Review to **Achieve Educational Excellence** in Australian Schools

Public submission made to the Review to Achieve Educational Excellence in Australian Schools

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Summary

Cognitive science points to the essential nature of knowledge as a foundation for developing any of the higher order abilities such as critical thinking that all of us rightly wish students to develop. A critical example of such an ability is reading comprehension which is dependent upon students gaining a wide knowledge of the world. If schools don't provide this knowledge, then the gap between students from privileged and disadvantaged background widens as the former gain this knowledge from home. Sadly, there are many misconceptions propagated in education that downplay the value of knowledge acquisition. The Australian Curriculum has been affected by these misconceptions and is not knowledge rich, representing a missed opportunity. In addition, the most popular teaching methods in Australia – inquiry-based learning, project-based learning, problem-based learning and other variations – employ implicit approaches. We have a wealth of evidence that, for novice learners such as schoolchildren learning new concepts, implicit approaches are far less effective that explicit teaching. This evidence may be triangulated across a surprisingly diverse body of evidence. Unfortunately, many in the educational community are opposed to explicit approaches for essentially political reasons or because they wrongly believe them to be demotivating. If we are going to invest in effective interventions, then we will need to tackle this opposition. This won't be helped by taking a simplistic approach to the research evidence.

Main submission

Submission to the Review to Achieve Educational Excellence

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What should education success for Australian students and schools look like?

We currently have a poor understanding of what we are trying to achieve. The Australian Curriculum is largely 'skills based' in that the content is thin and priority is instead placed on developing supposed 'skills' such as the ability to 'pose and respond to questions'. These do not fit the common understanding of the term 'skill' in that they are not directly trainable, apart from a few general heuristics, and they do not continue to improve through deliberate practice.

Overlaying each of the content areas are supposedly general capabilities such as critical thinking. Critical thinking is clearly important and we can recognise it as a feature of expertise in a particular area. However, there is no short-cut to achieving it.

Cognitive science overwhelmingly demonstrates that any higher order abilities such as critical thinking require a firm grounding in relevant content knowledge. Daniel T. Willingham, a psychologist at the University of Virginia, suggests that small children are capable of thinking critically about content that they are familiar with and trained scientists may fail to think critically about content they are unfamiliar with (Willingham, 2007). Willingham poses the question, "Can critical thinking actually be taught?" before answering, "Decades of cognitive research point to a disappointing answer: not really. People who have sought to teach critical thinking have assumed that it is a skill, like riding a bicycle, and that, like other skills, once you learn it, you can apply it in any situation. Research from cognitive science shows that thinking is not that sort of skill. The processes of thinking are intertwined with the content of thought (that is, domain knowledge)."

The new Health and Social Studies (HASS) Curriculum is a good example of the skills approach and seems to be based upon John Dewey's 'expanding horizons' model. This starts with the child's immediate horizons and works outwards. Instead of learning about Ancient Rome, for example, the content of Year 1 is for students to develop an understanding of, "Differences in family structures and roles today, and how these have changed or remained the same over time." This is quite vague. Alongside this supposed content, students learn 'skills' such as to, "Compare objects from the past with those from the present"; abilities that cognitive science suggests will be entirely knowledge dependent. It is notable that the 'expanding horizons' model was being criticised as demotivating and theoretically misguided by Kieran Egan as far back as 1980 and yet it is a recent introduction to our curriculum (Egan, 1980).

Reading comprehension is an example of a critical ability that is highly dependent upon relevant knowledge. In early reading instruction, comprehension is dependent upon the ability to decode written words. The content of early readers is usually highly familiar to the child and so once they decode the word, they are likely to understand the context. However, as reading instruction progresses, students are presented with more academic texts that may not be set in familiar contexts. At this point, knowledge becomes critical. This is not just about vocabulary, although vocabulary is a good proxy for knowledge. Writers tend to miss out information and so readers need to be able to fill in those gaps and build a picture of what is being discussed. This is responsible for the 'fourth grade slump' where children from less privileged backgrounds start to fall away in reading performance compared to their more privileged peers who are likely to have been exposed to more knowledge and vocabulary at home (Hirsch, 2003).

The knowledge-poor Australian Curriculum therefore represents a huge missed opportunity.

It is notable that at the timing of writing, the Australian government is considering introducing a phonics check similar to the one introduced in England in 2011. Yet England has also strengthened the content of its national curriculum and this does not seem to be under discussion here. We may find that any gains children make in decoding completely wash out over time due to the degraded content that they are exposed to.

It is fashionable to dismiss the need for content in the curriculum by suggesting that everything can be looked up on the internet. Again, this is misguided and at odds with cognitive science. Put simply, if you don't know something then you don't know what to look up. Cognitive load theory, developed by Professor John Sweller of the University of New South Wales and others, posits a model of the mind consisting of a severely limited working memory, where problem-solving, creative processes and so on take place, and an effectively limitless long term memory. Crucially, the limits of working memory completely fall away when dealing with knowledge retrieved from long term memory (Sweller et. al 2011). This knowledge is literally the content of thought; it's what we think with. You can't think with it if it is sitting somewhere out there on the internet.

Unfortunately, this is not well understood. Curriculum authorities in the states as well as the Australian Curriculum tend to prioritise the application of knowledge without focusing on the acquisition of this knowledge in the first place. We need to acknowledge that one reason for this is political. For instance, specifying set texts in an English curriculum is fraught and certain to provoke legitimate democratic debate. To avoid this, it is expedient to instead focus on nebulous skills.

What can we do to improve and how can we support ongoing improvement over time?

If schools are simply given new funding, then it is probable that they will spend it programmes that will degrade performance over time.

There is near overwhelming evidence that for novices learning new content, explicit approaches to teaching this content are superior to implicit ones (Kirschner et. al., 2006). Initially, these findings came from research into teacher expertise and the behaviours of the most effective teachers (see e.g. Yates, 2005). This was then supported by a range of attempts to teach ill-structured tasks such as writing (Rosenshine, 2009). We also have a more recent body of experimental work in cognitive science demonstrating the superiority of explicit methods (Paas et. al., 2003). It is important to note that these findings are not restricted to the rote recall of discrete facts, but that they extend to any academic concept or skill that has been tested, including those that tend to be considered as higher level.

Unfortunately, there is also near overwhelming consensus in the education sector that implicit approaches are superior to explicit ones. Implicit methods involve students in finding things out for themselves to some degree and come under a variety of labels: constructivist teaching, problem-based learning, inquiry-based learning, project-based learning, maker-spaces and many more. The critical difference between explicit and implicit approaches is whether new material is fully explained in a structured fashion when students first encounter it. Both will move to more independent tasks as students gain mastery.

The predominance of implicit approaches may be illustrated in a number of ways. For instance, the 2016 Australian Association for Research in Education (AARE) conference programme, which no longer seems to be available online, contained no references to explicit teaching or its common synonyms such as 'direct instruction'. It did, however, reference inquiry-based approaches. As I am writing this, the Australian Council for Educational Research has published its daily article aimed at teachers in its online "Teacher" magazine. It is an interview with Professor Simone Reinhold about inquiry-based learning. The effectiveness of this approach is never questioned (Earp, 2017). Many teachers reading the article will assume this is an example of good practice supported by the research evidence.

This "Teacher" article also refers to 'differentiation', the process of varying pace, content and activities to meet the perceived needs of students in a class. This is required by the Australian Professional Standards for Teacher (AITSL, 2011) and is accepted as good practice in education. Differentiation sounds highly plausible but there are risks to varying teaching based upon teachers' perceptions. What if these perceptions are incorrect? We know that teachers, just like everybody else, suffer from cognitive biases and these can bias teacher assessments against disadvantaged groups (Burgess & Greaves, 2013). Some forms of differentiation advocate the substitution of tasks; if a student struggles with writing then they may be allowed to complete a task by tape recording their voice. There are relatively few studies that have investigated differentiation in isolation but, of those that have, the evidence of effectiveness is missing (e.g. Brighton et. al., 2005; Capp, 2017).

Recent years have provided evidence on teaching methods from the Programme for International Student Assessment (PISA). An analysis of PISA 2010 mathematics results showed that 'teacher-directed' instruction was positively related to maths performance, although this relationship became negative for very high levels of teacher-directed instruction. The same analysis found an overwhelmingly negative relationship between 'student-oriented' instruction and maths performance (Caro et. al., 2016). Student-oriented instruction was defined as the extent to which the teacher gives different work to students who have difficulties learning and/or to those who can advance faster; the teacher assigns projects that require at least one week to complete; the teacher has students work in small groups to come up with joint solutions to a problem or task; and the teacher asks students to help plan classroom activities or topics. A student orientation is therefore an implicit approach that incorporates differentiation. Oddly, the Organisation for Economic Cooperation and Development (OECD) define good teaching to be 'student-oriented', despite this (Echazarra et. al., 2007).

For the 2015 round of testing, PISA focused on science teaching. They found that teacher-directed instruction was associated with higher achievement in science. This time, it was contrasted with 'enquiry-based' teaching which, in the context of science, includes a focus on practical activities. Enquiry-based teaching, an implicit approach, was associated with lower achievement (OECD, 2016).

McKinsey consulting have analysed the 2016 PISA data and state, "In all five regions, when teachers took the lead, scores were generally higher, and the more inquiry-based learning, the lower the scores… what works best is when the two styles work together—specifically, with teacher-directed instruction in most or almost all classes, and inquiry-based learning in some." (Mourshed et. al., 2017). This fits with teachers explicitly teaching new content to novices and releasing control as students gain expertise i.e. the explicit teaching model (Rosenshine, 2012).

Some implicit teaching methods have become the subject of rigorous randomised controlled trials with predictable results. Project-based learning is popular in Australia, with some schools using funding to send teachers to training sessions. The main idea is that students will learn content and a range of higher order skills through completing a project. This is not a new notion and has been written about by educationalists since at least 1918 (Kilpatrick, 1918). A report from the U.K. found little evidence for the approach in a review of the literature, and when it was tested in a number of schools in a randomised controlled trial, there was a potentially negative effect. However, the security of this finding was weak because so many schools chose to drop out of the project-based learning intervention (Menzies et. al., 2016).

Are there barriers to implementing these improvements?

Strangely, the preference for implicit teaching methods persists in the education community, despite the wealth of evidence. There are a number of reasons for this. Foremost is perhaps an ideological opposition to explicit teaching. Explicit teaching involves the teacher selecting material and deciding on tasks for students to complete. Popular educational theories prefer students to make choices themselves. Explicit teaching sets the teacher up as a figure of authority. If we conflate teaching methods with political ideas then explicit teaching can be framed as oppressive (e.g. Freire, 1970). Such reasoning is a strong current in the sociological education research.

Another driving force is the perception that implicit teaching approaches are more motivating than explicit approaches. It is unclear whether this is true. It is conceivable that students may be motivated by the opportunity to conduct their own experiment, but a teacher telling a story or explaining an interesting phenomenon – an explicit approach – is also likely to be motivating. The problem with arguing on the basis of motivation is that it confuses a passing or ‘situational’ interest with a long-term, ‘personal’ interest in a subject. Personal interest may well be influenced by situational interest but we also know that it is strongly influenced by self-efficacy; the perception of a student that they can be successful in their efforts (Zimmerman, 2000). This is, in turn, influenced by previous feelings of success and progress. One recent study in Canada found that achievement in early mathematics predicted later motivation but that motivation did not predict later achievement (Garon-Carrier et. al., 2016). If we want to foster motivation, we should certainly aim to avoid boring or staid delivery but, most of all, we should prioritise approaches that lead to the most learning. This takes us back, inevitably, to explicit teaching.

Nonetheless, countless government and social enterprise initiatives to encourage students to study science, technology, engineering and mathematics (STEM) are predicated on the idea of generating situational interest through science demonstrations, plays, games, experiments, talks given by professionals or other activities. These are bound to fail unless they are followed by quality, long-term teaching.

Finally, we must be careful to avoid naïve interpretations of evidence. Some sources use measures of effect size to rank and categorise a whole range of strikingly diverse interventions that have been tested in a wide variety of ways (e.g. Hattie, 2009; Evidence for Learning, 2017). This is a problem because effect sizes vary due to the age of the subjects, the design of the trial and a number of other factors (Wiliam, 2016). We should therefore only compare effect sizes from similar kinds of studies. For example, the Educational Endowment Foundation in the U.K. has started to run large-scale randomised controlled trials of various interventions. These are usually compared to a control condition that does not have the intervention. Given that it is impossible to 'blind' such trials in the way that trials of pharmaceuticals are able to use a placebo, it is likely that we will generate an effect due to expectations alone (a placebo effect). We should expect a larger effect size from a study such as this than from a study that compares two viable interventions. Simplistic reference to such trials or to tables of effect sizes may therefore be misleading and may damage the call for an evidence-based approach.

References

Australian Institute for Teaching and School Leadership (AITSL), 2011. Teacher Standards . [online] Available at: https://www.aitsl.edu.au/teach/standards

Brighton, C.M., Hertberg, H.L., Moon, T.R., Tomlinson, C.A. and Callahan, C.M. (2005). The Feasibility of High-end Learning in a Diverse Middle School. National Research Center on the Gifted and Talented.

Burgess, S., & Greaves, E. (2013). Test scores, subjective assessment, and stereotyping of ethnic minorities. Journal of Labor Economics, 31(3), 535-576.

Capp, M. J. (2017). The effectiveness of universal design for learning: a meta-analysis of literature between 2013 and 2016. International Journal of Inclusive Education, 1-17.

Caro, D.H., Lenkeit, J. and Kyriakides, L. (2016). Teaching strategies and differential effectiveness across learning contexts: Evidence from PISA 2012. Studies in Educational Evaluation, 49, pp.30-41.

Evidence for Learning (2017). Teaching and Learning Toolkit. Evidenceforlearning.org.au. Retrieved 5 October 2017, from http://evidenceforlearning.org.au/the-toolkit/

Earp, J., (2017) Teaching Methods: Inquiry based learning with Professor Simone Reinhold. Australian Council for Educational Research - ACER. Retrieved 5 October 2017, from https://www.teachermagazine.com.au/articles/teaching-methods-inquiry-based-learning-with-professor-simone-reinhold

Echazarra, A., Salinas, D., Méndez, I., Denis, V., and Rech, G. (2016). How teachers teach and students learn: Successful strategies for school. OECD Education Working Papers, No. 130, OECD Publishing, Paris.

Egan, K. (1980). John Dewey and the social studies curriculum. Theory & Research in Social Education, 8(2), 37-55.

Freire, P. (1970). Pedagogy of the Oppressed, trans. Myra Bergman Ramos. New York: Continuum, 65-80.

Garon-Carrier, G., Boivin, M., Guay, F., Kovas, Y., Dionne, G., Lemelin, J. P., ... & Tremblay, R. E. (2016). Intrinsic motivation and achievement in mathematics in elementary school: A longitudinal investigation of their association. Child development, 87(1), 165-175.

Hattie, J. A. (2009). Visible learning: A synthesis of 800+ meta-analyses on achievement. Abingdon: Routledge.

Hirsch, E. D. (2003). Reading comprehension requires knowledge—of words and the world. American Educator, 27(1), 10-13.

Kilpatrick, W. H. (1918). The project method: The use of the purposeful act in the educative process (No. 3). Teachers college, Columbia university.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. Educational psychologist, 41(2), 75-86.

Menzies, V., Hewitt, C., Kokotsaki, D., Collyer, C. and Wiggins, A. (2016). Project Based Learning: evaluation report and executive summary.

Mourshed, M., Krawitz, M., & Dorn, D. (2017). How to improve student educational outcomes: New insights from data analytics McKinsey & Company. Retrieved 5 October 2017, from https://www.mckinsey.com/industries/social-sector/our-insights/how-to-improve-student-educational-outcomes-new-insights-from-data-analytics

OECD (2016). PISA 2015 Results (Volume II): Policies and Practices for Successful Schools, OECD Publishing, Paris.

Paas, F., Renkl, A., & Sweller, J. (2003). Cognitive load theory and instructional design: Recent developments. Educational psychologist, 38(1), 1-4.

Rosenshine, B. (2009). The empirical support for direct instruction. Constructivist Instruction: Success or Failure?, (2005), 201–220. https://doi.org/10.1037/0003-066X.59.1.14

Rosenshine, B. (2012). Principles of Instruction: Research-Based Strategies That All Teachers Should Know. American educator, 36(1), 12.

Sweller, J., Ayres, P., & Kalyuga, S. (2011). Cognitive load theory (Vol. 1). Springer Science & Business Media.

Wiliam, D. (2016). Leadership for teacher learning. Hawker Brownlow Education

Willingham, D. T. (2007). Critical thinking. American Educator, 31(3), 8-19.

Yates, G. C. (2005). “How Obvious”: Personal reflections on the database of educational psychology and effective teaching research. Educational psychology, 25(6), 681-700.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. Contemporary educational psychology, 25(1), 82-91.