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Preschoolers' Self-Regulation in Context: Task Persistence Profiles with Mothers and Fathers and Later Attention Problems in Kindergarten

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Abstract

Task persistence is related to attentional regulation and is needed for the successful transition to school. Understanding preschoolers' task persistence with caregivers could better inform the development and prevention of attention problems across this transition. Preschoolers' real-time task persistence profiles during problem-solving tasks with mothers (*N*=214) and fathers (*N*=117) were examined as antecedents of teacher-rated attention problems in kindergarten, accounting for child temperament, parenting, and preschool attention problems. Group-based trajectory modeling identified five profiles with mothers and four with fathers; more children showed high task persistence with mothers than fathers. With mothers, when persistence started low and increased over time, children had lower inhibitory control, higher verbal skills, and received more directives. This increasing profile had the highest-rated attention problems, followed by the stable low persistence profile; both groups showed higher attention problems than children who started high and declined slowly in persistence over time. Results implied children who start tasks low in persistence may require the most maternal effort to get on task, and whether those efforts are successful (increasing persistence) or not (stable low persistence), may be the same children teachers perceive as having the most attention problems. Profiles with fathers were not associated with attention problems but pointed to the importance of father-child affective processes (child negative emotion, paternal praise) in children's task persistence. Findings suggest mothers and fathers play different roles in regulatory development and that person-centered profiles of self-regulation in context may inform the prevention of children's regulatory problems.

Keywords: task persistence, self-regulation, attention problems, parenting, fathers, person-centered modeling

Preschoolers' Self-Regulation in Context: Task Persistence Profiles with Mothers and Fathers and Later Attention Problems in Kindergarten

Task persistence, or the ability to sustain effort towards a task-oriented goal over time, is an important aspect of self-regulation in early childhood (Rothbart & Bates, 2006). It is a component of effortful control, which involves suppressing a dominant impulse and engaging in and sustaining behaviors (often task-oriented) as directed by a caregiver (Kochanska & Knaack, 2003). Task persistence is also considered an index of autonomous behavior when children focus on an other-directed task without continued prompting by a caregiver, thought to reflect the internalization of task goals (Lunkenheimer, Ram, Skowron, & Yin, 2017). It is also part of object mastery, which involves continued work at a task-oriented goal in order to master a task or skill (Maslin-Cole, Bretherton, & Morgan, 1993). Task persistence is thus an essential ingredient and salient behavioral manifestation of these broader skills. These skills then in turn contribute to success in the school context in terms of the greater likelihood of engagement in and completion of teacher-directed activities (McWayne, Fantuzzo, & McDermott, 2004; Schunk & Zimmerman, 1997).

Children's task persistence is also fundamentally related to attention regulation. Attention is defined in part as an ability to focus on tasks (Duncan & Magnuson, 2011) and has been sometimes operationalized as task persistence (Maslin-Cole et al., 1993). Attention deficit hyperactivity disorder (ADHD) is characterized by difficulties in behavioral inhibition (Barkley, 1997), which in turn impair task persistence (Dovis, Van der Oord, Wiers, & Prins, 2012; Hoza, Waschbusch, Owens, Pelham, & Kipp, 2001). When children fail to persist or are off-task in the classroom, teachers perceive them as having more problems with attentional regulation (Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009). Less persistent and attentive children are

also rated as less cooperative, which can lower the quality of teaching they receive (Hoza et al., 2001). In turn, teacher-rated attention problems in elementary school are associated with multiple negative outcomes, including greater behavioral problems and poorer academic achievement (Eisenberg et al., 2000; McClelland, Acock, Piccinin, Rhea, & Stallings, 2013).

Considering their consequences for development, it is necessary to better understand the antecedents of teacher-rated attention problems in the early school context. Although task persistence and attention overlap, we know relatively little about how task persistence fluctuates in real time and whether it predicts later attention problems. Further, a better understanding of real-time task persistence patterns with parents may inform how children apply task persistence in other caregiver-directed contexts such as school. To inform the assessment and prevention of attention problems, person-centered approaches may be useful to reveal whether certain children are at higher risk for attention problems. Thus, we examined whether preschoolers' real-time profiles of task persistence during problem-solving tasks with mothers and fathers were associated with teacher-rated attention problems in kindergarten in children at risk for behavior problems, accounting for baseline levels of attention problems in preschool and child temperament and parenting covariates of task persistence.

Task Persistence as a Contextualized, Dynamic, and Person-Centered Process

Task persistence is a key component of self-regulation in early childhood, and self-regulation behaviors tend to fluctuate over time (Thompson, Lewis, & Calkins, 2008), vary as a function of internal (e.g., child temperament) and external inputs (e.g., parenting; Cole, Martin, & Dennis, 2004), and organize into predictable patterns that reveal individual differences (Carver & Scheier, 2001). Though few studies have centered primarily on the development of task persistence, we do know that undirected preschoolers persist on average for about 1½ minutes on

play-based materials in the classroom, increasing to 2½ minutes with added prompting and reinforcement by teachers (Krantz & Scarth, 1979). Toddlers show some stability in task persistence over developmental time (Maslin-Cole et al., 1993), and preschoolers who persist longer at tasks at age 2 show fewer task completion failures at age 5 (Sigman, Cohen, Beckwith, & Topinka, 1987). Constructs closely related to task persistence such as effortful control also vary by child and parent influences and show continuity across early childhood (Kochanska & Knaack, 2003).

Persistence is a dynamic construct in that it involves sustaining attention and effort across time, thus it is implicit that persistence may change over the course of a task, particularly one that is challenging for the child. However, it is often studied in static ways via global ratings or parent or teacher report that mask temporal changes in this process (Chang & Olson, 2016). A real-time approach to modeling self-regulation may be important in early childhood (Lunkenheimer, Kemp, Lucas-Thompson, Cole, & Albrecht, 2017) given that children experience dynamic increases in regulatory skills and heavy socialization of regulation by caregivers in this stage (Grolnick & Ryan, 1989). Intraindividual variability in task persistence may be influenced by child and parent factors, and interindividual differences may have implications for the prevention of regulatory problems (Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002; Wakschlag et al., 2008). For example, knowing that children with lower inhibitory control give up midway through difficult tasks could inform family- or school-based efforts to promote task persistence. Also, modeling regulatory processes as dynamic and time-varying adds ecological validity and explained variance to the study of regulatory processes (Lunkenheimer, Ram, et al., 2017), including inattention in school specifically (Bardack, Herbers, & Obradović, 2018).

Person-centered approaches to regulatory behaviors may be useful given that regulatory processes may follow particular patterns within certain contexts (van Ryzin, Chatham, Kryzer, Kertes, & Gunnar, 2009) and may offer information about which individuals are at greater risk for regulatory problems (Thomson, Guhn, Richardson, Ark, & Shoveller, 2017). Specific to preschoolers, person-centered approaches have revealed distinct profiles of socioemotional skills, including self-regulation skills, that are related to school adjustment and suggest specific directions for prevention programming (Denham et al., 2012). Denham et al. (2012) showed that preschoolers with a high-risk profile (characterized by poorer regulatory skills) were rated as having poorer learning behaviors later in school, including poorer attentiveness and persistence in the classroom. The present study builds on this work by examining person-centered profiles of specific regulatory behaviors in the context of caregiver-child problem-solving interactions.

Parenting and Child Temperament Covariates of Task Persistence

Bioecological (Bronfenbrenner, 1977) and self-regulation models (Cole et al., 2004) suggest that regulatory behaviors develop in the context of complex and interacting internal and external factors. Prior research suggests that task persistence should be influenced by child temperament factors such as lower negative emotionality and higher inhibitory control that are thought to support greater self-regulation (Eisenberg et al., 2000; Kim & Kochanska, 2012; Rothbart & Bates, 2006). Children who are less emotionally reactive and more inhibited show higher effortful control, which implies greater task persistence skills (Kochanska & Knaack, 2003). Similarly, lower levels of approach (as an index of lower reactivity) paired with higher levels of soothability (as an index of greater control processes) are related to children's greater task persistence (Dennis, 2006). Though no known research has examined how temperament

covaries with task persistence profiles, prior work would imply that higher negative emotion and lower inhibitory control could characterize profiles of lower task persistence.

Child task persistence is also shaped by the caregiver's level and type of support as caregivers provide the security and motivation needed to persist in the face of difficulty (Martin, Ryan, & Brooks-Gunn, 2013). Parental scaffolding and reinforcement during challenging tasks aid preschoolers' self-regulation (Lunkenheimer, Kemp, & Albrecht, 2013) including observed task persistence (Mokrova, O'Brien, Calkins, Leerkes, & Marcovitch, 2012) and are protective for children at risk for dysregulation due to more difficult temperaments (Kim & Kochanska, 2012). Scaffolding and reinforcement in preschool are also specifically related to better task persistence and related constructs in later school contexts (Pino-Pasternak & Whitebread, 2010). For example, scaffolding characterized by better emotional and autonomy support is related to higher levels of task persistence in kindergarten (Neitzel & Stright, 2003). Additionally, higher parent-child positive affective quality during problem-solving tasks is related to children's better work habits and teacher-child relations in kindergarten (Pianta, Nimetz, & Bennett, 1997). In contrast, parental scaffolding that is too directive and does now allow for the child's autonomous efforts may be a risk factor for regulatory difficulties (Pianta et al., 1997; Stright, Herr, & Neitzel, 2009). Accordingly, we examined parental directives and praise (i.e., positive reinforcement), generally expecting that more frequent directives and less frequent praise would be more likely to characterize profiles involving children's lower task persistence.

The Influence of Mothers versus Fathers on Child Task Persistence

A secondary goal of the present work was to examine children's task persistence profiles in the context of both mother-child and father-child interactions, given that both mothers and fathers shape child development (Lamb & Lewis, 2013) and could contribute to children's

regulatory behaviors in different ways. Relevant prior research has centered largely on mothers (Volling, Kolak, & Blandon, 2009). Mother-child interactions have been shown to be more mutually responsive and cyclic than those with fathers (Feldman, 2003; Kochanska & Aksan, 2004), which could suggest that children are more well-regulated with mothers than fathers overall. However, responsiveness by both mothers and fathers predicts children's better regulatory skills (Davidov & Grusec, 2006), both mothers and fathers tailor their scaffolding to meet children's needs on problem-solving tasks (Pratt, Kerig, Cowan, & Cowan, 1988), and fathers' positive parenting has been linked to children's task orientation (Easterbrooks & Goldberg, 1984). Thus, there is reason to expect that both mothers and fathers could influence children's task persistence, and additional information about fathers' roles in children's regulatory behaviors could inform family-based interventions for children's regulatory problems.

Present Study

Task persistence plays a central role in the various regulatory behaviors needed to succeed in school and is closely related to children's attention. But we lack sufficient knowledge about observed task persistence in early interactions with caregivers and whether it is associated with later attention problems in school. The goals of this study were threefold. First, we examined person-centered profiles of 3-year-old children's real-time task persistence during mother-child and father-child problem-solving interactions and whether they were associated with concurrent child temperament dimensions (negative emotion, inhibitory control) and parent behavior (praise, directives). Second, we examined whether task persistence profiles with mothers and fathers were associated with children's later teacher-rated attention problems in kindergarten. Third, we explored whether task persistence profiles, their covariates, and associated attention problems differed with respect to interactions with mothers versus fathers.

The present study expanded on work by Chang and Olson (2016) on task persistence in the same dataset. They measured children's task persistence with mothers aggregated into three time points and examined how these linear patterns of persistence across the task related to concurrent maternal behavioral and emotional responsiveness and later externalizing problems. They found three patterns: high, declining, and low task persistence. Higher child IQ and maternal behavioral responsiveness distinguished high from low task persistence classes; otherwise, covariates did not distinguish task persistence classes. We expanded on this work, conjecturing that by examining child temperament factors known to be related to task persistence (i.e., negative emotion and inhibitory control), parenting behaviors that directly support children's task persistence (i.e., praise and directive statements), and nonlinear profiles of persistence over the course of the task, we might learn more about relations between children's early task persistence and later problems in the school context. We also controlled for children's verbal skills given prior demonstrated effects of IQ (Chang & Olson, 2016) and the potential for verbal skills to affect understanding of the dyadic problem-solving task. We also controlled for child sex given known differences in attention problems by sex (Hoza et al., 2001). These processes were examined in a community sample of children oversampled for behavior problems, thus increasing the likelihood of showing the attention problem behaviors of interest. We hypothesized that profiles would be characterized by lower task persistence when children's negative emotion was higher, inhibitory control was lower, and parenting was less supportive, but otherwise made no specific hypotheses regarding task persistence profiles.

Method

Participants

Participants were 227 children (52% male) oversampled for higher child behavior problems and their parents and teachers. Children were assessed at 3 years (T1; *M* = 37.67 months, *SD* = 2.74 months, range = 27-45 months) and 5 years (T2; *M* = 63.53 months, *SD* = 2.68 months, range = 52-71 months). Forty-four percent had a T score greater than 60 on the externalizing subscale of the Child Behavior Checklist (Achenbach & Rescorla, 2001) at study entry. Approximately 2.5% met criteria for borderline clinical levels and 5.5% met criteria for clinical levels of attention problems (clinical group T-score *M* = 76.80, *SD* = 5.19) based on CBCL T-score cutoffs at study entry (age 3 years). Families with severe risk factors (e.g., developmental disabilities, poverty) were excluded. Families were recruited via flyers in preschools and doctors' offices and referred by preschool teachers and pediatricians.

Median annual income was $70,000 - $80,000. Mean occupational status was 6.73 for mothers (range = 2-9, *SD* = 1.63) and 7.25 for fathers (range = 1-9, *SD* = 1.95) on Hollingshead's (1975) occupational scale indicating that parents were minor professionals on average. Forty-nine percent of mothers self-reported as stay-at-home and 51% reported as being employed outside the home. Sixty-three percent of mothers and 55% of fathers had four years of college; 38% of mothers and 45% of fathers had additional graduate or professional training. Parents were 88% married, 4% cohabiting, 5% single, and 3% separated or divorced. Fathers were 87% Non-Hispanic White, 9% African American, 1% Hispanic, 2% Asian, and 1% "other" and mothers were 92% Non-Hispanic White, 5% African American, 2% Hispanic, and 1% Asian.

Thirteen mother-child and 110 father-child dyads were excluded because dyadic data was missing or fathers elected not to participate. The final analytic sample included 214 mother-child dyads and 117 father-child dyads at T1; 104 children were assessed with both mothers and fathers. Missing values were missing completely at random for both mother-child, !"(167) =

176.082, #=.300, and father-child dyads, !"(133) = 130.734, #=.539 (Little, 1988). There were no significant differences in child sex, !"(1)=.006, #=.937, maternal education, !"(4)=3.125, #=.537, paternal education, !"(4)=4376, #=.358, T1 attention problems, *t*(186)=-.333, *p*=0.739, T2 attention problems, *t*(188)=-0.320, *p*=0.749, child negative affect with mothers, *t*(210)=-0.973, *p*=0.332, persistence with mothers, *t*(210)=0.109, *p*=0.913, maternal praise, *t*(210)=0.109, *p*=0.953, or maternal directives, *t*(210)=-0.286, *p*=0.775, for families whose fathers participated versus did not. At T2, 35 families were missing data on variables of interest; there were no significant differences in T1 attention problems between families who had complete T2 data and those who did not, *t*(186) = 1.661, *p* = 0.098.

Procedure

During a three-hour home assessment at T1, a female social worker first obtained informed consent from parents to participate and to contact children's preschool teachers. Children were given a brief age-appropriate description of what was involved and were asked for their verbal assent to participate. The social worker then conducted an interview with parents and videotaped the parent-child interaction tasks, including a block design task. Mothers and fathers participated separately on different days. Parents also completed questionnaires and mailed them to the lab or had them picked up by an experimenter. Children also completed a three-hour laboratory assessment at T1. Experimenters for lab assessments were graduate and undergraduate students in psychology. Children engaged in one-on-one tasks with experimenters and in structured and unstructured play with unfamiliar peers; these tasks assessed children's regulatory and cognitive abilities. Families were compensated $100 for participation. Teachers completed informed consent to participate at T1 and T2, and rated the child's behavior including attention problems. Teachers filled out questionnaires and mailed them in or had them picked up

by an experimenter. Teachers were given $20 gift certificates for their participation at each time point. All study procedures and materials were approved by the Institutional Review Board at the University of Michigan for the study "Social Risk and Self-Regulation Problems in Early Childhood," protocol # BO3-00003400-R1. See Olson & Sameroff (1997) for more information on study procedures.

Measures

Parent-child interaction task: Block design. Observations of child negative emotion, parental praise and directive statements, and child task persistence were derived from the coding of a videotaped interaction task in which parents and children worked together to recreate three block designs using four plastic cubes (Chang & Olson, 2016). The block designs were adapted from the Wechsler Intelligence Scale for Children - Third edition (Wechsler, 1991). Designs increased in difficulty over time and were above the child's cognitive level, requiring parental guidance for completion. Parents were told they could help their child in any way to complete the task and no time limit was set; mother-child tasks lasted 339 seconds and father-child tasks lasted 420 seconds on average. It was important to ensure that the dyadic data analyzed would involve active work because early task completion could have influenced child task persistence levels. Thus, task duration was considered in preliminary analyses; see Results for how duration was truncated for analysis based on comparative model fit to ensure consistency across dyads.

Child negative emotion. Child negative emotion was operationalized as the degree of negative affect expressed by the child during the task with mother and father, respectively. Negative affect was coded based on facial expression, vocal tone, and body language on a three-point scale (none, low, high) for each 30-second interval. "None" indicated the absence of negative affect; "low negative" reflected one instance of low or moderate irritation, distress, or

annoyance; and "high negative" reflected more than one instance or high intensity negative affect. Examples included frowns, whiny vocal tone, and tantrums. Codes were averaged across intervals to get an aggregate negative emotion score. Interrater reliability was established at an average criterion of .80 based on 40% of the sample. We accounted for perfect and relative agreements using weighted kappa where differences are weighted more heavily when codes are farther apart on the scale (e.g., high vs. none). The average weighted kappa for child negative emotion was .96. Disagreements between raters were resolved using consensus coding.

Parental praise and directives. Parents' praise and directive statements were tallied in each 30-s epoch. Each statement was a complete sentence, thus parents could make multiple statements in sequence. *Praise* included positive responses, motivational statements, or reinforcement (e.g., "There you go, "Yay" or, "I bet you can do this"). *Directives* were instances in which the parent presented the child with clear commands to elicit a desired response or behavior. Directives could be "Do" commands (e.g., "Put it here") or "Don't" commands that were not harsh (e.g., "Don't throw the block"). Praise and directive statements were summed across intervals; average weighted kappas were .89 for praise and .96 for directives.

Child task persistence. Task persistence was defined as the child's observed independent and effortful task-oriented or on-task behavior. During each 30-s interval, child task persistence was rated by an experimenter using a 4-point scale: 1 (*none*) = child never attempted the task and remained off-task most of the time, 2 (*mild*) = child engaged in low levels of task persistence and was off-task at least 50% of the time, 3 (*moderate*) = child demonstrated moderate task persistence and was on-task at least 50% of the time, 4 (*high*) = child was highly persistent with at most one brief instance of off-task behavior. Interrater reliability was 0.86 and 0.84 for task persistence in mother-child and father-child interactions, respectively.

Inhibitory control. The Children's Behavior Questionnaire (Rothbart, Ahadi, Hershey, & Fisher, 2001) is a parent-report measure of temperament for children aged 3-7 years. The 13-item inhibitory control subscale examines how well children suppress their approach tendencies when given a directive or encountering a novel situation. Mothers responded to items such as "has difficulty waiting in line for something," and "can easily stop an activity when s/he is told no" using a scale from 1 (*extremely untrue of child*) to 7 (*extremely true of child*). Item responses were summed to form an overall inhibitory control score. Cronbach's alpha was 0.79.

Child verbal skills. The Wechsler Preschool and Primary Scale of Intelligence third edition (WPPSI-III; Wechsler, 2002) Receptive Vocabulary test was used to assess verbal skills. Children were presented with 25 words of increasing difficulty and were asked to explain the meaning of each word (e.g., "What does _____ mean?"). A sum of the number of words correctly described was converted to scaled scores according to WPPSI-III nationalized norms.

Child attention problems. Teachers rated children on the 20-item Attention Problems scale of the Teacher Report Form at T1 (TRF/2-5) and T2 (TRF/6-18; Achenbach & Rescorla, 2001). Teachers rated children on items such as "can't concentrate," "daydreams," and "difficulty following instructions" over the preceding two months where 0 indicates "not true," 1 indicates "somewhat or sometimes true," and 2 indicates "very true or often true." Higher scores indicate more attention problems. Cronbach's alpha was 0.91 at T1 and 0.93 at T2.

Analytic Plan

First, to model task persistence in real time, unconditional latent growth curve models were fit to examine whether task persistence patterns were linear, quadratic, or cubic. After determining the functional form, unconditional group-based trajectory models (GBTM) were fit to examine person-centered profiles of child task persistence for separate mother-child and

father-child interaction models. GBTM is an application of a finite mixture modeling framework that assumes heterogeneity in the trajectories of a construct in the population. Trajectories can be differentiated based on growth parameters such as the intercept, slope, and higher order growth functions, which allow for a person-centered analysis of individual change. These unconditional models were used to extract the number of latent classes that represented profiles of task persistence and individuals were assigned to latent classes based on their posterior probabilities of class membership. There are not set sample size requirements in finite mixture modeling since model fit depends on model complexity, properties of the latent class indicators, and the number, nature, and separation of the classes (Masyn, 2013). Analyses were run in Mplus 7.31 and full information maximum likelihood estimation was used for missing data.

Second, to explore covariates of task persistence classes, conditional GBTM models were fit for mother-child and father-child dyads. The flexibility of GBTM permits extensions that include covariates, predictors, or distal outcomes of class membership. The relationship between covariates and class is examined by specifying the probability of classification based on a multinomial or binomial logit model (Nagin & Odgers, 2012). Covariates are examined in terms of the likelihood of membership into specific persistence classes when compared to a reference class; interest in atypical response patterns will warrant that the typical response pattern constitutes the reference class (van Ryzin et al., 2009). Thus, we specified high persistence as the reference class (Chang & Olson, 2016) in mother-child and father-child dyads. We used the three-step guidelines of Asparouhov and Muthén (2014) to test covariates of class membership, specifically child sex, verbal skills, inhibitory control, negative emotion, parental praise, and parental directives; this approach ensured that parameters derived from the unconditional GBTM model remained unchanged with the inclusion of covariates in the conditional model. Direct

effects of covariates on growth parameters and indirect effects via latent classes were examined to ensure appropriate model selection. The resulting classes were also compared to the extracted classes from the unconditional GBTM to confirm similar model fit.

Third, to examine relations between task persistence class and distal factors, we performed conditional GBTM analyses using a three-step approach in reference to teacher-rated attention problems in kindergarten (Asparouhov & Muthén, 2014). With this approach, we were able to estimate whether task persistence profiles were associated with later attention problems accounting for the effects of child temperament, parenting, and sociodemographic covariates and children's baseline levels of attention problems in preschool. Thus, the distal models retained all prior covariates with the addition of preschool attention problems to control for baseline levels of attention problems when examining relations with kindergarten attention problems.

Model fit and adequacy. Fit criteria for latent growth curve models included Ξ^2, root mean square error of approximation (RMSEA; < 0.06 indicates good fit), comparative fit index (CFI; > 0.95 indicates good fit), and standard root mean square residual (SRMR; < 0.08 indicates good fit) (Hu & Bentler, 1999). Model selection and class enumeration for unconditional and conditional GBTM models were guided by sample size adjusted Bayesian Information Criteria (SSA-BIC), bootstrapped Likelihood Ratio Test (B-LRT; a smaller p-value indicates that the k – 1 model should be rejected in favor of the model with k classes; Tofighi & Enders, 2008), and entropy (values closer to 1 indicate greater precision; Nagin & Odgers, 2012). We tested model adequacy using three additional criteria per Nagin and Odgers' (2012) recommendations. The first is a close correspondence (i.e., less than 50%) between the estimated probability of class membership and the proportion assigned to that class based on the posterior probability. Second, the average posterior probability (AvePP) of assignment for each individual into a class should

exceed a minimum threshold of 0.7. Third, Odds of Correct Classification (OCC) based on posterior probabilities of class membership should exceed the minimum threshold of 5.

Results

Preliminary Analyses

Preliminary analyses involved testing planned covariates (child sex and verbal skills) and sociodemographic factors. Boys had higher attention problems in preschool, $t(186) = 2.942$, $p < 0.01$, and kindergarten, $t(188) = 3.732$, $p < 0.001$. Child verbal skills were positively correlated with task persistence with both mothers, $r = .13$, $p < .05$, and fathers, $r = .19$, $p < .05$. Thus, these planned covariates were retained. Child ethnicity, SES, and parental education and occupation (including stay-at-home status) were not related to main study variables and thus not included in primary models; child age was positively related to average task persistence with fathers, $r = .26$, $p < .05$, but not to task persistence with mothers nor child attention problems and thus was not retained as a covariate. There were no significant differences in the number of directive statements by mothers ($M = 13.16$, $SD = 11.97$) vs. fathers ($M = 14.81$, $SD = 14.35$), $t(263.65) = 3.05$, $p = 0.275$, nor in the amount of children's negative emotion with mothers ($M = 1.12$, $SD = 0.27$) vs. fathers ($M = 1.13$, $SD = 0.24$), $t(255.07) = -0.449$, $p = 0.654$. Mothers made more praise statements ($M = 9.56$, $SD = 7.03$) than fathers ($M = 8.79$, $SD = 8.91$), $t(292.66) = 4.375$, $p < 0.001$. Descriptive data and correlations are displayed in Table 1.

Modeling Dynamic Task Persistence Patterns in Real Time

To compare real-time task persistence patterns across dyads, it was important to ensure sufficient consistency of the task experience given that differences in duration and early task completion could have influenced observed child task persistence levels. Thus, competing latent growth curve models for varying task durations were performed. All dyads had a minimum of

210 seconds of data (seven 30-s epochs), which was compared to the next most common task durations of 240-s, 270-s, and 300-s. Models of 210-s durations fit best across mother- and father-child dyads and were retained for primary analyses (Table 2).

Results showed a quadratic model fit better than a linear model for mother- and father-child dyads. Cubic models resulted in non-convergence and warranted exclusion, thus a quadratic model was retained for subsequent analyses. Variability around growth parameters for mother-child (intercept = 0.891, $p < 0.001$, slope = 0.244, $p < 0.001$, and quadratic = 0.006, $p < 0.001$) and father-child dyads (intercept = 1.013, $p < 0.001$, slope = 0.283, $p < 0.001$, and quadratic = 0.006, $p < 0.01$) showed significant heterogeneity in task persistence.

Estimating Task Persistence Classes for Mother-Child and Father-Child Dyads

Next, unconditional GBTMs (person-centered models) were specified to estimate latent classes of task persistence in mother- and father-child dyads. This unconditional model grouped individuals based on the posterior probabilities of the estimated trajectories accounting for model error. Results indicated good model fit using a 5-class solution for mother-child dyads and a 4-class solution for father-child dyads (Table 3). Further model adequacy assessment based on recommendations by Nagin and Odgers (2012) as well as entropy and VLMR values validated a 5-class solution for mothers and a 4-class solution for fathers. Thus, these solutions were retained for subsequent conditional models for mother-child and father-child dyads (Figure 1).

Variability in task persistence was evident in each of the latent classes for mother- and father-child dyads. In mother-child dyads, the largest group of children (48.8%) displayed consistently high task persistence and were classified as the *high persistence class*. Children classified under the *increasing persistence class* (7.6%) displayed low initial task persistence and increased to high levels of task persistence. Children classified under the *slow decline*

persistence class (14.3%) exhibited high initial levels of task persistence that declined slowly while those classified under the *rapid decline persistence class* (11.2%) exhibited high initial persistence levels that declined rapidly. Finally, 18.1% of children were classified under the *low persistence class* where they exhibited consistently low task persistence levels across the task.

In father-child dyads, the largest group of children (38.5%) displayed consistently high task persistence and were classified as the *high persistence class*. Children classified under the *early decline/late increase persistence class* (10.3%) displayed an initial decline and then increased to high task persistence levels. In contrast, the children who were classified under the *early increase/late decline persistence class* (17.2%) exhibited an initial increase and then declined in task persistence over time. Finally, children in the *low persistence class* (34.0%) displayed consistently low task persistence.

Covariates of Task Persistence Classes

The next step was to examine how child and parent covariates were associated with membership in children's task persistence classes separately for mother- and father-child dyads. Table 4 indicates the *ns*, *Ms*, and *SDs* for all classes in the conditional GBTM model including covariates. See Table 5 for how covariates were significantly related to each class based on the final conditional GBTM model including covariates and outcomes (given no change in covariate associations between models with and without outcomes, only one table was provided for parsimony; see below).

With respect to mother-child dyads and with the high persistence class as the reference class, children in the *increasing persistence class* had higher verbal skills and lower inhibitory control, and received more maternal directives. Children in the *rapid decline persistence class* received more maternal directives and marginally fewer praise statements relative to children in

the high persistence class. Finally, children in the *low persistence class* received less praise, more directives, and showed marginally higher negative emotion compared to children in the high persistence class. None of the covariates showed significant associations with the *slow decline persistence class*. With respect to father-child dyads, children in the *early decline/late increase persistence class* showed higher negative emotion compared to children in the high persistence class. Children classified in the *early increase/late decline persistence class* received less paternal praise than children in the high persistence class. Children in the *low persistence class* showed higher negative emotion, received less paternal praise, and had higher levels of inhibitory control than children in the high persistence class.

Task Persistence Classes and Kindergarten Attention Problems

Distal factors were incorporated into the final mother- and father-child GBTMs to examine task persistence class differences in mean levels of teacher-rated attention problems in kindergarten accounting for covariates, including preschool attention problems. For parsimony, given that specific covariate associations with task persistence profiles and their significance levels did not change with the transition from the covariate GBTM model to the distal GBTM model, Table 5 represents the parameter estimates for associations with both covariates and kindergarten attention problem mean scores in the distal GBTM models.

For mother-child dyads, the overall test for equality of means across the five persistence classes for teacher-rated attention problems in kindergarten was significant, Wald **!"** (4, N = 214) = 12.752, $p < 0.01$. Subsequent tests of equality of means across classes indicated significant pairwise differences. Specifically, class-specific differences were found between the *increasing* and *slow decline* classes, Wald **!"** (1, N = 214) = 7.641, $p < 0.01$, *increasing* and *rapid decline* classes, Wald **!"** (1, N = 214) = 4.678, $p < 0.05$, and *increasing* and *low* classes,

Wald !" (1, $N = 214$) = 11.934, $p < 0.001$, such that the increasing task persistence class showed higher levels of teacher-rated attention problems in kindergarten than the three other classes. There was also a significant difference between the *slow decline* and *low* classes, Wald !" (1, $N = 214$) = 3.958, $p < .05$, such that mean teacher-rated attention problems were higher in the low class than the slow decline class. For father-child dyads, the overall test for equality of means for teacher-rated kindergarten attention problems was not significant, Wald !" (3, $N = 117$) = 5.696, $p = 0.13$, thus no further pairwise comparisons were conducted.

Post-Hoc Analysis

A post-hoc analysis was performed to examine whether class membership was related within families, $\Xi^2(9, N = 104) = 27.231$, $p < 0.001$, indicating a significant relation in class with mother and with father. The largest subgroups showed high task persistence with both parents (25%) and low task persistence with both parents (12.5%), suggesting some stability of child task persistence across relationship contexts. The third largest subgroup (11.5%) showed high persistence with mother and low persistence with father.

Discussion

The present findings offer novel contributions to research on typical and atypical self-regulation in early childhood. First, we gained new knowledge about profiles of preschoolers' real-time task persistence with caregivers in children at higher risk for behavior problems. There was heterogeneity in task persistence and qualitative differences in profiles with mothers versus fathers. We also found that both child and parent covariates covaried with real-time task persistence, with child verbal skills, inhibitory control, negative emotion, and parental directives and praise differentiating task persistence profiles. Covariates differed between mothers and fathers, with distinct combinations of child and parent factors relating to task persistence with

each parent. Additionally, task persistence profiles with mothers were associated with children's later attention problems in kindergarten, with children starting low in task persistence with mothers (and subsequently remaining low or increasing over time) showing significantly higher levels of later teacher-rated attention problems than other profiles. Thus, this study demonstrated novel evidence that preschoolers' person-centered profiles of task persistence were meaningfully related to concurrent child and parent factors and later kindergarten problems in ways that could inform the development and prevention of regulatory problems.

Dynamic and Person-Centered Approaches to Self-Regulation

Task persistence unfolds as a dynamic regulatory process in real time in the context of internal and external supports and constraints (Chang & Olson, 2016). Understanding the dynamic and person-centered nature of this process may offer important information about self-regulatory development and which children are at highest risk for regulatory problems. In the present study, more children showed stable (high or low) than variable (increasing or declining) patterns of task persistence over time in both mother- and father-child interactions. In terms of development, this may mean that by age 3 the majority of children show stable patterns of task persistence with caregivers, which builds on prior work showing stability of task persistence in toddlers and preschoolers (Maslin-Cole et al., 1993; Sigman et al., 1987).

In terms of intervention implications, a fifth of children in mother-child dyads and a third in father-child dyads fell into the low task persistence class. Thus, sizeable subgroups showed room for growth and could be targeted for interventions to improve task persistence. Existing interventions that promote preschoolers' self-regulation to promote school outcomes (Schmitt, McClelland, Tominey, & Acock, 2015) could be tailored to add task persistence. Relatedly, interventions for children with ADHD show an emphasis on self-regulation to be effective in

increasing the duration of children's on-task behavior (Reid, Trout, & Schartz, 2005). Stable low task persistence profiles with mothers and with fathers were characterized by lower praise, suggesting that parental positive reinforcement may be a consideration in intervention, though it is not yet clear whether it is a cause or consequence of task persistence. Another question is whether person-centered assessment can supplement tools shown to identify children's clinically significant disruptive behavior, such as the Disruptive Behavior Diagnostic Observation Schedule (DB-DOS; Wakschlag et al., 2008). The DB-DOS illustrates that child functioning across contexts is a marker of impairment; relatedly, the present results suggest person-centered profiles may indicate challenges in parent-child interactions that relate to teachers' perceptions of the child in the school context.

Task Persistence with Mothers versus Fathers

Mother and father models revealed different task persistence patterns. Although both showed stable high and stable low profiles, the remaining profiles differed in number and form across mothers and fathers. Prior research shows more regulated, consistent interactions between mothers and children (Kochanska & Aksan, 2004) and more variability with fathers (Feldman, 2003), so profiles may have reflected these differences. Greater variability with fathers combined with the lack of association with later attention problems may signify that children's regulatory behaviors with fathers in this age range are less stable than those with mothers and/or are a less reliable indicator of children's attention or school-based problems.

Class membership distribution was also distinct across mothers and fathers: more preschoolers fell into the high persistence class with mothers (49%) than fathers (39%) and class membership was more evenly distributed with fathers. These differences were not explained by mothers potentially spending more time with children because maternal stay-at-home status was

not related to study variables. Children may show lower persistence with fathers because they typically engage in proportionally fewer problem-solving interactions with fathers than mothers, or perhaps because higher emotional or physical fluctuations characteristic of father-child interactions reduce children's task persistence (Feldman, 2003). For children participating with both parents, a greater proportion were high or low with both, implying child contributions play a role in real-time task persistence profiles that may confer stability across relationships. But there was also a notable subgroup showing high persistence with mother and low persistence with father, underscoring mother-father differences in class membership distribution. In sum, findings show there are some commonalties across mother- and father-child interactions in terms of the more stable task persistence profiles, but also key differences such that covariates, trajectories, and the distribution of children's observed task persistence profiles varied by parent.

Child and Parent Covariates of Task Persistence

Child and parent factors interact to predict child outcomes (Kim & Kochanska, 2012), but less research has examined how they covary with observed, real-time regulatory processes in early childhood. We found that children in the increasing, rapid decline, and low task persistence classes received more maternal directives than the high class, likely reflecting that these children needed (and their mothers provided) more direction. Higher verbal skills and lower inhibitory control were also associated with increasing task persistence with mothers when compared to the high class. Considered together, more directives may have aided children with lower inhibitory control, but who also had the cognitive skills to make use of those directives, to increase in persistence over time. An alternative explanation is that maternal directiveness may have been correlated with both lower inhibitory control and poorer task persistence given its associations with children's regulatory difficulties in the literature (e.g., Stright et al., 2009).

Notably, covariates of a more affective nature, specifically child negative emotion and paternal praise, were the primary covariates related to task persistence profiles with fathers. Fathers' parenting is influenced by child factors (Tamis-Lemonda et al., 2004), including children's negative emotions (McBride et al., 2002), and children's negative emotion should interfere with self-regulation skills such as task persistence (Eisenberg et al., 2000). Low paternal praise characterized both the low and early increase/late decline classes, suggesting that fathers' praise may be particularly important to child task persistence. These findings echo prior work showing the importance of paternal warmth and responsiveness (Daniel, Madigan, & Jenkins, 2016) and suggest more attention should be paid to the affective nature of father-child interactions in the development of children's regulatory difficulties.

Task Persistence Profiles and Kindergarten Attention Problems

This study offered the first empirical evidence that preschoolers' profiles of real-time task persistence were associated with later attention problems in school. Specifically, preschoolers who began low in persistence with mothers and increased over time had the highest teacher-rated attention problems in kindergarten. This profile was associated with lower inhibitory control, higher verbal skills, and higher maternal directives. It is possible that dysregulated children who required extra effort from mothers and were able to make use of this direction via their cognitive skills were the same children teachers perceived as having difficulties and requiring extra assistance to remain on-task in the classroom. This group had higher attention problems than the slow decline, rapid decline, and low persistence profiles, suggesting that those at highest risk for attention problems may be those who prompt extra effort from caregivers as compared to those who generally struggle with task persistence.

Notably, the stable low persistence profile also showed significantly higher attention problems than the slow decline profile, meaning the two profiles showing significantly higher attention problems than others were the only two profiles with low *initial* task persistence with mothers. Thus, low intercepts of observed task persistence with caregivers may be a particular marker of future risk, perhaps reflecting the effort required by the caregiver to engage the child, whether those efforts appear successful (increasing profile) or not (low profile). As these significant differences were discovered based on only a few minutes of dyadic interaction, this suggests that future work could pay special attention to these initial minutes and that better assessments of caregiver perceptions of the effort needed to engage the child may be useful. Covariates of these profiles also suggest that children with higher cognitive skills but poorer self-regulation, and children experiencing low praise from mothers (stable low persistence profile), may be at particular risk for teacher-rated attention problems.

These findings build on prior work showing that early mother-child interactions predict children's task persistence in kindergarten (Neitzel & Stright, 2003) and that early parent-child interactions may be a useful target for the assessment and promotion of school readiness (McClelland et al., 2013). The comparative lack of distal findings for fathers could signify that regulatory behaviors with mothers are more representative of school behavior or teacher ratings, given that prior research has shown maternal support to be a stronger predictor of child outcomes than paternal support (Tamis-Lemonda, Shannon, Cabrera, & Lamb, 2004).

Limitations, Future Directions, and Conclusions

We examined attention problems in children overrecruited for behavior problems, but attention problems were not high in this sample (8% total in borderline or clinical range based on T-scores) and overall the sample was not high-risk. Thus, the present findings may generalize to

children at risk for attention problems but not to those with clinical levels of attention problems. Relations between task persistence profiles and kindergarten problems were limited to interactions with mothers (as compared to fathers), and groups showing significant differences in attention problems were smaller in size (relative to the high task persistence class). Though our *n* for father-child dyadic observations was large for the available literature on fathers, and model fit indices were significant, the *n* was still modest for our chosen analytic models. Thus, these relations should be examined with larger samples to increase analytic power and determine if findings are replicated for both mothers and fathers. More microscopic measurement of task persistence (shorter than 30s intervals) could also increase ecological validity and reveal more information about moment-to-moment regulatory behaviors in the context of parental guidance. Cross-sectional relations at Time 1 cannot be used to estimate causal relations among parent and child factors, thus future work could tease apart directionality to better estimate parent vs. child effects in relations among parenting, child temperament, and real-time behavioral patterns.

Children could show similarity in task persistence across parents due to shared environmental factors within the family, such as educational resources, parenting values, or household routines. We examined within-child class membership with mothers vs. fathers post-hoc but not within primary models due to differences in mother-father subsample sizes. Thus, future work could address this influence of shared environmental factors. Given there were also differences across parents within-child, another question is whether mothers and fathers play different roles (e.g., compensatory) in supporting children's regulatory development; for example, perhaps mothers are more likely to socialize consistency in behavior whereas fathers are more likely to socialize responses to variability or change. Other unmeasured differences between mothers and fathers (e.g., sensitivity) and other parenting behaviors that inform

moment-to-moment scaffolding also could have contributed to differences in task persistence and could be addressed in future work. Future research could also incorporate a wider variety of family structures (e.g., same-sex parents) and more sociodemographically heterogeneous samples to better understand how parents shape children's regulatory development.

Developmental researchers have called for the study of dynamic, real-time responses to interpersonal contexts to operationalize regulatory processes in more ecologically valid ways and obtain richer scientific knowledge of regulatory development (e.g., Cole et al., 2004; Lunkenheimer, Kemp, et al., 2017). By identifying person-centered patterns of real-time regulatory processes that contribute to adaptive versus maladaptive outcomes and situating these processes in ecological contexts with an appreciation for both internal and external influences, we may better delineate normative from atypical developmental pathways in children's regulatory development.

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Table 1

Descriptive Data and Correlations

	1	2	3	4	5	6	7	8	9	10	11	*N*	*M*	*SD*
1. Persistence w/ mother	1											214	2.97	.948
2. Child negative emotion w/ mother	-.392***	1										216	1.12	.267
3. Maternal praise	.281***	-.126	1									222	9.56	7.03
4. Maternal directives	-.325***	.163*	.161*	1								222	13.16	11.97
5. Persistence w/ father	.513***	-.243**	.098	-.156	1							117	2.66	1.03
6. Child negative emotion w/ father	-.397***	.084	-.066	.124	-.516***	1						119	1.13	.242
7. Paternal praise	.250**	-.097	.026	-.253**	.447***	-.250**	1					119	8.79	8.91
8. Paternal directives	-.115	.087	.054	.161	-.205*	.050	.118	1				119	14.81	14.35
9. Child verbal skills	.133*	-.092	.029	-.199**	.189*	-.236*	.133	-.027	1			215	11.36	3.48
10. Child inhibitory control	.077	-.022	.098	-.201**	.143	.143	.175	-.158	.227**	1		221	4.59	.722
11. Preschool attention problems	-.109	.027	-.068	.225**	-.131	.008	-.256*	.024	-.114	-.366***	1	178	4.86	5.84
12. Kindergarten attention problems	-.159*	.029	-.054	.188*	-.185	.022	-.052	.191	-.024	-.243**	.450***	181	5.83	7.67

*$p < .05$ **$p < .01$ ***$p < .001$

Table 2

Latent Growth Curve Model Fit for Initial Tests of the Functional Form of Task Persistence

	Mother-Child (N = 214)		Father-Child (N = 117)	
	Linear	Quadratic	Linear	Quadratic
!"	37.099 (16)***	19.215 (12)^{ns}	38.678 (16)**	14.041 (12)^{ns}
AIC	3598.383	3585.063	2164.660	2145.731
BIC	3635.409	3635.553	2195.044	2187.163
RMSEA	0.078	0.053	0.110	0.038
	(CI: 0.045; 0.112)	(CI: 0.000; 0.095)	(CI: 0.066; 0.155)	(CI: 0.000; 0.106)
CFI	0.943	0.980	0.878	0.989
SRMR	0.060	0.033	0.101	0.054

*p < .05 **p < .01 ***p < .001

Table 3

Unconditional Model Comparison for Number of Latent Trajectory Classes for Mother-Child and Father-Child Dyads

	Mother-Child (N = 214)			Father-Child (N = 117)		
Trajectory Class	SSA-BIC	B-LRT	Entropy	SSA-BIC	B-LRT	Entropy
1	4132.479	--	--	2389.778	--	--
2	3571.917	569.350***	0.937	2119.660	276.522***	0.978
3	3449.274	131.432***	0.966	2066.308	59.756***	0.992
4	3323.155	134.908***	0.974	1964.229	122.709***	0.992
5	3227.253	104.691***	0.980	Non-convergence		

Note: SSA-BIC = sample size-adjusted Bayesian information criteria, B-LRT = bootstrapped likelihood ratio test. *p < .05 **p < .01 ***p < .001

Table 4

Covariate Means and Standard Deviations for Mother-Child and Father-Child Models

	Mother-Child Task Persistence Class									
	High		Increasing		Slow Decline		Rapid Decline		Low	
	(*n* = 104)		(*n* = 16)		(*n* = 31)		(*n* = 24)		(*n* = 39)	
Covariates	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Preschool attention problems	4.131	5.098	7.625	8.733	2.500	3.098	6.263	7.256	5.875	6.058
Child sex	50% female		38% female		58% female		44% female		45% female	
Verbal skills	11.384	3.437	12.133	3.378	11.516	3.171	11.286	3.243	10.351	3.537
Inhibitory control	0.006	2.362	-2.433	2.176	-0.074	2.694	-0.786	2.534	-0.502	2.005
Child negative emotion	1.062	0.157	1.054	0.088	1.100	0.209	1.192	0.210	1.290	0.489
Maternal praise	10.709	6.925	9.750	6.758	9.710	7.221	9.541	8.241	5.816	5.088
Maternal directives	9.893	8.411	18.063	12.861	12.258	10.745	21.083	19.724	17.079	11.963

	Father-Child Task Persistence Class							
	High		Early Decline/Late Increase		Early Increase/Late Decline		Low	
	(*n* = 45)		(*n* = 12)		(*n* = 21)		(*n* = 39)	
Covariates	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Preschool attention problems	3.438	5.003	6.364	8.213	4.059	4.351	5.500	5.922
Child sex	42% female		33% female		62% female		54% female	
Verbal skills	12.907	3.890	11.250	3.596	11.619	3.450	10.676	3.310
Inhibitory control	-0.073	2.184	-0.432	2.261	-0.666	2.543	-1.005	2.057
Child negative emotion	1.025	0.072	1.325	0.630	1.104	0.202	1.222	0.406
Paternal praise	9.533	5.097	10.800	8.979	11.857	10.195	8.132	7.125
Paternal directives	9.822	8.534	10.000	9.381	17.667	20.922	15.421	9.989

Table 5

Class Membership for Mother-Child and Father-Child GBTM Models with Covariates and Kindergarten Outcomes

		Mother-Child Task Persistence Class							
		High		Increasing		Slow Decline		Rapid Decline		Low	
Outcome											
Kindergarten attention problems (*M*)		5.219		11.578		3.964		6.557		6.801	
Covariates	Reference Class	*B*	*SE B*	*B*	*SE B*	*B*	*SE B*	*B*	*SE B*
Preschool attention problems		-0.007	0.082	-0.113	0.058	0.006	-.053	0.010	0.043
Child sex		-0.367	0.886	-0.044	0.514	0.516	0.573	0.352	0.543
Verbal skills		0.237**	0.084	0.044	0.069	0.044	0.93	-0.062	0.093
Inhibitory control		-0.544*	0.260	-0.100	0.133	-0.194	0.144	-0.030	0.124
Child negative emotion		-1.355	2.404	1.032	1.275	1.488	1.250	2.190†	1.252
Maternal praise		-0.094	0.058	-0.041	0.039	-0.104†	0.054	-0.202**	0.060
Maternal directives		0.096**	0.028	0.046	0.029	0.106**	0.033	0.097***	0.028

		Father-Child Task Persistence Class					
		High	Early Decline/Late Increase		Early Increase/Late Decline		Low
Outcome							
Kindergarten attention problems (*M*)		5.579	1.802		4.002		7.255
Covariates	Reference Class		*B*	*SE B*	*B*	*SE B*	*B*	*SE B*
Preschool attention problems			0.067	0.070	-0.040	0.072	0.032	0.062
Child sex			-0.207	0.852	0.411	0.784	0.795	0.771
Verbal skills			-0.198	0.145	-0.248†	0.145	-0.238	0.151
Inhibitory control			0.272	0.212	0.199	0.220	0.342*	0.161
Child negative emotion			9.084*	4.352	6.685	4.783	10.639*	4.441
Paternal praise			-0.071	0.048	-0.177**	0.065	-0.238***	0.066
Paternal directives			0.014	0.039	0.059	0.037	0.040	0.035

Note: Beta values represent multinomial logistic regression coefficients in log odds units. Models were estimated using a variance equality constraint; mother-child outcome *SD* = 7.54 and father-child outcome *SD* = 7.00. †$p < 0.10$ *$p < .05$ **$p < .01$ ***$p < .001$

(a) (b)

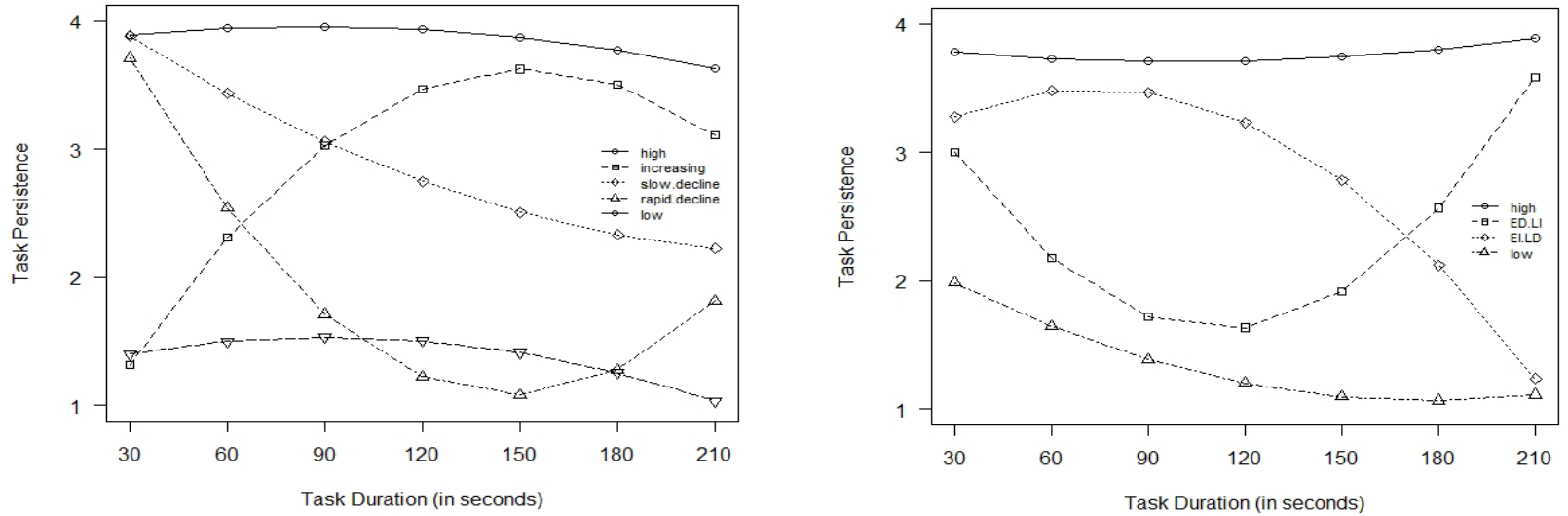

Figure 1. Estimated sample means for (a) mother-child and (b) father-child task persistence trajectories
Note: ED/LI = early decline/late increase; EI/LD = early increase/late decline