Executive Function Skills and Academic Achievement in Pre-K: Contributions of Learning-Related Behaviors

Kimberly A. Turner[1], Dale C. Farran, Mary Wagner Fuhs[1]
Jennifer C. Norvell, & Katherine M. Newman

Peabody Research Institute
Vanderbilt University

Society for Research on Child Development, April 2013

[1]During the completion of this work Turner and Fuhs were supported by an Institute of Education Sciences Postdoctoral Fellowship (R305B100016), awarded to Dale C. Farran and Mark W. Lipsey

Research Team

Tools of the Mind Evaluation (IES R305E090009)

Principal Investigators

- Dale C. Farran, PhD
- Mark W. Lipsey, PhD
- Sandra Wilson, PhD

Tools of the Mind Curriculum Staff

- Curriculum Developers
  - Deborah Leong, PhD
  - Elena Bodrova, PhD
- Trainer
  - Sheila Corbin Williams, MEd
- Coaches
  - Carolyn Boyles
  - Barbara Corry
  - Patti Dale
  - Anne Whitefield

Project Coordinators

- Elizabeth Vorhaus, MEd
- Deanna Meador, MA
- Diane Spencer, MEd

Post-Doctoral Fellow

- Mary Wagner Fuhs, PhD

Research Associate

- Kimberly A. Turner, PhD

Research Assistants

- Ashley Keene
- Jennifer Norvell, MEd

Doctoral Fellows

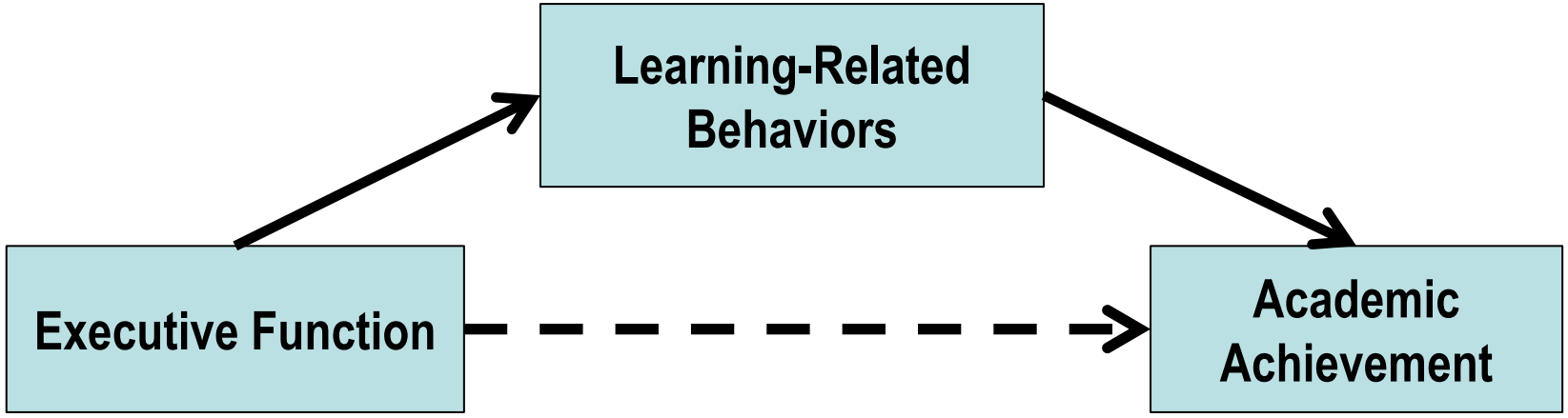
- Karen Anthony
- Lydia Bentley
- Cathy Yun

Study Rationale

- Established associations between young children's entering executive function skills and subsequent academic achievement (e.g., Blair & Razza, 2007; Bull, Espy, & Wiebe, 2008; Duncan et al., 2007; McClelland, Cameron, Connor, Farris, Jewkes, & Morrison, 2007)

Study Rationale

- Researchers have hypothesized that executive function facilitates children's ability to successfully adapt to school context (e.g., Blair & Diamond, 2008; McClelland & Cameron, 2011; Eisenberg, Valiente, & Eggum, 2010)

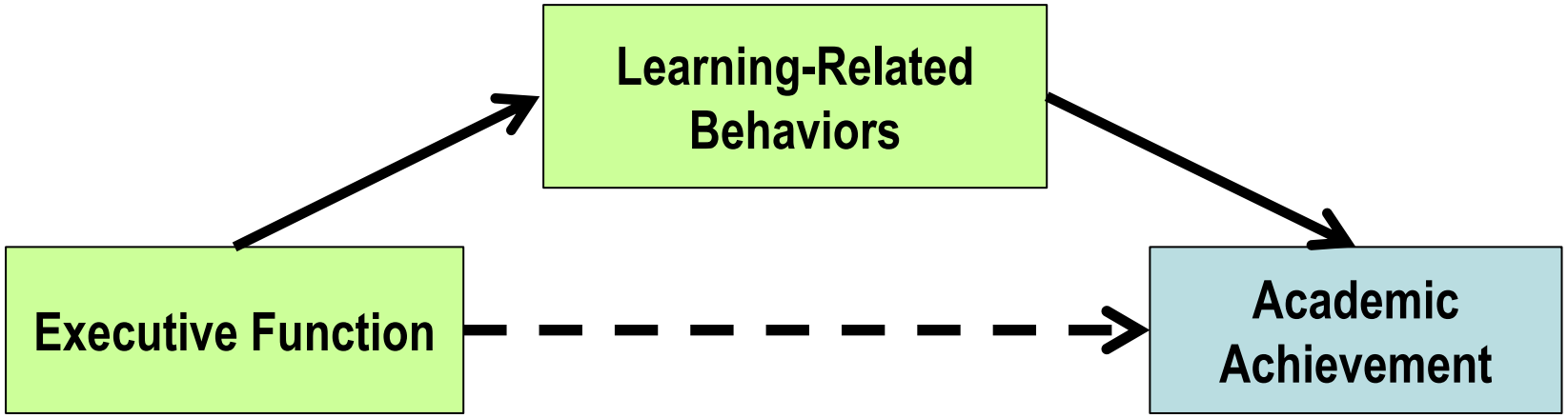


Learning-Related Behaviors

- Children's ability to successfully adapt to the demands of the classroom, includes
  - Focus and actively engage in learning opportunities
  - Complete tasks with multiple steps
  - Participate in learning interaction with peers and teachers
  - Avoid disengagement, isolation, and disruption

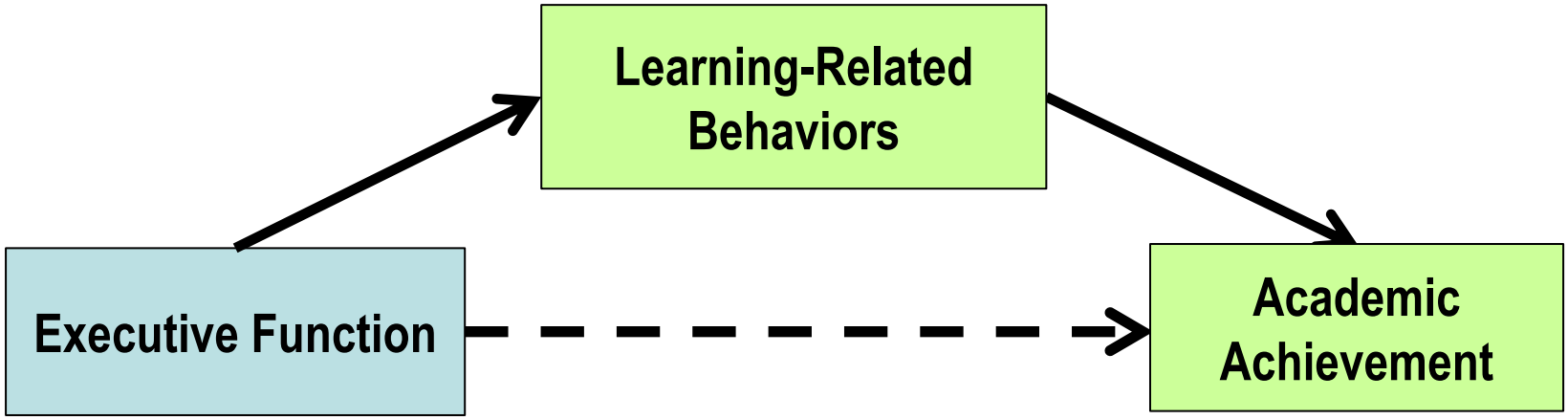
Learning-Related Behaviors & Executive Function Skills

- Teacher-reports of children's learning-related behaviors associated with direct assessments of executive function (Brock et al., 2009 ; Fuhs, Farran, Turner, under review)
- Observations of engagement related to direct assessments of executive function (Brock et al., 2009)



Learning-Related Behaviors & Academic Achievement

- Associations found between learning-related behaviors and concurrent and future achievement:
  - Teacher ratings (DiPerna, Lei, & Reid, 2007; Howse, Calkins, Anastopoulos, Kean, & Shelton, 2003, McClelland, Acock, & Morrison, 2006)
  - Behavioral observations (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Downer, Vitiello, Maier, & Williford, 2011)

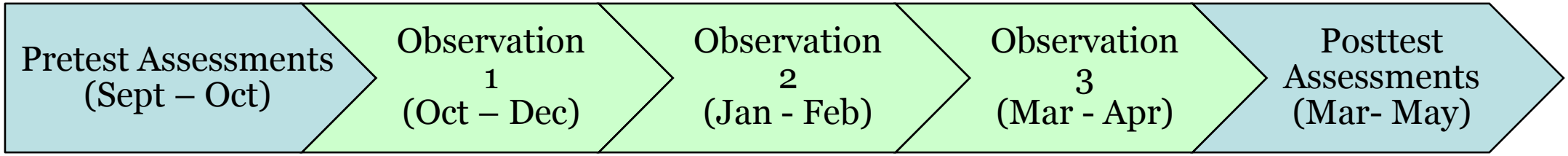


Participants

- 702 native English speakers who participated in a large-scale evaluation of a pre-k curriculum
  - Completed at least one measure at both the beginning and end of pre-k and observed for at least 2 of the 3 in-class observations

- Children were from 80 pre-k classrooms, which were situated in 57 schools across 6 school districts

Procedures & Measures



- Direct Assessments
  - Executive Function
    - Copy Design, Corsi Blocks, Dimensional Change Card Sort, Head Toes Knees Shoulders, Peg Tapping
  - Academic Achievement
    - Academic Knowledge, Applied Problems, Letter-Word Identification, Quantitative Concepts, Picture Vocabulary, Spelling

Procedures & Measures

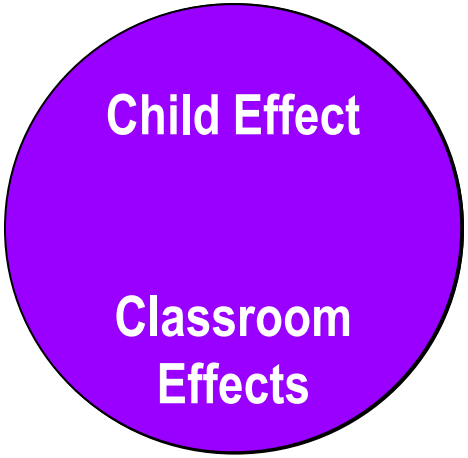
- Classroom Observations / Learning-Related Behaviors
  - Child Observation in Preschool (COP; Farran & Son-Yarbrough, 2001; Bilbrey, Vorhaus, Farran, & Shufelt, 2010)
  - Variables:
    - Level of Involvement During Learning Opportunities
    - Sequential Behaviors
    - Social Learning Interactions (Associate or Cooperative)
    - Off-task and Disruptive Behaviors
      - Off task when academic activities were occurring
      - Disruption of class time or in time-out

Analytic Plan

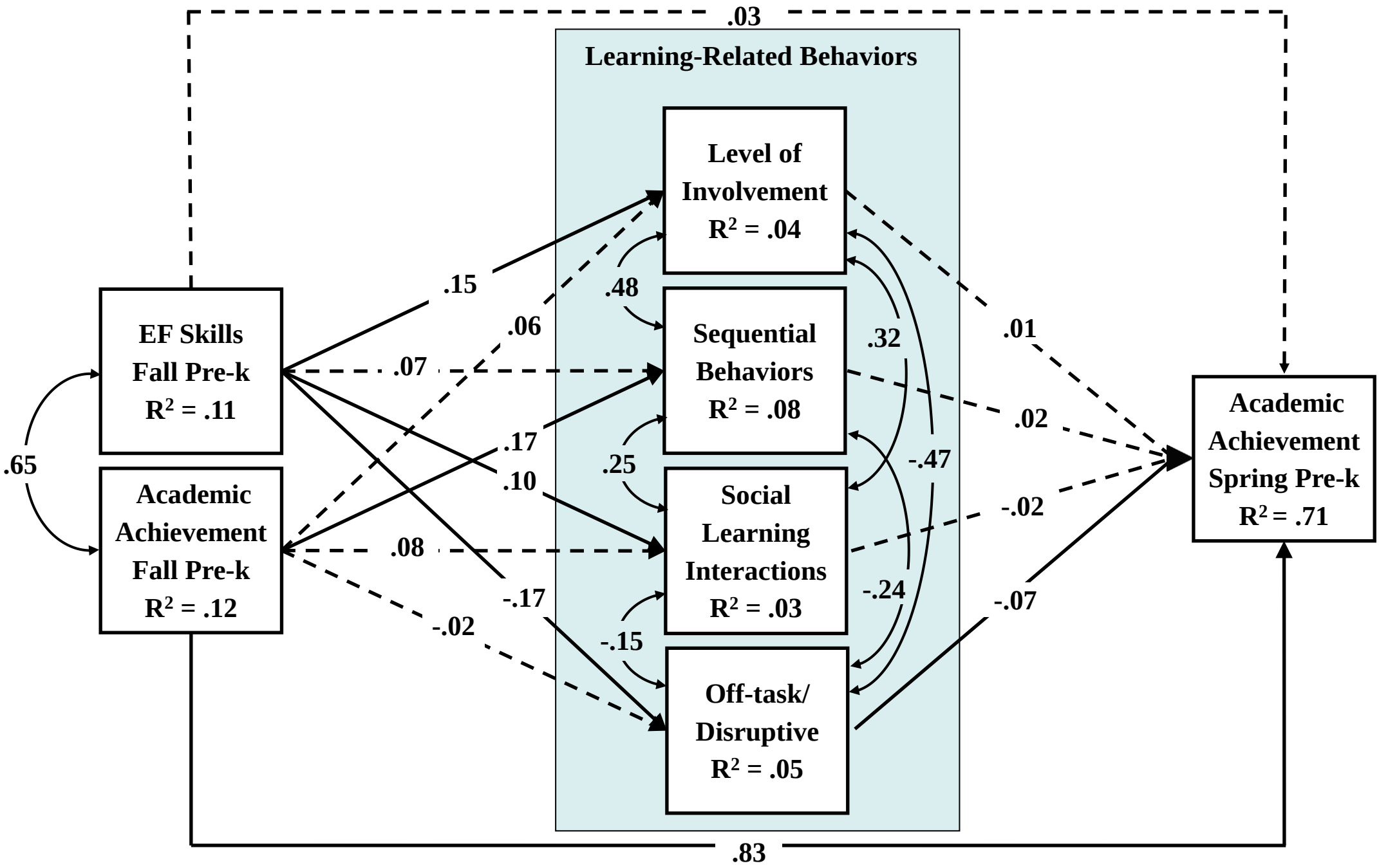
- Test of Direct and Indirect Effects Path Analysis in Mplus 7.0
  - Independent and dependent variables centered at group mean
  - Standard errors adjusted to account for dependency among observations

Methodological Challenges

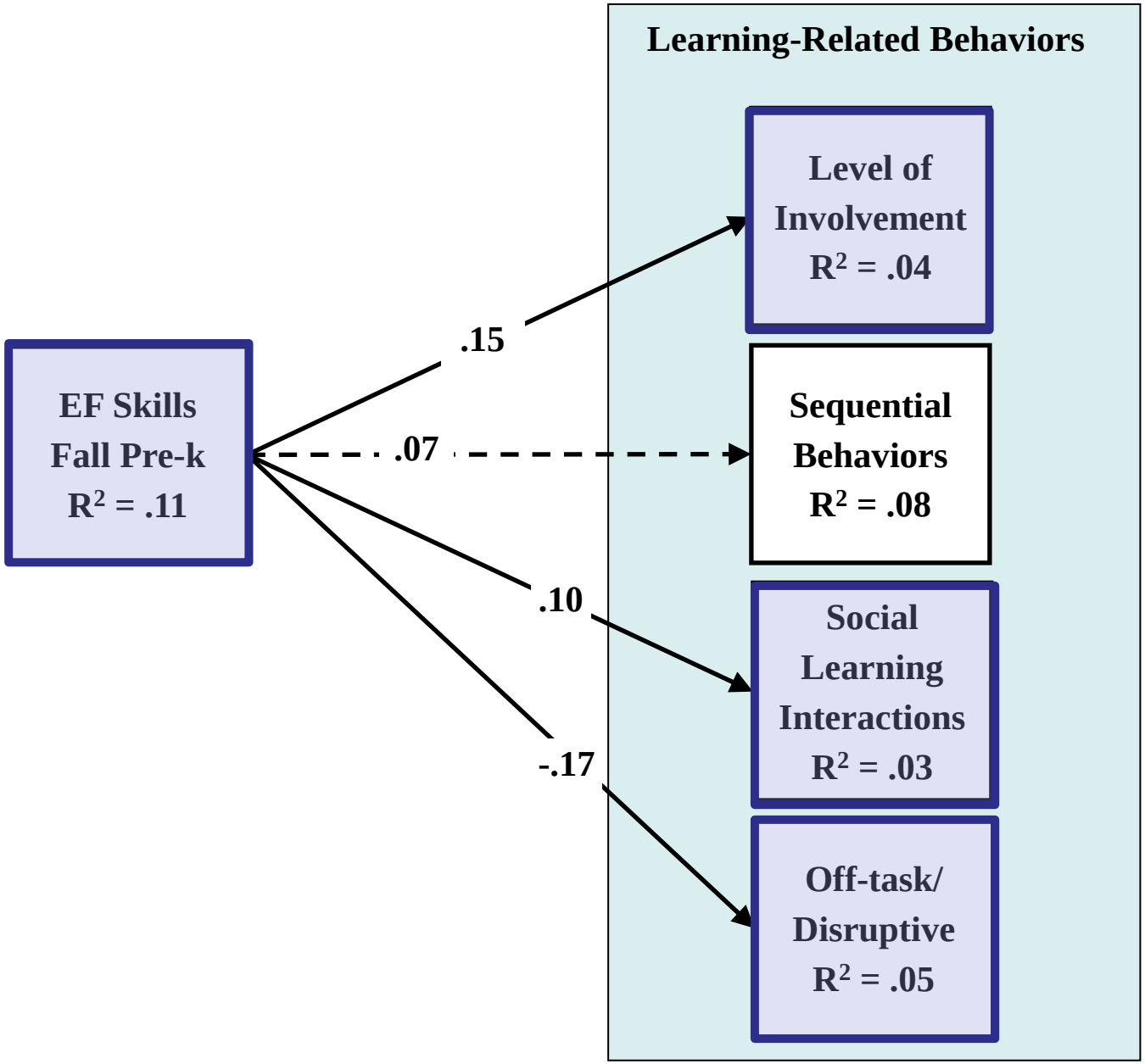
- Interested in examining if children's entering skills predict their use of learning-related behaviors and subsequent academic achievement
- Children's skills and behaviors are influences by the classroom context



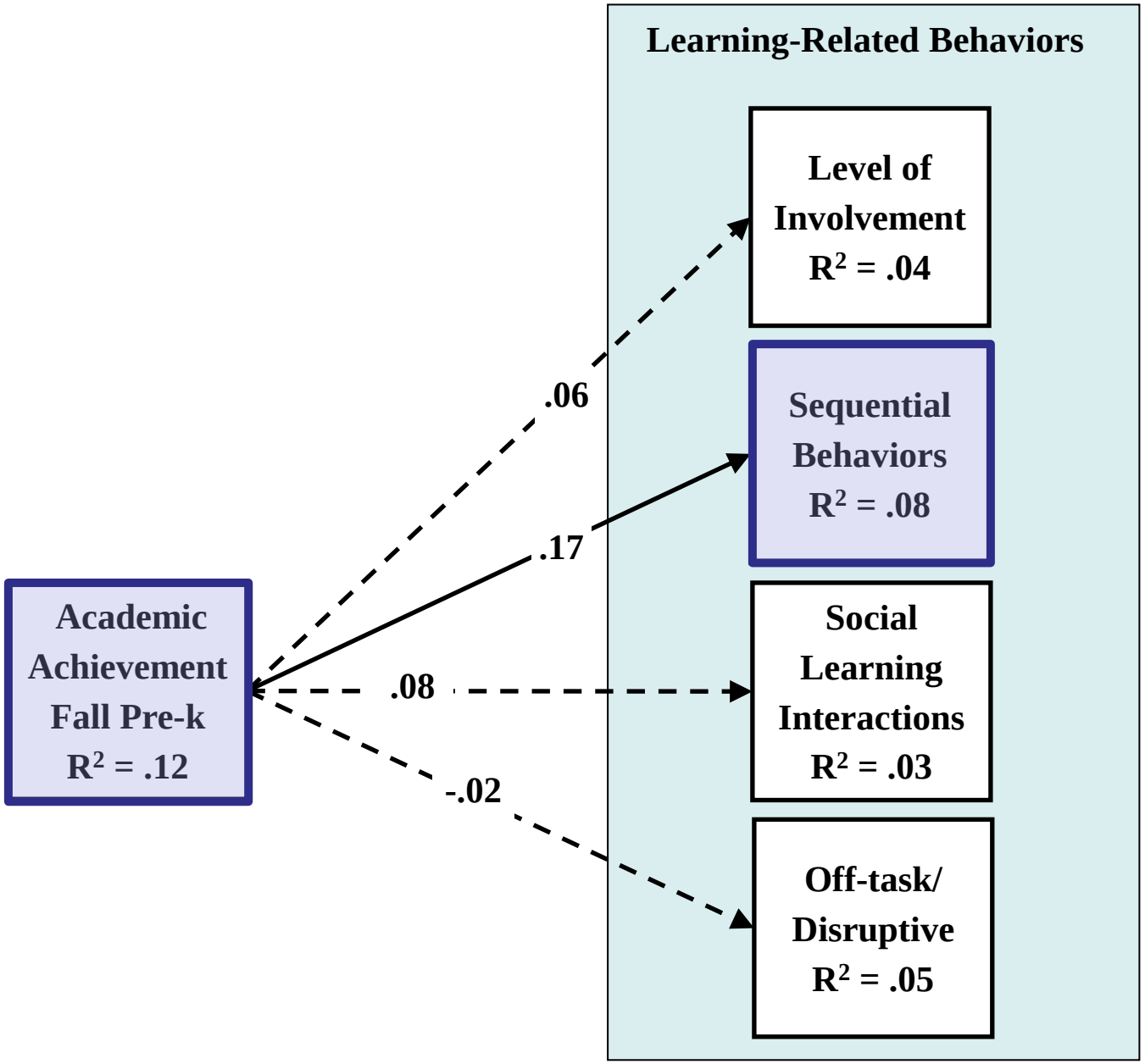
Direct Effects:
Overall Model



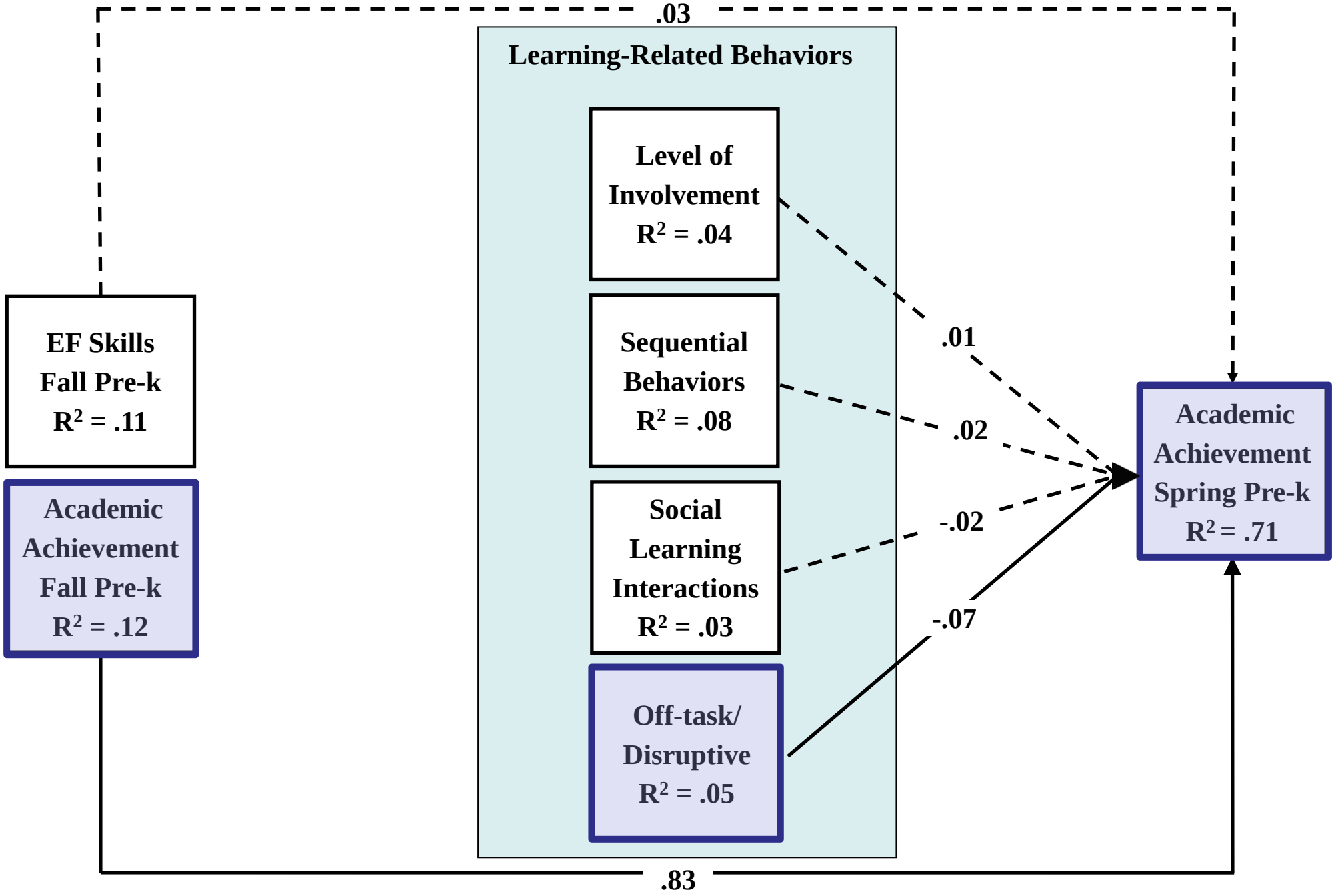
Direct Effects:
EF Skills & Learning Related Behaviors



Direct Effects:
Achievement & Learning Related Behaviors



Direct Effects:
Predictors of End of Pre-K Achievement



Indirect Effects:
Test of Mediation

	Estimate (Standard Errors)
EF T1 → AA T2, Cumulative Indirect Effect	0.012 (0.006)*
EF T1 → Level of Involvement → AA T2	0.001 (0.004)
EF T1 → Sequential Behaviors → AA T2	0.001 (0.002)
EF T1 → Social Learning → AA T2	-0.002 (0.003)
EF T1 → Off-task/ Disruptive → AA T2	0.013 (0.005)*
AA T1 → AA T2, Cumulative Indirect Effect	0.004 (0.006)
AA T1 → Level of Involvement → AA T2	0.001 (0.002)
AA T1 → Sequential Behaviors → AA T2	0.003 (0.004)
AA T1 → Social Learning → AA T2	-0.002 (0.002)
AA T1 → Off-task/ Disruptive → AA T2	0.002 (0.005)

Notes:
*$p < .05$.

Conclusions

- Greater executive function skills at beginning of pre-k were associated with:
  - Higher levels of involvement during learning opportunities
  - More participation in social-learning interactions
  - Less demonstrations of off-task and disruptive behaviors
- Children's learning-related behaviors were a mechanism by which children's executive function skills facilitated their pre-k academic gains
  - Driven by negative behaviors, which were infrequent in sample (5% of snapshots)
  - Exclusion of negative behaviors from model: Positive behaviors (involvement and sequential behaviors) facilitate gains

Conclusions

- Results highlight the importance of entering academic and cognitive regulations skills for understanding how children respond to learning opportunities and succeed academically
- How children exert themselves in their environment is only half the picture
  - Need to identify strategies and practices that enhance the richness of the learning opportunities for children with higher skills while also providing access to learning for those with lower skills

PEABODY research institute

Kimberly Turner

- **E-mail: kimberly.turner@vanderbilt.edu**
- **http://peabody.vanderbilt.edu/pri.xml**

- **Peabody Research Institute**
- Vanderbilt University
- **Box 0181 GPC, 230 Appleton Place**
- Nashville, TN 37203-5721
- **(615) 322-8015**