

# The role of early self-regulation in children's math achievement

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## Rationale and research question

- Self-regulation is a key construct in human development. It refers to the ability to control emotion, behaviour and cognition in a way that is adaptive to the environment. Well-developed self-regulation skills are associated with more positive social, academic and wellbeing outcomes right across the lifespan (McClelland & Wanless, 2012).
- Self-regulation develops rapidly and crucially in the early years. Early indicators of self-regulatory skills have been found to predict successful transition to school and children's academic achievement primarily in North American and European cohorts to date. This is likely to be because children who are able to self-regulate in the classroom setting are better able to capitalise on the learning opportunities presented (Ursache, Blair & Raver, 2013).
- Despite an increased focus on, and funding for, outcomes-based education, national testing indicates that child cohorts entering school display substantial gaps in competencies and that these gaps tend to be exacerbated over time (Nicholson, Lucas, Berthelsen, & Wake, 2012). This is particularly the case in mathematics education, as studies have found that success in early mathematics is a predictor of later learning in both mathematics (Jordan et al., 2009) and overall achievement (Duncan et al., 2007; Romano et al., 2010).
- More knowledge about the very early precursors and pathways to school success will inform parents, early childhood educators, and other professionals about where developmental supports might be best targeted. This is of particular importance given that the effect of early mathematical competence on later school outcomes is increasingly being acknowledged.
- There are few studies of Australian children's self-regulation skills, and there appear to be no Australian studies investigating the relationship between self-regulation and mathematical achievement.

The research question for this study is: **How do children's early emotional and cognitive self-regulatory abilities contribute to school math achievement; and to what extent is their influence on math achievement mediated by the self-regulation skills children employ in the classroom setting?**

## Methodology

### Growing Up in Australia: The Longitudinal Study of Australian Children (LSAC)

- Birth cohort of 5107 children, nationally representative.
- Data collection every two years on a wide range of child, parent, household, neighbourhood and education factors: Wave 1 (infancy) to Wave 5 (8-9 years)

### Structural equation modelling (SEM) analysis using Mplus

## Participants

These analyses included **2393 children** with complete data on the measures of interest across Waves 2 and 4. No longer nationally representative as more likely to be non-Indigenous or English-speaking and be less disadvantaged.

- 49% girls
- 8% non-English speaking home environment
- 2% Indigenous or Torres Strait Islander
- Mean age of 34 months at Wave 2 and 6.3 years at Wave 4.

## Measures

### Self-regulation (Wave 2 at 34 months) – mother-report

- Emotional regulation – Reactivity scale from the *Short Temperament Scale for Toddlers*
- Cognitive regulation – Persistence scale from the same temperament measure

### Classroom self-regulation (Wave 4 at 6-7 years) – teacher-report

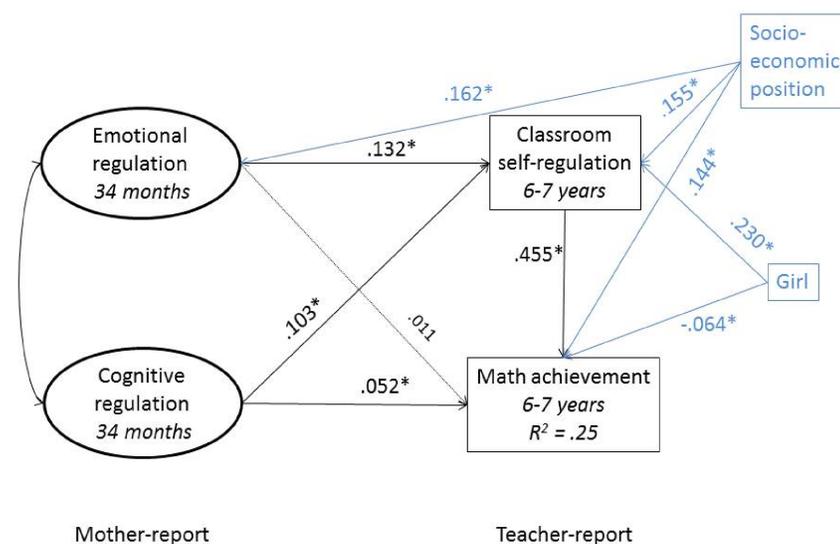
- Approaches to Learning Scale (eager to learn, independent, pays attention etc.)

### Math achievement (Wave 4) – teacher-report

- Academic Rating Scales (ARS) - Math

### Control variables

- Child gender
- Socio-economic position (from Wave 1 when children were infants). LSAC derived variable combining household income, parent education and parental occupational prestige



All estimates are standardised. \* = statistically significant. Non-significant estimates related to the control variables are not shown.

This study used unit record data from *Growing Up in Australia, the Longitudinal Study of Australian Children*. The study is conducted in partnership between the Department of Social Services (DSS), the Australian Institute of Family Studies (AIFS) and the Australian Bureau of Statistics (ABS). The findings and views reported in this paper are those of the authors and should not be attributed to DSS, AIFS or the ABS.

## Results

- As shown in the figure, the strongest predictor of math achievement for children was classroom self-regulation as reported by teachers. Emotional and cognitive regulation as reported by mothers four years earlier, when children were on average 34-months-old, also contributed to math achievement.
- Cognitive regulation had both a direct effect on math achievement as well as an indirect effect through its association with classroom self-regulation.
- Early emotional regulation contributed to later math only through its influence on classroom self-regulation.
- The model accounted for the significant effects of socio-economic position and gender. Specifically, girls were associated with higher classroom self-regulation and lower math achievement. A higher socio-economic position was associated with better early emotional regulation and higher classroom self-regulation and math achievement.
- The model fit the data well (CFI = .983; RMSEA = .037).
- The model accounted for 25% of the variance in math achievement in this group of children.

## Conclusions and implications

- Self-regulation at 34 months and at 6-7 years in the classroom, appear to contribute to math achievement in Australian children.
- Cognitive regulation (attention to task, persistence in completing tasks etc) at 34 months was an important predictor of math achievement both directly and indirectly (through classroom self-regulation).
- Children with better self-regulation skills across the early years are likely to have most effectively capitalised on mathematical learning opportunities not only in the school setting but also in prior-to-school settings.
- Parents and professionals in the early years should prioritise support for the development of emotional and cognitive regulation skills in young children.
- This study and our other work (Williams, 2013), suggest that
  - Positive changes that can be made in children's cognitive self-regulation from 2 to 5 years of age are likely to have important benefits for children's ongoing development.
  - Support for developing emotional regulation skills in children particularly from 1 to 3 years of age will also provide a sound basis for future learning for children.
- Strong skills in early self-regulation will contribute to children being more able to self-regulate within formal classroom settings, which is a key predictor of academic achievement.

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