, due to the journalism, sociology and political science degrees that were studied by participants in the Australian Freedom Rides likely influencing their choices in activism (Foley, 2010). In practice, although it was highlighted to students that these behaviouralist theories had largely been discredited, these theories were used to understand the planning and aims of the activists involved in advocating for Indigenous rights in Australia. These links were made via reference to the explicit mentions in the Student Action for Aborigines (SAFA) Newsletter, 'Talkabout', to their drawing inspiration from Martin Luther King's publications and activism, especially during 1964 in the lead up to the Freedom Ride (Australian Institute of Aboriginal and Torres Strait Islander Studies, 2015).

This triangulation between civic action, anti-racism protest and psychology was then mapped to historical events, such as SAFA's now famous entry to Moree and Kempsey swimming pools in 1965, with the intention of understanding how activists were challenging contemporaneous social and cultural norms in Australia. The aims of this action (and others like it) were to challenge social conformity, compliance with laws that promoted inequality and the entrenched segregation in these towns (Hawley, Hewett & Monaghan, 2018). Within this context, students were encouraged to frame political action in terms of how they promoted awareness of problems in terms of how impacts were experienced by broader sections of Australian society, so that solutions might eventually be sought by those in power. This strategy was particularly effective at making Indigenous

rights relevant to the students, especially because there was such a low Indigenous population amongst the cohort.



After this engagement with the psychological theories that influenced the activists they studied, these students' responses shifted to those that are listed in Sample 2, below:

**Sample 2: Student responses to 'How much are your actions influenced by your groups?' in early November, 2018.**

'Indefinitely, our actions are influenced by others and groups around us. Research has shown that this is due to our limbic system (our emotional section of the brain), overtakes or over runs our neocortex (our higher order thinking) section of the brain. As a result individuals can no longer think "logically" and consequently make decisions based on what we think would make us feel better emotionally. This can be proven in many psychology experiments such as the Asch Conformity Study conducted by Dr Solomon Asch as it demonstrated that people do conform with others or groups around them even if they know or believe in something else because we want to "fit in" to make us emotionally feel good.'

'The works of Mary Ainsworth show that different people react to the same situation depending on what they personally feel. By being a part of the group your actions are influenced by your connection with the others in the group. For if you are excluded or parted from the group, Ainsworth's experiment shows that there are three main responses to this type of situation. A person may either respond in the way of being completely okay with the situation, be distressed and emotional about the situation or a mixture of both where the person is okay about it however they are also upset at the same time. This has been explained to be the reason due to the relation between the group. Therefore, Mary Ainsworth's example shows that it is the connection between a group that influences the response to a situation.'



'I found out that many different animals can be tested on like in this case rats. I also learnt that animals by repeating and acknowledging what they have done that rewards them it will help them constantly do that action in the future. Skinner was heavily influenced by the work of John B. Watson as well as early behaviourist pioneers Ivan Pavlov and Edward Thorndike which helped him come up with the ideas for his experiments. This can be shown through the similarities between all of their works and experiments and how they all have the same but different ways of working with the same idea. Skinner's experiments help us see that group psychology helps with individuals learning faster and continuing that action in the future.'

The responses that students provided demonstrate a willingness to engage with psychological theories as a way of understanding contemporary 1960s Australia. In turn, the students related these frameworks, especially the Asch paradigm, to understand their own ways of thinking. As the responses of two out of three responses demonstrate (by the presence of 'us' in the first response and 'I also learnt' in the third response) students were also more likely to personalise the concepts they learned about from the 'Rights and Freedoms' case study. This foundation provided the means for students to comprehend several impacts of Indigenous rights movements in Australia:

- Refining civil rights to be more inclusive created a form of politics better able to represent the interests of the whole country, than previously.
- Contributions of political activists extended beyond their intended advocacy: Indigenous protesters' achievements preceded other developments in Australian history, such as the gradual erosion of several pieces of legislation now known as the 'White Australia Policy'.
- The treatment of Indigenous Australians by non-Indigenous Australians can be better understood through scientific theories: many schools in the teaching of 'Rights and Freedoms' refer to eugenics as the genesis of assimilation policies that were infamously adopted by Protection Boards and portrayed in Phillip Noyce's 2002 film, 'Rabbit Proof Fence'. By making more consistent reference to scientific theories from other periods of time (such as the 1960s), students will be able to see a broader range of continuities in history and therefore understand the degree to which racism was embedded in the social context that this activism was trying to rectify. Additionally, over the long term, scientific investigations and human rights concerns worked together in Australian history to shape notions of wellbeing and how to establish social cohesion on this content.
- Moreover, it helped students understand that although events such as protests or petitions are begun by a minority seeking to rectify their political exclusion and denial of rights, the events themselves are thought experiments that can prompt the middle-ground of society into reconsidering their actions and opinions. Additionally, to be effective, these thought experiments must be part of a concerted, sustained series of actions that target specific issues that are agreed upon by several different groups, rather than broader, big picture concerns (Professor Meagan Davis, quoted in Snow, 2019).
- That being said, one limitation in these responses is they do not address the issue of racism. To further refine the pre/post-question there would need to be more focus on how group dynamics influence forms of prejudice. In future, an additional

question could be posed, such as ‘What could change people with racist attitudes to being more engaged with different cultures?’ This focus on engagement would be intended to inquire into what attitudes towards this form of prejudice exist (which are examined in the unit of work) as well as the extent to which students are engaged (or disengaged) with cultures other than their own.

### (Some) conclusions and suggested future directions

This case study was predicated on attempting to help students understand the concerns of people who were not part of their social, cultural or political networks. Another aim was to allow students to understand their own behaviours and attitudes, about inclusion and exclusion, to develop their understanding of how school communities work.

The samples above show that as a result of framing history in psychological theories and explicit teaching about how civic action has been successful in Australia, students developed a more comprehensive understanding of how their attitudes form and what informs their behaviours. Moreover, it goes some way to show how young people will find democratic processes engaging, once they see such political ideas embedded in their own behaviours.

Two critiques that could be levelled at this form of teaching ‘Rights and Freedoms’, is the relevance to the syllabus, as well as its dependency on the maturity level of students in interrogating behavioural theories. Yet these theories always underpin the actions of civil rights movements: the Freedom Rides in the USA, as well as those in Australia, were comprised of journalism, psychology and social studies students. Disregarding the role of psychology in promoting human rights would therefore miss an important component of understanding the motives of human rights advocates that students’ study, and these theories provide a clear starting point for students to evaluate the success of civil and human rights movements that feature in Stage 5 history. Additionally, Jane Eliot’s documentary has been pivotal in the USA as part of a longitudinal study in how schools can promote anti-racist and tolerant attitudes. These student activists who are studied in Rights and Freedoms therefore function as role models for how students can visibly contribute to their local communities, rather than being unable to make any form of difference to issues they hear so much about in other subjects, such as climate change, pollution and forms of inequalities that are studied in the geography syllabus in New South Wales.

The implications of this case study focus on how learning experiences can be made more authentic for students. In this method of teaching Stage 5 history, the authenticity was established by connecting historical circumstances to psychological theories that accounted for human behaviour, as well as how both circumstances and theories were used by Indigenous and human rights activists to coordinate responses to social and political issues in Australia.

These considerations have shown to positively impact student learning and engagement. In future teaching, they could include moving between three categories to show the relevance of the anti-racism focus of ‘Rights and Freedoms’ from a micro to macro scale:

- Linking tasks to contemporary affairs/immediate relevance: At the time of writing, the appointment of Ken Wyatt being as the first Indigenous Minister of Indigenous Affairs, while Linda Burney has been appointed as Shadow Minister of Indigenous Affairs. That this arrangement, of First Australians having a say in the rights and respect shown to kinship groups, has not happened sooner, is a point of discussion in itself.
- Linking tasks to ideas that have a personal-context relevance: Theories that explain local concerns can be introduced, such as the behaviouralist psychology in this case study. Alternatively, theories that are more appropriate for the unit could be adapted, such as how military strategy organised education and training, for Stage 5's other compulsory unit, 'Australians at War'.
- Linking tasks to macro-context relevance: A focus on Indigenous peoples worldwide, since there is the consistency in most developed nations that their Indigenous peoples have disproportionately higher incarceration and crime rates than other segments of the population. This statistic is applicable to Australian Indigenous peoples (especially in the Northern Territory and parts of Western Australia) as well as the Sami in Sweden. Other cases, such as Indigenous Greenlanders, who currently hold the highest proportion of teenage suicide, globally. Further exploration could be conducted through the LandMark map of Indigenous peoples.

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## Teaching students to be critical online learners

**Fiona Sharman** - Fiona Sharman, secondary teacher librarian at Roseville College

In a 'post-truth' world, how well equipped are our students at distinguishing between genuine news reporting, 'fake news' and advertising content?

In 2016, on the back of Donald Trump's election as President of the United States of America, it seemed increasingly important that our students learn not only how to navigate the extreme volume of online material, but also to interpret real news content from a burgeoning volume of fake news. In 2016, the Oxford Dictionary 'Word of the Year' was 'post-truth'. I remember asking myself the question: how would I cope with information, in this new context, if I were only 12 or 13 years old?

When I read the article, '[Evaluating information: The cornerstone of civic online reasoning](#)' by the Stanford History Education Group (SHEG, 2016), it provided a fantastic template for how to conduct a study that would measure students' online evaluation of information skills. Specifically, the study targeted students' capacity to accurately identify and evaluate online news and advertising content from a range of sources, including online news sites, social media posts and online image-sharing sites.

The SHEG study found that overall young people's ability to reason about information on the Internet can be summed up in one word: bleak (SHEG, 2016, p4).

### Student performance

Would our Roseville students perform differently to the SHEG cohort?

This was the question that we wanted to explore, so the library conducted a Roseville-based study to measure students in this area. Where SHEG had tested middle school, upper secondary and junior college students, we chose to focus on Year 8 students so that we could apply the findings to our Year 7 Information Literacy program and then test those students in Year 8 to assess the impact of our teaching of these skills. The only

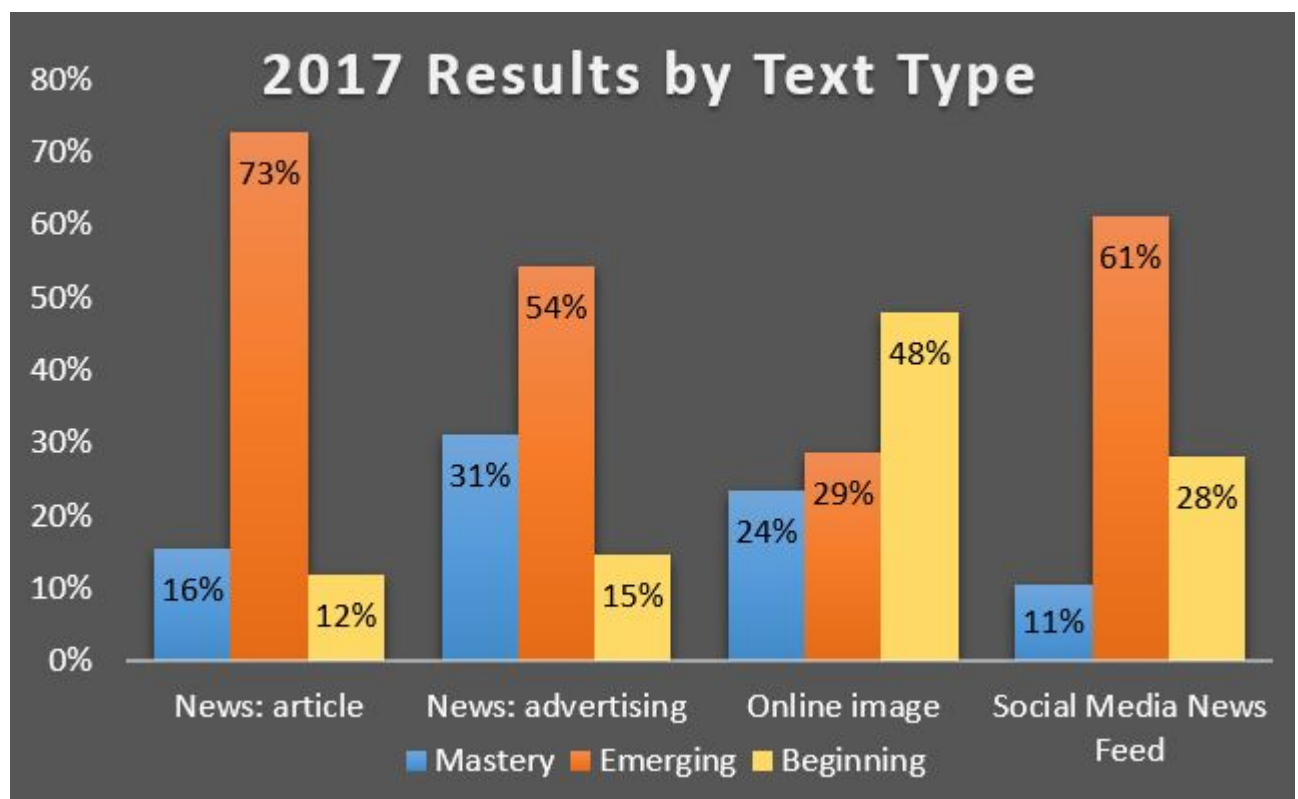
modification we made to the SHEG study was that we substituted some of the texts with Australian examples.

### How did we assess students' capacity to evaluate online news information?

The marking code that we used reflected a level of achievement ranging from 1-3 and mirrored the SHEG study. These coded numbers represented the following levels of student achievement: beginning (1), emerging (2) or mastery level (3). Essentially, this means:

- Beginning = Incorrect or incoherent answer
- Emerging = Correct answer with unclear or absent reasoning
- Mastery = Correct answer with clear and coherent reasoning

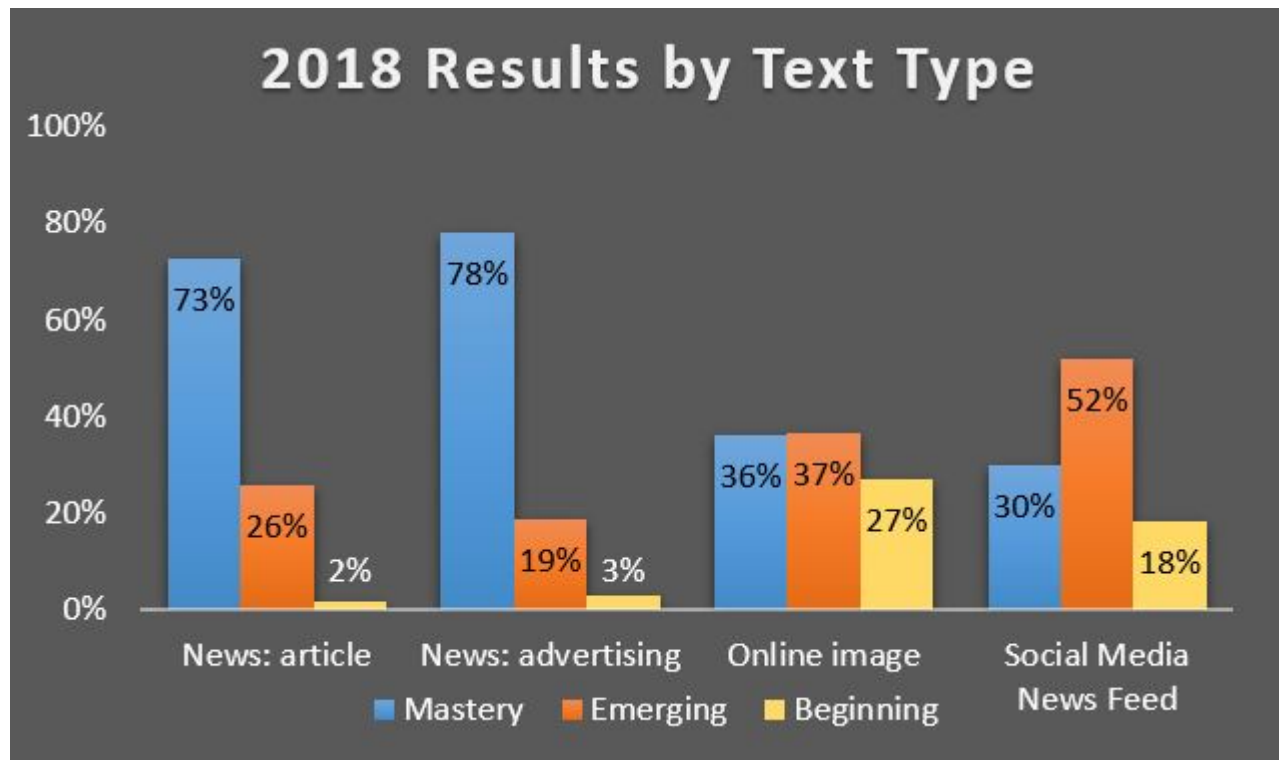
In 2017, we tested 120 Year 8 students who had not been directly taught online evaluation of information skills. We discovered that there was indeed a need to teach students 'explicitly' how to evaluate online news and advertising content. While students were generally good at identifying texts accurately, their ability to use reasoning to justify their decisions was very limited. More detail can be found in the Roseville College Year 8 2017 final report, [Online evaluation of information task](#) (Roseville College, 2017).



### Revising our Year 7 Information Literacy program

The 2017 study's results directly informed a short unit of work on 'Fake News' (3-4 x 50 min lessons) that was delivered to Year 7 in late 2017. When we tested this cohort in 2018, we saw a strong improvement in the number of students possessing a

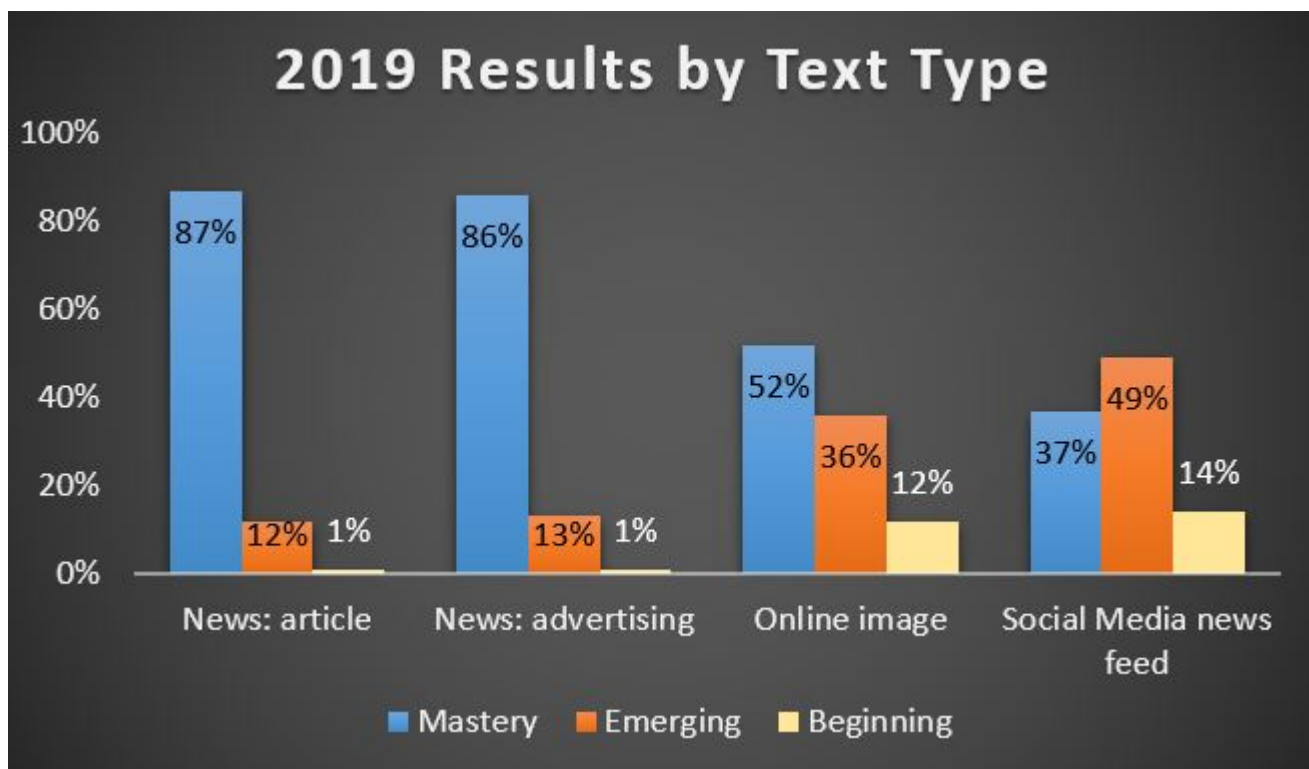
‘mastery’ level of analysis, especially in the areas that we spent the most time teaching: news articles and ‘native’ advertising. More detail can be found in the Roseville College Year 8 2018 final report, [Online evaluation of information task](#). (Roseville College, 2018).



### Creating a 3 year action research cycle

The Roseville study evolved organically to become a 3 year action-research project run by the library. Our main purposes were to prioritise online evaluation skills as part of our teaching of information literacy and to measure the effectiveness of our lessons on these skills. What we found was an overwhelmingly positive response from students. The study’s results clearly reinforced that if you teach students ‘directly’ how to engage in critical thinking about online texts, then their capacity to accurately identify and evaluate texts, using specific textual evidence to support their beliefs, will improve dramatically. That is, more of them will develop a ‘mastery’ level of understanding.

In 2019, the Year 8 cohort had experienced a greater focus on learning how to analyse online images and social media posts than the 2018 cohort. Due to timing restraints, these text types had not been given the same depth in the previous year and the 2018 results revealed them to be areas for further improvement. The 2019 results showed clearly that where we focused our teaching (the news article and advertising text types), was where the dramatic improvement in skills was most evident. More detail can be found in the Roseville College Year 8 2019 final report, [Online evaluation of information task](#) (Roseville College, 2019).



### Moving on from the study

A 'Fake News' unit has continued to play an integral role within our Year 7 Information Literacy program. Student feedback reflects that they enjoy learning about and critiquing online news content, and we feel strongly about the value of these skills. ACARA's **Critical and Creative Thinking Learning continuum** supports that students in Year 8 should be able to demonstrate that they can 'critically analyse information and evidence according to criteria such as validity and relevance' (ACARA, n.d.). We believe this includes the use of online news content to deepen their understanding of a topic or event.

Our study affirmed that to improve students' capacity to engage with online news information in a critical way they need 'direct' instruction and modelling of how to do this.

The results also support that students retain this explicit instruction and continue to apply it over time.

### Teaching online evaluation of information skills

Some ideas:

- Deconstruct and construct social media texts, whereby students evaluate news and information for integrity and perspective on a key topic.
- Compare and contrast social media representations of a key topic, thus exploring the complexity of online news content.
- Measure social media's involvement in a key topic/news story in order to influence the spread of news and certain perspectives.



- Measure social media’s involvement in terms of human versus bot generated posts (using tools such as: **Hoaxy**, **InVid**, **Botometer**).
- Reflect on the social/political/economic impacts of social media posts in shaping the broader society.

Hoaxy, InVid and Botometer are free software tools that support students in gaining a greater understanding of the corruptibility of online texts; in turn, teaching with them reinforces student understanding of the need to practice greater scrutiny of online content.

### Underpinned by democratic values

Teaching students ‘how’ to be critical online learners supports their potential to be critical life-long learners and active, well-informed citizens beyond their schooling. Libraries have a valuable role to play in this area and teacher librarians can work towards embedding these skills in student learning tasks.

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