

# The Bidirectional Interplay Between Self-regulation and Expressive Vocabulary during Toddlerhood

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## Introduction

Self-regulation and language are foundational skills that emerge early and develop rapidly during toddlerhood.

**Self-regulation:** the ability to deliberately plan and adjust behaviors and emotions to specific settings or situations [1]. Comprises children's effortful control and executive function related skills, namely working memory and attention shifting.

**Expressive vocabulary:** children's ability to produce oral language.

Recently, dynamic models of development have argued that skills such as self-regulation and expressive vocabulary are intertwined and play an important role in the development of each other [2]. Despite the importance of self-regulation related skills and expressive vocabulary early in life, most studies have focused on the preschool period, leaving a knowledge gap about the intertwined nature of both skills during toddlerhood, a unique period of high interindividual variation. **Building on the dynamic skill theoretical model, the current study intends to address this gap by investigating the bidirectional links between self-regulation and expressive vocabulary in toddlers.**

## Method

**Participants:** 268 children (52% boys)

	M	SD	Minimum	Maximum	N
<b>Child characteristics</b>					268
Age (months)	29.63	4.18	16	47	
<b>Educator characteristics</b>					29
Age (years)	38.31	7.64	24	54	
Experience (years)	12.62	5.92	2	24	
<b>Classroom characteristics</b>					29
Group size	16	3	8	22	
Number of adults	2.14	0.65	1	4	

**Measures:** To assess expressive vocabulary we used one task from the Griffiths Language subscale [3]. To assess self-regulation we used two measures of executive function (attention shifting and working memory) and one measure of effortful control.

- Attention shifting: Visual Attention task from the NEPSY [4]
- Working memory: Hidden Boxes Task [5]
- Effortful control: Toy Wrap Task, from the PSRA [6]

**Procedures:** Crèches' directors, educators, and parents gave their informed consent by signing consent letters that contained detailed information about the project. Child assessments occurred in three waves: W1 (October to December 2016); W2 (May to July 2017); W3 (October to December 2017).

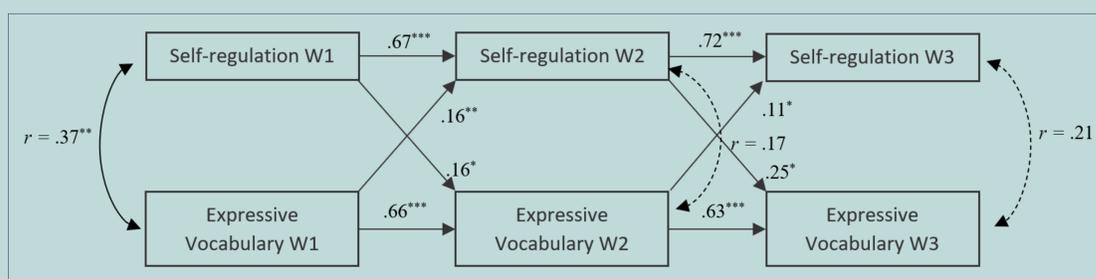
## Results

**First steps: determining the factor structure of tasks assessing self-regulation and testing for longitudinal measurement invariance**

- A confirmatory factor analysis (CFA) was conducted to determine the factor structure of tasks assessing self-regulation (attention shifting, working memory, and effortful control). CFA factor loadings for attention shifting ranged from .68 to .86, for working memory from .25 to .45, and for effortful control from .51 to .55.
- The latent factor solution was then tested for longitudinal measurement invariance across the three time points. Partial metric invariance was met,  $\chi^2(19) = 19.629, p = .417$ ; CFI = .998; RMSEA = .011; SRMR = .056.

**To address our main goal: testing for bidirectional effects using autoregressive cross-lagged regression models**

- A series of conditional models were estimated to determine which model best represented the associations between self-regulation and expressive vocabulary: no cross-lagged, unidirectional, and bidirectional models. In all models, self-regulation was analyzed as a unitary latent factor. Final models were estimated constraining lagged and autoregressive parameters to be invariant over time, controlling for child age and sex.



The **bidirectional model showed the best fit to the data** ( $\chi^2(57) = 103.13$ ; CFI = .942; RMSEA = .055; SRMR = .071) **and had a significant improvement over the unidirectional models** ( $\Delta \chi^2_{SB}(1) = 42.42, p < .001$ , and  $\Delta \chi^2_{SB}(1) = 4.46, p = .035$ ). Cross-lagged paths indicated that **self-regulation was a significant predictor of expressive vocabulary**, and that **expressive vocabulary was a significant predictor of self-regulation** across the three assessment waves, after controlling for age and sex.

## Conclusions

Our findings support the idea of a bidirectional interplay between self-regulation and expressive vocabulary, adding to previous studies by indicating that the bidirectional interplay between these two skills starts very early when children start experiencing a growth spurt on their expressive vocabulary and self-regulation related skills. First, self-regulation can play an important role in the acquisition of toddlers' expressive vocabulary skills, adding to previous studies establishing a link between toddlers' self-regulation and children's receptive vocabulary [7]. Second, findings from the current study point out the possibility that producing words can be particularly important in helping children to regulate their actions early in development, which further supports Vygotsky's theory [8] claiming that language can help regulate children's behavior through the internalization of caregiver's regulatory speech.

**Taken together, our findings add to current evidence suggesting that self-regulation and expressive vocabulary are intertwined and each one seems to play a key role in the functioning and development of each other during early childhood.**

[1] McClelland, M. M., & Cameron, C. E. (2012). Self-regulation in early childhood: Improving conceptual clarity and developing ecologically valid measures. *Child Development Perspectives*, 6(2), 136-142. doi: 10.1111/j.1750-8606.2011.00191.x [2] Fischer, K. W., & Bidell, T. R. (2006). Dynamic development of action, thought, and emotion. In W. Damon & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (6th ed., pp. 313-399). New York, NY: Wiley. [3] Griffiths, R. (1996). *Griffiths mental development scales: 0-2 years*. Oxon: The Test Agency. [4] Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A developmental neuropsychological assessment*. San Antonio, TX: Psychological Corporation. [5] Mulder, H., Hoofs, H., Verhagen, J., van der Veen, I., & Leseman, P. P. M. (2014). Psychometric properties and convergent and predictive validity of an executive function test battery for two-year-olds. *Frontiers in Psychology*, 5. doi: 10.3389/fpsyg.2014.00733 [6] Smith-Donald, R., Raver, C. C., Hayes, T., & Richardson, B. (2007). Preliminary construct and concurrent validity of the Preschool Self-Regulation Assessment (PSRA) for field-based research. *Early Childhood Research Quarterly*, 22(2), 173-187. doi: 10.1016/j.ecresq.2007.01.002 [7] Fitzpatrick, C., & Pagani, L. S. (2012). Toddler working memory skills predict kindergarten school readiness. *Intelligence*, 40(2), 205-212. doi: 10.1016/j.intell.2011.11.007 [8] Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.