



## Minnesota Executive Function Scale (MEFS App) Research References

### Psychometrics and Validation:

For the latest technical report, visit <https://reflectionsociences.com/researchers/>

- Beck, D. M., Schaefer, C., & Pang, K., & Carlson, S. M. (2011). Executive function in preschool children: Test-retest reliability. *Journal of Cognition and Development, 12*, 169-193. <https://doi.org/10.1080/15248372.2011.563485>
- Carlson, S. M., Faja, S., & Beck, D. M. (2015). Incorporating early development into measurement approaches: The need for a continuum of measures across development. In J. A. Griffin, P. McCardle, & L. S. Freund (Eds.), *Executive function in preschool age children: Integrating measurement, neurodevelopment, and translational research* (pp. 45-64). Washington, DC: American Psychological Association. <https://doi.org/10.1037/14797-003>
- Carlson, S. M., & Harrod, J. (2013, April). Validation of the Executive Function Scale for Early Childhood. In J. Griffin (Chair), *Developing the Next Generation of Preschool Outcome Measures: The Interagency School Readiness Measurement Consortium*. Poster symposium presented at the biennial meeting of the Society for Research in Child Development. Seattle, WA.
- Doebel, S., & Zelazo, P. D. (2015). A meta-analysis of the Dimensional Change Card Sort: Implications for developmental theories and the measurement of executive function in children. *Developmental Review, 38*, 241-268. <https://doi.org/10.1016/j.dr.2015.09.001>
- Meuwissen, A. S., et al. (2017). The psychometrics of the Minnesota Executive Function Scale. In P. Morris (Chair), *Strengthening the Measurement Toolbox: Development and Validation of Technology-based Executive Function and Cognitive Assessments*. Paper symposium presented at the biennial meeting of the Society for Research in Child Development. Austin, TX.
- Perone, S., Anderson, A., & Youatt, E. (2020). Don't forget your lunch: Age and individual differences in how children perform everyday tasks. *Cognitive Development, 54*, 100879. <https://doi.org/10.1016/j.cogdev.2020.100879>

### MEFS is correlated with academic skills:

- Chu, F. W., vanMarle, K., & Geary, D. C. (2013). Quantitative deficits of preschool children at risk for a mathematical learning disability. *Frontiers in Psychology, 4*, 1-10. [includes a prior research version of the MEFS] <https://doi.org/10.3389/fpsyg.2013.00195>
- vanMarle, K., Chu, F. W., Li, Y., & Geary, D. C. (2014). Acuity of the approximate number system and preschoolers' quantitative development. *Developmental Science*[includes a prior research version of the MEFS]. <https://doi.org/10.1111/desc.12143>.

Prager, E. O., Sera, M., & Carlson, S. M. (2016). Executive function and magnitude skills in preschool children. *Journal of Experimental Child Psychology*, 147, 126-139.

<https://doi.org/10.1016/j.jecp.2016.01.002>

Mazzocco, M. M., Chan, J. Y., & Bock, A. M. (2017). Early executive function and mathematics relations: Correlation does not ensure concordance. *Advances in Child Development and Behavior*, 53, 289-307. <https://doi.org/10.1016/bs.acdb.2017.05.001>

Grenell, A., & Carlson, S. M. (2021). Individual differences in executive function and learning: The role of knowledge type and conflict with prior knowledge. *Journal of Experimental Child Psychology*, 206. <https://doi.org/10.1016/j.jecp.2020.105079>

Ernst, J., Grenell, A., & Carlson, S. (2022). Associations between executive function and early math and literacy skills in preschool children. *International Journal of Educational Research Open*, 3, 100201. <https://doi.org/10.1016/j.ijedro.2022.100201>

## **MEFS predicts academic achievement:**

Hassinger-Das, B., Jordan, N. C., Glutting, J., Irwin, C., & Dyson, N., (2014). Domain-general mediators of the relation between kindergarten number sense and first-grade mathematics achievement. *Journal of Experimental Child Psychology*, 118, 78-92. [includes a prior research version of the MEFS] <https://doi.org/10.1016/j.jecp.2013.09.008>

Reflection Sciences Technical Report (2017). Prediction of admissions measures to kindergarten reading level. *Report to Marymount School (2014-2016)*.

Reflection Sciences Blog (2020). *MEFS in Preschool Predicts Third Grade Reading and Math Achievement on the Measures of Academic Progress (MAP)*. <https://reflectionsociences.com/pre-k-executive-function-predicts-3rd-grade-academic-achievement/>

Kalstabakken, A., Desjardins, C., Anderson, J., Berghuis, K., Hillyer, C., Seiwert, M., . . . Masten, A. (2021). Executive function measures in early childhood screening: Concurrent and predictive validity. *Early Childhood Research Quarterly*, 57, 144-155. <https://doi.org/10.1016/j.ecresq.2021.05.009> [includes a prior research version of the MEFS]

Chan, J., & Scalise, N. (2022). Numeracy skills mediate the relation between executive function and mathematics achievement in early childhood. *Cognitive Development*, 62, 101154. <https://doi.org/10.1016/j.cogdev.2022.101154>

Distefano, R., Palmer, A. R., Kalstabakken, A. W., Hillyer, C. K., Seiwert, M. J., Zelazo, P. D., Carlson, S. M., & Masten, A. S. (2023). Predictive validity of NIH Toolbox Executive Function measures with Developmental Extensions: Pre-Kindergarten screening to third grade benchmark tests of achievement. *Manuscript revision under review*. [includes a prior research version of the MEFS]

Kalstabakken, A. W., Palmer, A. R., Distefano, R., Hillyer, C. K., Seiwert, M. J., Zelazo, P. D., Carlson, S. M., & Masten, A. S. Executive function assessment in early childhood screening: Predictive value for third grade math and reading achievement. *Manuscript under review*. [includes a prior research version of the MEFS]

## **MEFS performance is lower in at-risk populations (but not at floor):**

- Hostinar, C. E., Stellern, S. S., Schaefer, C. M., Carlson, S. M., & Gunnar, M. R. (2012). The impact of early life adversity on executive function in children adopted internationally from orphanages. *Proceedings of the National Academy of Sciences*, *109*, 17208-17212. <https://doi.org/10.1073/pnas.1121246109> [includes a prior research version of the MEFS]
- Doom, J., Gunnar, M. R., Georgieff, M. K., Kroupina, M. G., Frenn, K., Fuglestad, A. J., & Carlson, S. M. (2014). Beyond stimulus deprivation: Iron deficiency and cognitive deficits in post-institutionalized children. *Child Development*, *85*, 1805-1812. <https://doi.org/10.1111/cdev.12231> [includes a prior research version of the MEFS]
- Fuglestad, A., Whitley, M., Carlson, S., Boys, C., Eckerle, J., Fink, B., & Wozniak, J. (2015). Executive functioning deficits in preschool children with Fetal Alcohol Spectrum Disorders. *Child Neuropsychology*, *21*(6), 716-731. <https://doi.org/10.1080/09297049.2014.933792> [includes a prior research version of the MEFS]
- Rockhold, M., Kruger, A., de Water, E., Lindgren, C., Sandness, K., Eckerle, J., Schumacher, M., Fink, B., Boys, C., Carlson, S. M., Fuglestad, A., Mattson, S., Jones, K., Riley, E., & Wozniak, J. (2020). Social functioning across development in children and adolescents with prenatal alcohol exposure. *Alcoholism: Clinical and Experimental Research*. Online DOI: [10.1111/acer.14538](https://doi.org/10.1111/acer.14538)
- Tamm, L., Loren, R., Peugh, J., & Ciesielski, H. (2021). The association of executive functioning with academic, behavior, and social performance ratings in children with ADHD. *Journal of Learning Disabilities*, *54*(2), 124-138. <https://doi.org/10.1177/002221942096133>
- Weger, C., Boonstra, F., & Goossens, J. (2021). Differences between children with Down syndrome and typically developing children in adaptive behavior, executive functions, and visual acuity. *Scientific Reports*, *11*(1), 7602. <https://doi.org/10.1038/s41598-021-85037-4>

## **MEFS is related to parenting quality:**

- Meuwissen, A. S., & Carlson, S. M. (2015). Fathers matter: The role of father parenting in preschool children's executive function. *Journal of Experimental Child Psychology*, *140*, 1-15. <https://doi.org/10.1016/j.jecp.2015.06.010> [includes a prior research version of the MEFS]
- Distefano, R., Galinsky, E., McClelland, M. M., Zelazo, P. D., & Carlson, S. M. (2018). Autonomy supportive parenting and associations with child and parent executive function. *Journal of Applied Developmental Psychology*, *58*, 77-85. <https://doi.org/10.1016/j.appdev.2018.04.007>
- Meuwissen, A. S., & Carlson, S. M. (2018). The role of father parenting in child school readiness: A longitudinal follow-up. *Journal of Family Psychology*. <https://doi.org/10.1037/fam0000418>
- Meuwissen, A. S., & Carlson, S. M. (2019). An experimental study of the effects of autonomy support on preschoolers' self-regulation. *Journal of Applied Developmental Psychology*. <https://doi.org/10.1016/j.appdev.2018.10.001>

Almutairi, S. M. (2019). The role of parenting factors in accelerating or hindering the development of EF in preschool children. Doctoral dissertation, Miami University, Oxford, OH.  
[http://rave.ohiolink.edu/etdc/view?acc\\_num=miami1554984908299487](http://rave.ohiolink.edu/etdc/view?acc_num=miami1554984908299487)

Castelo, R. J., Meuwissen, A. S., Distefano, R., McClelland, M. M., Galinsky, E., Zelazo, P. D., & Carlson, S. M. (2022). Parent provision of choice is a key component of autonomy support in predicting child executive function skills. *Frontiers in Psychology*.  
<https://doi.org/10.3389/fpsyg.2021.773492>

### **MEFS is sensitive to EF interventions and SEL curricula:**

White, R. E., & Carlson, S. M. (2015). What would Batman do? Social psychological distance improves executive function performance in young children. *Developmental Science*, doi: 10.1111/desc.12314. [includes a prior research version of the MEFS]

Schubert, E. C. (2016). *Examining moderators of response to executive function reflection training: Initial skill and socioeconomic status*. Doctoral dissertation, University of MN, Minneapolis, MN.  
<https://hdl.handle.net/11299/190500>

Zelazo, P. D., Forston, J. L., Masten, A. S., & Carlson, S. M. (2018). Mindfulness plus reflection training: Effects on executive function in early childhood. *Frontiers in Psychology*, 9:208. doi: 10.3389/fpsyg.2018.00208

Grenell, A., Prager, E. O., Schaefer, C., White, R., Kross, E., Duckworth, A. L., & Carlson, S. M. (2018). Individual differences in the effectiveness of self-distancing for young children's emotion regulation. *British Journal of Developmental Psychology*, 37, 84-100. <http://dx.doi.org/10.1111/bjdp.12259>

Anderson, K. L., Weimer, M., & Fuhs, M. W. (2020). Teacher fidelity to Conscious Discipline and children's executive function skills. *Early Childhood Research Quarterly*, 51, 14-25. doi: [10.1016/j.ecresq.2019.08.003](https://doi.org/10.1016/j.ecresq.2019.08.003)

Oeri, N., & Roebbers, C. (2020). Regulating disappointment can impair cognitive performance in kindergarten children: Individual differences in ego depletion. *Journal of Experimental Child Psychology*, 190. doi: 10.1016/j.jecp.2019.104728.

Prager, E. O., Ernst, J., Mazzocco, M. M., & Carlson, S. M. (2023). Executive function and mathematics in preschool children: Training and transfer effects. *Journal of Experimental Child Psychology*.  
<https://doi.org/10.1016/j.jecp.2023.105663>

### **MEFS performance is linked to brain function and psychophysiology:**

Perone, S., Palanisamy, J., & Carlson, S. M. (2018). Age-related change in brain rhythms from early to middle childhood: Links to executive function. *Developmental Science*. doi: 10.1111/desc.12691

Rudd, K., Roubinov, D., Jones-Mason, K., Alkon, A., & Bush, N. (2021). Developmental consequences of early life stress on risk for psychopathology: Longitudinal associations with children's multisystem physiological regulation and executive functioning. *Development and Psychopathology*, 33(5), 1759-1773. <https://doi.org/10.1017/S0954579421000730>

### Other research using the MEFS:

Martins, E. C., Osorio, A., Verissimo, M., & Martins, C., (2014). Emotion understanding in preschool children: The role of executive functions. *International Journal of Behavioral Development*. doi: 10.1177/0165025414556096. [includes a prior research version of the MEFS]

Lee, W. S. C., & Carlson, S. M. (2015). Knowing when to be “rational:” Economic decision-making and executive function in preschool children. *Child Development*. doi: 10.1111/cdev.12401 [includes a prior research version of the MEFS]

Ernst, J. & Burcak, F. (2019). Young children’s contributions to sustainability: The influence of nature play on curiosity, executive function skills, creative thinking, and resilience. *Sustainability*, 11, 4212. <https://doi.org/10.3390/su11154212>

Zamzow, J., & Ernst, J. (2020). Supporting school readiness naturally: Exploring executive function growth in nature preschools. *International Journal of Early Childhood Environmental Education*, 7(2), 6. <https://eric.ed.gov/?id=EJ1254980>

Courage, M., Frizzell, L., Walsh, C., & Smith, M. (2021). Toddlers using tablets: they engage, play, and learn. *Frontiers in Psychology*, 12, 564479. <https://doi.org/10.3389/fpsyg.2021.564479>

Lasch, C., Carlson, S., & Elison, J. (2023). Responding to joint attention as a developmental catalyst: Longitudinal associations with language and social responsiveness. *Infancy*, 28(2), 339-366. <https://doi.org/10.1111/infa.12515>

### Other publications citing the MEFS:

Ackerman, D. J., & Friedman-Krauss, A. H. (2017). Preschoolers’ executive function: Importance, contributors, research needs and assessment options. *ETS Research Report Series*, 2017(1), 1–24. <https://doi.org/10.1002/ets2.12148>

Gaete, J., Sanchez, M., Nejaz, L., & Otegui, M. (2019). Mental health prevention in preschool children: Study protocol for a feasibility and acceptability randomized control trial of a culturally adapted version of the I Can Problem Solve (ICPS) program in Chile. *Trials*, 20, 158. <https://doi.org/10.1186/s13063-019-3245-3>

Howell, B. R., Styner, M. A., Gao, W., Yap, P., Wang, L., Baluyot, K....Elison, J. T. (2019). The UNC/UMN Baby Connectome Project (BCP): An overview of the study design and protocol development. *NeuroImage*, 185, 891-905. <https://doi.org/10.1016/j.neuroimage.2018.03.049>

McCoy, D. C. (2019). Measuring young children's executive function and self-regulation in classrooms and other real-world settings. *Clinical Child and Family Psychology Review*, 22, 63-74.  
<https://doi.org/10.1007/s10567-019-00285-1>