To: Professor Barney Dalgarno

Chair, Expert Panel

Inquiry into Literacy and Numeracy in ACT Public Schools

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Dear Professor Dalgarno,

Submission to the Inquiry into Literacy and Numeracy in ACT Public Schools

The Centre for Independent Studies (CIS) appreciates the opportunity to provide a submission to the ACT Inquiry into Literacy and Numeracy. We are writing to appraise the Panel of research that is relevant to this Inquiry, including in the area of mathematics and numeracy.

The CIS is a leading independent public policy think tank in Australia. It has been a strong advocate for free markets and limited government for more than 40 years. The CIS is independent and non-partisan in both its funding and research, does no commissioned research nor takes any government money to support its public policy work.

This submission does not directly seek to answer the 20 questions posted in the Consultation Paper (December 2023). However, the submission offers analysis and evidence on some matters the Panel has been asked to consider, per the Terms of Reference:

- to the appropriate extent of system-level support for teachers and schools in their teaching and learning work;
- whether and where mandates ought to apply; and
- which pedagogical approaches improve learning outcomes in literacy and numeracy.

Two streams of CIS research — on the science of learning and on evidence-based mathematics teaching more broadly — are therefore relevant. Both projects focus on instructional forms that have been demonstrated by evidence to advance the learning of all students (**Consultation Paper Q2**), but particularly disadvantaged learners (**Consultation Paper Q11**).

In *AP63 What is the science of learning?* the case is made on the basis of cognitive science and educational psychology for explicit instruction of a well-sequenced and knowledge-focused curriculum as the pedagogical approach most beneficial to all students. The paper notes in particular the risks to equity of student-driven inquiry learning as a foundation for instruction; arguing that while these approaches are beneficial to students aised in environments of high social, educational and cultural capital, they are detrimental to less-advantaged students. This work builds on an earlier publication by Dr Lorraine Hammond (*AP20 Confronting Indigenous educational disadvantage*) which notes the benefits of direct and explicit instruction for majority-Indigenous school communities in WA's Kimberley region.

In *[RR47 Implementing the science of learning: teacher experiences]*, school leaders and teachers participated in interviews and focus groups about their experiences implementing science of learning-aligned practices such as explicit teaching and the science of reading. Participants spoke of the sense of professional satisfaction they experienced from being able to see rapid and meaningful student learning growth after switching to these methods.

However, another clear thread in the study was the lack of formal support from school systems, initial teacher education and professional development opportunities which left teachers forced to rely on informal methods of building up their knowledge and skills. Based on these findings, the report makes the case for a combination of top-down and bottom-up approaches to scale good practice. Top-down measures include stronger system-level messaging on the importance of the science of learning, the removal of contradictory advice and provision of greater support in curriculum, assessment, and resources. Bottom-up measures include identifying and enabling successful schools to share knowledge and practice, so others can learn from their success. These findings are relevant to **Consultation Paper Q4**.

The above papers contain insights relevant to all curriculum areas. Other CIS work focuses on mathematics and numeracy practices that align with the principles of explicit teaching. In the case of maths, there has been considerable research globally to elucidate individual and contextual factors which reliably contribute to mathematics achievement; the ACT is far from alone in grappling with the issue of equity and cycles of disadvantage in education.

In a recent systematic analysis of contributing factors to PISA mathematics results, Wang and colleagues (Wang, Perry, Malpique and Ide, 2023) identified socioeconomic status as positively associated with mathematics achievement. However, we draw the Panel's attention specifically to the authors' finding that student-centred instruction was consistently negatively associated with student achievement in mathematics.

In addition, there has been much research into the academic value of exposing students to rich problem-solving tasks to increase engagement in school mathematics. The Australian Curriculum contains in its architecture the Proficiency strands of Problem-Solving and Reasoning to underscore the importance of students' involvement in such tasks. However, the importance of having a rich, connected body of mathematical knowledge from which to draw when problem-solving and reasoning — built up through learning episodes focused on Conceptual Understanding and Fluency — has been overshadowed in practice.

The Instructional Hierarchy, a conceptual model that bears a surface resemblance to the Proficiency Strands but emphasises the *hierarchical* nature of development of competence in acquisition, fluency, generalisation and adaptation of any new skills, has been used as a framework to demonstrate students benefit differentially from educational interventions based on their level of existing skill and prior knowledge (e.g. Codding, VanDerHeyden & Chehayeb, 2023; Szadokierski, Burns & McComas, 2017; Maki, Zaslofksy, Knight, Ebbesmeyer & Chelmo-Boatman, 2021). Pedagogical approaches which utilise rich, open-ended problem-based tasks as a foundation for instruction, without adequate teaching to ensure all students have the necessary background knowledge to engage in such tasks productively, necessarily advantage students from more privileged backgrounds. An approach to address inequity in the education system must therefore ensure that all students have opportunities to develop such background knowledge through being directly taught it at school.

These themes and others inform the work within the CIS Mathematics stream from expert contributors. In *AP38 Myths That Undermine Maths Teaching*, education researchers Sarah Powell, Elizabeth Hughes and Corey Peltier debunk seven commonly-held myths about teaching maths:

1. Conceptual then procedural understanding;
2. Teaching algorithms is harmful;
3. Inquiry learning is the best approach;
4. Productive struggle is important;
5. Growth mindset increases achievement;
6. Executive function training is important; and
7. Timed assessments cause mathematics anxiety.

The researchers argue that maths teaching must reject unsubstantiated methods and focus on proven pedagogy to ensure all students succeed.

In *AP57 The need for speed: why fluency counts for maths learning*, Australian educator Toni Hatten-Roberts argues that the prioritising of conceptual understanding of mathematics over procedural and factual fluency is a key cause of students' declining mathematics outcomes. Hatten-Roberts makes the case that mathematical fluency is a foundational competency that underpins higher-level skills such as problem-solving and reasoning, and it can be achieved in the classroom through retrieval, spaced and interleaved practice, and timed testing. She also draws on the experience of the UK's Multiplication Tables Check at the end of Year 4 to argue for a similar screening in Term 3 of Year 4 of Australian students.

In support of this position, a considerable body of research continues to demonstrate that classroom instruction with an intensive focus on building fluency with core skills is advantageous to all students. In a study of Classwide Intervention, VanDerHeyden and Codding (2015) demonstrated that such an approach produced measurable gains in mathematics achievement regardless of group classification such as socioeconomic or disability status. In fact, students who entered the fluency intervention with the highest level of educational risk experienced the greatest gains from the instructional intervention, a finding directly relevant to **Consultation Paper Q11**.

In *AP61 Facing Up to Maths Anxiety*, cognitive psychologist and maths researcher David C. Geary notes from PISA data that an increase in its Index of Mathematics Anxiety is associated in a decrease in mathematics achievement of 18 score points (about a year's worth of learning). However, Geary argues that rather than being the cause of low achievement, maths anxiety is its effect: students who experience early difficulties with maths are more likely to suffer from maths anxiety, rather than the other way around. But because maths anxiety is poorly understood, 'solutions' abound that reduce the role of timed tests and procedural fluency abound, though evidence shows these are likely compound problems rather than solve them.

In *AP62 Maths Practices You Can Count On*, education researchers Sarah Powell, Sarah King and Sarah Benz outline the evidence base for and practice implications of five research-validated maths teaching practices:

1. Focus on the language of mathematics;
2. Use multiple representations;
3. Be systematic and explicit with instruction;
4. Build fluency; and
5. Focus on word problems.

The authors also emphasise the importance of formative assessment practices that track student progress and enable teachers to modify instruction accordingly.

Though each of these papers has a different function and focus, they identify similar problems in the current teaching of mathematics — most notably the privileging of conceptual understanding, problem-solving and reasoning and the ongoing negligence of fluency as an instructional focus, at least in part due to a misplaced fear of timed testing as the root cause of maths anxiety.

The papers also advocate for the application of explicit teaching principles as a basis to address this issue. For students to experience academic success and the ensuing engagement and wellbeing benefits, there should be a well-designed curriculum where concepts are broken up into smaller pieces and taught, practiced, and demonstrated systematically. Such an approach addresses inequity through ensuring that all students, regardless of their level of advantage, have opportunities to build the knowledge necessary to problem-solve and reason effectively.

As discussed in more detail in *RR47 Implementing the science of learning: teacher experiences*, this is difficult work for teachers and schools to do on their own, even in systems that lack the ACT';s reputation for school autonomy. They require clear guidance about which practices are most likely to be effective for all students, and they require assistance across the areas of curriculum implementation, lesson plans, and assessment tools to make best practice common practice.

In a small system such as the ACT, there is ample opportunity for the ACT Education Directorate to take on a more active role by mandating approaches (such as explicit teaching principles across the curriculum and structured early literacy) that have overwhelming evidence of efficacy from both research and practice evidence, and providing guidance and supporting resources to teachers across year levels and subject areas.

Regards,

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On behalf of the Education program at the Centre for Independent Studies

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