HHS Public Access

Author manuscript

J Child Fam Stud. Author manuscript; available in PMC 2018 May 01.

Published in final edited form as:

J Child Fam Stud. 2017 May ; 26(5): 1481–1490. doi:10.1007/s10826-016-0633-0.

It's OK to Fail: Individual and Dyadic Regulatory Antecedents of Mastery Motivation in Preschool

Erika Lunkenheimer[1,2] and **Jun Wang**[3]

[1]Colorado State University

[2]Pennsylvania State University

[3]Tufts University

Abstract

Mastery motivation is closely related to children's regulatory processes and is socialized by parents. However, we know little about how individual child and dyadic parent-child regulatory processes work together to foster the early development of mastery motivation in preschool. The present study examined dyadic persistence in parent-child interactions, children's effortful control, and children's successful versus failed attempts in a challenging object mastery task at age 3.5 years and their prediction of teacher ratings of object-oriented and social mastery motivation in preschool at a 4-month follow-up ($N = 100$). Path analytic models revealed that greater dyadic persistence during parent-child interactions predicted children's higher levels of social mastery. A greater rate of both successful and failed attempts at a challenging task predicted children's higher levels of object mastery. However, failed attempts were positively related to concurrent individual and dyadic regulatory measures, whereas successful attempts were not. Findings suggest that parent-child coregulation makes a significant contribution to mastery motivation development and that there may be distinct antecedents for object-oriented versus social forms of mastery motivation. Findings also suggest that a child's early ability to persist in the face of failure may be an important predictor of mastery motivation in preschool.

Keywords

mastery motivation; self-regulation; effortful control; parent-child interaction; school readiness

Corresponding author: Erika Lunkenheimer, PhD, Associate Professor, Psychology, Pennsylvania State University, 140 Moore Building, University Park, PA, 16801, (814) 863-1991, ezl5238@psu.edu.

Compliance with Ethical Standards

This manuscript was prepared in accord with the ethical standards of the American Psychological Association and the National Institutes of Health. This research was funded by the National Institute for Child Health and Human Development. There were no conflicts of interest involved in producing this manuscript or in submitting to the Journal of Child and Family Studies. This research involved human subjects, not animal subjects, and all aspects of the study were approved by the Research Integrity and Compliance Review Office at the university at which the research was conducted. Adult research participants completed a written informed consent procedure regarding their participation in the study and preschool children completed a verbal assent procedure.

Introduction

Researchers and educators have long speculated about the best way to foster children's intrinsic ability and motivation to persist at an other-directed task (Redding, Morgan, & Harmon, 1988), such as the teacher-directed tasks children encounter daily in school. Children's abilities to regulate themselves, such as inhibiting impulsive and dysregulated behavior, are thought to underlie mastery motivation in the school context (Chang & Burns, 2005). Therefore, understanding the self-regulatory antecedents of mastery motivation may be important in promoting mastery in school (Wigfield & Eccles, 2002; Zimmerman, 2000). Given this important role of early self-regulation, support of self-regulation and task persistence by parents may also be an important antecedent to mastery motivation (Kelley, Brownell, & Campbell, 2000; Ryan & Deci, 2000a). Accordingly, in the present study we examined whether individual and dyadic regulatory processes predicted children's mastery motivation in preschool, accounting for the child's performance (successes and failures) on an object mastery task.

Mastery motivation has been defined as, "a psychological force that stimulates an individual to attempt independently, in a focused and persistent manner, to solve problems and master a skill or task that is moderately challenging to him or her" (Morgan, Harmon, & Maslin-Cole, 1990, p. 319). Thus, task-oriented persistence is part of the definition of mastery motivation, and also acts as an index of self-regulation in early childhood (Rothbart & Bates, 2006). Although task persistence appears fairly stable in infants and toddlers (Maslin-Cole, Bretherton, & Morgan, 1993), evidence for continuity in task persistence from preschool onward has been mixed or lacking (Maslin-Cole et al., 1993). Whereas some research shows a crucial role of early task persistence in predicting school-age children's mastery and achievement (Berhenke, Miller, Brown, Seifer, & Dickstein, 2011), other research has found that social aspects of self-regulation are better predictors than task persistence of later academic outcomes (Drake, Belsky, & Fearon, 2014). These mixed findings may be due to the contextual dependency of other-oriented tasks and the variety of socialization influences children experience around persistence and mastery, including differing reward structures and differential modeling by caregivers (Ryan & La Guardia, 2000). These inconsistencies underscore the importance of obtaining a better understanding of how both dyadic and individual regulatory processes contribute to the development of mastery motivation during this developmental period.

Another regulatory construct that may underlie mastery motivation is effortful control. Effortful control is defined as suppressing a dominant impulse and initiating and sustaining a subdominant response per environmental demands (Rothbart & Bates, 2006). In childhood, these demands typically consist of a parent or teacher requesting the child's persistence on a task. Considering that motivation to persist in the face of failure may reflect an ability to persist without immediate rewards, this ability may be more likely to overlap with effortful control. Compared to aspects of self-regulation such as reactivity, persistence and effortful control develop later, become more voluntary, and are shaped by caregivers throughout early childhood (Kochanska, Murray, & Harlan, 2000; Rothbart & Bates, 2006). Children at greater risk (e.g., from low-income families) show declines in persistence from preschool to first grade (McDermott, Rikoon, & Fantuzzo, 2014) and low levels of persistence from age 5

to 10 years (Zhou et al., 2007). Thus, a better understanding of what shapes the development of mastery motivation in early childhood could inform how parents and teachers optimally support the regulatory behaviors that underlie mastery motivation, particularly for children at greater risk.

Whereas regulatory skills may facilitate mastery motivation, exposure to success is also important in cultivating mastery experiences (Martens & Witt, 2004). Children who are successful at a task tend to persist more at that same task (Maslin-Cole et al., 1993). Children typically set their expectations lower after failing at a task, and set them higher or do not change them after experiencing success (Lehto, 2004). But occasional experiences of failure may also be important. Theorists argue that experiences with small failures, coupled with adaptive responses to those failures, may assist in the child's intrinsic motivation to persist at object-oriented and social goals (Harter, 1978; Zimmerman, 2000). Conversely, too few or no experiences of failure may have negative implications for children's motivation and persistence. Therefore, accounting for children's experiences of success and failure in the examination of links between regulatory processes and mastery motivation may be important given that both success and failure may be important in developing mastery orientation.

Though children's individual self-regulatory skills may contribute to mastery motivation (Barrett & Morgan, 1995), mastery motivation is also socialized by the environment. Positive parental support on challenging tasks should provide a context for mastery development as children learn from others how to persist in the face of difficulty (Vygotsky, 1978). As evidence, parental scaffolding and responsiveness (Mulvaney, McCartney, Bub, & Marshall, 2006), proactive parenting (Lunkenheimer, Kemp, & Albrecht, 2013), and positive affective exchanges (Wang, Morgan, & Biringen, 2014) predict higher levels of self-regulation and mastery in early childhood. What has not been fully considered in prior research, however, is whether patterns within parent-child task-oriented interactions, for example dyadic persistence toward a shared goal, help to foster mastery motivation in the child (although see Kochanska & Kim, 2014 for an exception). Prior research has tended to focus on the caregiver's response to the child's success or failure, or direct parental support of the child's persistent behavior, rather than dyadic persistence in situations in which parent and child work together on goal-oriented tasks.

In the present study we investigated parent-child dyadic persistence, child effortful control, and children's object mastery task performance and their prediction of children's mastery motivation in preschool as rated by teachers. The primary goal was to understand whether dyadic parent-child coregulatory behavior contributed to children's early mastery motivation, and how its contributions compared to those of individual child factors in predicting early mastery motivation. In this examination, we accounted for children's task performance by assessing both successful and failed attempts at an experimentally manipulated (partially impossible) object mastery task. A secondary goal was to examine the antecedents of three different components of mastery motivation in the preschool setting: object mastery, social mastery with teachers, and social mastery with peers. We hypothesized that higher levels of dyadic persistence, children's effortful control, and successful and failed attempts at an object mastery task would predict children's greater

mastery motivation in preschool. However, we did not make specific hypotheses about whether antecedents would be differentially related to the three different components of mastery motivation, as this was an exploratory question.

Method

Participants

Participants were 100 children and their families (54% female), identified as 86% White, 8% Biracial, 3% Asian, and 3% "other" race, and as 10% Hispanic or Latino ethnicity. Children were 41 months old on average at Time 1 (T1; *SD* = 3, *Range* = 37.74 – 44.15) and 45 months at Time 2 (T2; *SD* = 3, *Range* = 42.02 – 48.46). Median annual family income was $65,000 and parental education was high on average (college graduate). Of biological parents, 79% were married, 7% cohabiting, 7% single, 5% separated or divorced, and 1% remarried. Participants were recruited via flyers placed in day care centers, preschools, and businesses, and through email listserves of agencies serving families with young children. Families were excluded if they could not speak and read in English, if children had a pervasive developmental disorder, or if parents or children had a heart condition that interfered with physiological data collection.

Procedure

The present study was part of a larger study investigating parent-child interaction in relation to children's self-regulation. During a 2.5-hour laboratory visit at T1, mothers filled out questionnaires while the child was completing tasks with the examiner including an object mastery task, an effortful control battery, and a vocabulary skills test. Mothers and children also completed dyadic tasks, including a problem-solving task. Families were compensated $50. At T2, teachers completed questionnaires online, including an assessment of the child's object and social mastery motivation in the preschool setting, and were compensated with a $20 gift card. Sixty-seven of the 100 teachers agreed to participate. This group of children for whom teachers declined to participate or could not be reached did not differ significantly on any study variables.

Measures

Effortful control—Effortful control was assessed using three observed tasks from a behavioral battery (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996). The Tower Task assessed the ability to suppress and initiate behaviors in a turn-taking situation; the proportion of turns correctly initiated by the child out of the total possible turns was averaged across two trials. The Snack Delay assessed the ability to delay gratification and suppress and initiate impulses concerning food; children were scored on their ability to delay behaviors (e.g., eating the candy) until after the experimenter had lifted and/or rung a bell and scores were averaged across four trials. The Gift Delay assessed the ability to delay gratification by waiting for a gift to be wrapped; scores were an aggregate of the latencies to peek or touch the gift and the strategies used to peek at or touch the gift (e.g., touches or lifts the gift). Individual task scores were standardized and averaged to compute a total effortful control score (alpha = .79).

Successful versus failed attempts—To account for object mastery task performance, we utilized a fishing task (Gilmore & Cuskelly, 2009) in which children fished sea creatures out of a Tupperware container with a magnetic fishing rod. The majority of the task was easy or mildly challenging but possible to complete, and a small portion was impossible to complete; this design has been used in prior research on object mastery (Morgan, Busch-Rossnagel, Maslin-Cole, & Harmon, 1992). Following a brief demonstration, children were instructed to use the fishing rod to fish 12 creatures out of the pool one by one and put them on the table. The center of each creature was embedded with metal and these metal pieces had been manipulated to vary in size: 6 were large and therefore easy to pick up with the magnet, 4 were medium and mildly difficult to pick up, and 2 were small and extremely difficult to pick up (impossible for most three year-olds). Creatures were placed randomly so that the order of exposure to the possible versus impossible creatures would vary randomly, and sufficient time was provided to attempt all 12 creatures (8 minutes). There was a potential cap on the number of successful attempts matching the number of possible pieces, but no cap on the potential number of failed attempts using the impossible pieces. We interpreted the number of failed attempts in this task as a proxy of the child's persistence in the face of failure, given that a higher number of failed attempts reflected the child's choice to make repeated attempts to complete the impossible pieces.

The task was recorded in Noldus Observer XT 8.0 software and coders were tested for reliability on 20% of the dataset in relation to a standard set by the second author, and an 80% agreement or better interrater reliability criterion was met. *Success* was coded when the child successfully attached one sea creature to the fishing rod, fished it out, and then dropped it onto the table as instructed. *Failure* was coded when the child successfully attached a creature to the fishing rod, however briefly, but then the creature dropped off the rod and fell back into the pool, regardless of how close the child came to fishing it out. All remaining behavior was coded as *No Outcome* to distinguish it from episodes where a successful or failed attempt was made; for example, when the child was trying to attach the fishing rod to a sea creature. The total counts of successful and failed attempts, respectively, were then divided by the total task time (8 minutes) to compute the rates per minute at which children made successful or failed attempts.

Dyadic task persistence—A problem-solving task was used to assess observed dyadic persistence during a challenging situation; please see Lunkenheimer, Kemp, Lucas-Thompson, Cole, & Albrecht (2016) for a detailed task description. Mothers were instructed to help their children complete three 3D puzzle designs that increased in difficulty over time using only their words in order to win a prize (all children received the prize regardless). The task was recorded in Noldus Observer XT 8.0 and coded with a coding system for parent-child interactions (Lunkenheimer, 2009). Coders were tested for reliability on 20% of the dataset in relation to a standard set by the first author, and an 80% agreement or better interrater reliability criterion was met. There were nine codes for parent behavior (teaching, directive, proactive structure, positive reinforcement, emotional support, engagement, disengagement, intrusion, and negative discipline) and seven codes for child behavior (compliance, persistence, social conversation, solitary/parallel play, noncompliance, disengagement, and behavioral dysregulation).

Dyadic persistence was computed using State Space Grids (SSGs) in GridWare 1.1 (Lamey, Hollenstein, Lewis & Granic, 2004). SSGs allow for observational data to be quantified as two ordinal variables that define a state space for a system (Hollenstein, 2007). Each cell on the grid represents a dyadic state defined by a combination of specific behaviors (e.g., parent directive – child compliance). Given the nine codes for parent behavior and seven codes for child behavior, this produced a 63-cell grid upon which the trajectory of dyadic states was plotted. We focused on the adaptive behavior region of the grid that included only positive or neutral behaviors for the parent (proactive structure, teaching, directive, positive reinforcement, emotional support, engagement) and child (compliance, persistence, social conversation, solitary/parallel play). Dyadic persistence was defined as a longer average duration per visit in seconds for all behavior within this adaptive region (where a visit represents any transition into a new dyadic behavioral state on the grid; see Figure 1 where a larger data point represents a longer duration in that state). In other words, if once the dyad entered an adaptive dyadic state to accomplish their goal they were more likely to persist in that state longer as opposed to changing strategies, they were rated as having higher dyadic persistence. Thus, in a fixed-time task, when the dyad showed fewer states with longer durations as opposed to more states with shorter durations, we operationalized this as greater dyadic persistence. Figure 1 displays examples of dyads showing lower vs. higher dyadic persistence as modeled by SSGs.

Receptive vocabulary skills—In analytic models, we controlled for the child's receptive vocabulary skills, which could have influenced the child's understanding of the object mastery task instructions and therefore rates of success and failure in the task. The Wechsler Preschool and Primary Scale of Intelligence third edition (WPPSI-III; Wechsler, 2002) was used to assess receptive vocabulary. This subtest measures understanding of verbal directions, auditory memory, auditory processing, auditory and visual discrimination, integrating visual perception and auditory input, and phonological and working memory. Children are shown four pictures per page and asked to point to the picture that depicts a certain word stated by the experimenter (e.g., "Show me the lamp" or "Show me drawing"); there are 38 total items. When children make 5 incorrect responses in a row, the task is ended. The receptive vocabulary score is the sum of the child's correct responses.

Mastery pleasure—In analytic models, we controlled for the child's mastery pleasure, or their enjoyment of accomplishing goals. Mastery pleasure is an important component of mastery motivation (Morgan et al., 1990) and could have influenced rates of success and failure during the object mastery task. Parents completed the Dimensions of Mastery Questionnaire (Morgan, Busch-Rossnagel, Barrett, & Wang, 2009). Five items made up the mastery pleasure subscale, which reflected children's positive emotional expressions during or upon goal attainment. Items included, "Shows excitement when he or she is successful," and "Smiles broadly after finishing something" (Cronbach's alpha = .88).

Object-oriented and social mastery motivation (MM)—Teachers' ratings on the DMQ (Morgan et al., 2009) at T2 were used to capture object MM, social MM with teachers, and social MM with peers in preschool. *Object MM* was based on a six-item subscale that measured the degree to which children were motivated to master object-

oriented tasks (Cronbach's alpha = .91). Items included, "Works for a long time trying to do something hard," and "Repeats a new skill until he or she can do it well." *Social MM with adults* was assessed using a seven-item subscale that measured the degree to which children were motivated to master interactions with teachers (Cronbach's alpha = .84). Items included, "Tries hard to interest adults in playing with him or her," and "Likes to play actively with me or other adults." *Social MM with children* was assessed using a seven-item subscale that measured the degree to which children were motivated to master peer interactions (Cronbach's alpha = .90). Items included, "Tries hard to understand other children's feelings," and "Tries hard to make friends with other kids."

Data Analyses

First, preliminary analyses were performed to examine variable distributions and sociodemographic factors. Descriptive analyses and bivariate correlations were also performed. In primary analyses, we examined whether effortful control, dyadic persistence, and children's successful versus failed attempts at a challenging object mastery task predicted the three dimensions of teacher-rated MM, controlling for the child's vocabulary skills and mastery pleasure. These relations were examined in a path analytic model performed in Mplus version 5 (Muthén & Muthén, 1998–2007) using full information maximum likelihood estimation, which accommodates missing data by estimating each parameter using all available data for that parameter. Data met criteria for the use of maximum likelihood estimation (Allison, 2003). Data was missing completely at random according to Little's (1998) test, $\chi^2(43) = 39.28$, *ns*. Assumptions of normality were met for object persistence, Shapiro-Wilk's $W(56) = .97$, *ns*, social persistence with teachers, $W(56) = .96$, *ns*, and social persistence with peers, $W(56) = .96$, *ns*.

The comparative fit index (CFI), root-mean-square error of approximation (RMSEA), and standardized root mean square residual (SRMR) were used to assess model fit. A CFI of .90 and above indicates adequate fit and .95 and above indicates good fit (Hu & Bentler, 1995). RMSEA values less than .08 indicate adequate fit and values less than .05 indicate a good fit (Browne & Cudeck, 1993). SRMR values less than .08 indicate good fit (Hu & Bentler, 1995).

Results

Table 1 includes descriptive statistics of all study variables. Failed attempts were normally distributed but successful attempts were not, $D(89) = 1.59$, $p < .05$, perhaps due to kurtotic clustering around the number of attempts that mapped on to the number of pieces that were easy to use. Mastery pleasure also showed a non-normal distribution, $D(100) = 2.65$, $p < .001$, suggesting that most mothers rated children high on mastery pleasure. These two variables were transformed with a natural logarithmic transformation prior to primary analyses. All other variables were normally distributed. The sociodemographic factors of socioeconomic status, maternal education, child gender, and child ethnicity were not related to the variables of interest.

As shown in Table 2, failed attempts were positively correlated with vocabulary skills, effortful control, dyadic persistence, and object MM at T2, whereas successful attempts

were not correlated with individual or dyadic regulatory indices or MM outcomes. Dyadic persistence was positively related to social MM with teachers and peers at T2. Within the set of outcome variables, object MM was intercorrelated with social MM with teachers, and the two forms of social MM were interrelated; however, object MM was not related to social MM with peers.

In primary path analytic analyses performed to test our main research questions, model fit was strong, $\chi^2(5)=5.47$, *ns*, CFI = .99, RMSEA = .03, SRMR = .05. Standardized parameters are shown in Figure 2. Children's rates of successful and failed attempts on the object mastery task both predicted object MM, though not social MM, in the preschool setting. The rate of failed attempts was also positively associated with concurrent vocabulary skills, effortful control, and persistence in the parent-child dyad. In contrast, the rate of successful attempts was not related to effortful control or dyadic persistence and was negatively associated with children's vocabulary skills. Thus, the rate of failed attempts, which we interpreted as persistence in the face of failure given our task design, was a correlate of parent-child coregulation and child self-regulation while the rate of successful attempts was not.

Dyadic persistence predicted social MM with both teachers and peers in the preschool setting, though not object MM. Thus, the antecedent that was relational in nature (parent-child coregulation) predicted social MM, whereas an object-oriented antecedent (successful and failed attempts) predicted object MM. Though effortful control showed positive relations with children's persistence in the face of failure, it did not predict children's MM in preschool.

Finally, in terms of the three outcomes reflecting different dimensions of MM, object MM was related to social MM with teachers, and the two forms of social MM were interrelated. However, object MM and social MM with peers were not interrelated. Overall, this model accounted for 18% of the variance in object MM, $SE = .09$, $p < .05$, and 15% of the variance in social MM with teachers, $SE = .08$, $p < .05$. It was marginally significant in explaining the variance in social MM with peers, Estimate = .11, $SE = .07$, $p < .10$.

Discussion

In order to master a task, children need the regulatory skills and executive functions to choose a strategy and see it through, even when their initial efforts are not successful (Chan & Moore, 2006). They also need the support from caregivers that allows them to tolerate failure and persist until they master their goals (Jeon, Peterson, & DeCoster, 2013). These processes lay the foundation for mastery motivation and academic achievement in the school years (Martens & Witt, 2004). Thus, an important question is how individual and dyadic regulatory processes lay the groundwork for the development of mastery motivation that is applied in the school setting.

We found that dyadic persistence between parents and children predicted social mastery with teachers and peers in the preschool setting. This offers novel evidence suggesting that parents' and children's joint focus and persistence on a challenging, goal-oriented task

contributes to the child's ability to persist in the context of social relations in preschool. Prior research has addressed socialization of persistence and related regulatory skills in multiple ways, including parental support and control styles (Kelley et al., 2000; Jeon et al., 2013; Robinson, Burns, & Davis, 2009; Walker & MacPhee, 2011), parental expectations of success (Lobel & Bempechat, 1992), and parental performance feedback (Kelley et al., 2000). However, little research has addressed how persistence might be modeled or practiced within the context of dynamic parent-child interactions. Our dynamic systems-based measure allowed us to capture the degree to which parent and child were focused in their strategies toward a common goal.

The effects of dyadic persistence echo prior work showing that a mutually responsive orientation between parent and child (including coordinated routines, mutual cooperation, and harmonious communication) contributes to the child's effortful control and internalization of codes of conduct (Kochanska & Kim, 2014). We also found that dyadic persistence was related to the child's repeated failed attempts at impossible pieces of a difficult task, which we interpreted as a proxy of persistence in the face of failure. Taken together, the present findings imply that optimal coregulation in the form of dyadic persistence contributes not just to the child's social mastery in other important settings and relationships, but may also contribute to the child's persistence in the face of difficulty, perhaps through the modeling of persistent behavior.

Individual child self-regulation in the form of effortful control did not predict mastery motivation, which was surprising given that regulatory constructs like attention and persistence are thought to underlie both effortful control and mastery motivation (Chang & Burns, 2005). However, effortful control was related to children's object mastery task failures. Thus, overall, when children showed higher persistence on the impossible pieces of the task, this was related to higher vocabulary skills, effortful control, and dyadic persistence in mother-child interactions. Further, failed attempts were a correlate of effortful control whereas successful attempts were not, although both success and failure predicted later mastery motivation. Successful attempts were also negatively, not positively, related to children's vocabulary skills; this finding may imply that children with lower vocabulary skills, perhaps as a proxy for lower cognitive skills, gave up on the difficult pieces of the task more quickly and spent more time on the easier pieces. Collectively, these findings revealed the importance of persistence in the face of failure as an individual factor that is positively related to self-regulation and predictive of mastery motivation.

These results on persistence in the face of failure may be important in light of the recent trend of overparenting (Segrin, Woszidlo, Givertz, & Montgomery, 2013), defined as developmentally inappropriate levels of involvement and directiveness and lower levels of autonomy granting with children (Padilla-Walker & Nelson, 2012). In these situations, the child presumably experiences fewer failures and has fewer opportunities to self-regulate following those failures. Accordingly, the present findings imply that we could encourage parents to help their children feel more comfortable with and persist in the face of small, task-oriented failures. Parents' views of failure as opportunities for learning (as opposed to debilitating) are predictive of children's more malleable perspectives on their own intelligence (Haimovitz & Dweck, 2016). Also, existing interventions have also found that

persistence in the face of failure can be an important goal for children in promoting school success (Paunesku et al., 2015).

When accounting for children's task performance, we included measures of both success and failure given prior research indicating that both may be important contributors to mastery motivation (De Castella, Byrne, & Covington, 2013). The fact that both predicted mastery motivation may reflect that a balance of successful and failed attempts is needed to optimize self-regulated learning (Gickling & Armstrong, 1978). However, differential relations with regulatory constructs also suggest that these processes may have different etiological pathways. Considering that effortful control is a temperament-based construct that was positively related to failed attempts, persistence in the face of failure may be more rooted in temperamental aspects of self-regulation (Ruff & Rothbart, 1996). The ability to effortfully sustain focus on a difficult task would presumably aid a child to persist even when they fail. In contrast, persistence during success could be more dependent on other factors that were not measured in the present study, such as rewards (Ryan & Deci, 2000b) or achievement attributions (Chan & Moore, 2006).

Although exploratory in nature, we examined whether individual and dyadic regulatory processes contributed differentially to object-oriented and social components of mastery motivation. We found continuity within each domain. Children's object-oriented performance in the laboratory predicted object-oriented mastery motivation in preschool, and dyadic parent-child persistence in the laboratory predicted social mastery motivation in preschool. Although these continuities may not be surprising, they reflect a novel contribution to the literature: they suggest that different components of children's early mastery motivation should be treated as distinct but related constructs and that they may have distinct etiological pathways. This raises the question of whether interventions to promote children's mastery could benefit from distinct approaches to promoting social mastery versus object-oriented mastery in school. Children may have strengths or weaknesses in each domain and interventions could be targeted accordingly; for example, children with poor caregiving experiences (e.g., abused children) may mistrust caregivers and thus have impaired social motivation with teachers that limits school success.

In terms of study limitations, one presumption we made was that the rate of failed attempts represented persistence in the face of failure. However, these attempts may have also reflected constructs we did not measure, such as intrinsic or extrinsic motivation, attentional control, or approach/avoidance tendencies. Other constructs that could be examined in future research include responsiveness to incentives or threat (Bjornebekk, 2007) or behavioral problems that could interfere with persistence such as ADHD (Hoza, Waschbusch, Owens, Pelham, & Kipp, 2001). Our dyadic persistence variable involved the assumption that persistence around a smaller number of adaptive strategies reflected the dyad's ability to persist towards completing their goal. However, there is the possibility that this measure also reflected other processes, such as flexibility or rigidity in the dyad's behavior, or the parent's creativity in devising different strategies to use; replication of the present findings will be important.

Of the three outcomes, the explained variance in social persistence with peers was only marginally significant, suggesting that a focus on unique antecedents of social persistence with peers is needed in future research. Also, we had limited outcome data at T2 given that only 2/3 of children's teachers agreed to participate, which may have reduced our power with which to detect effects; although this missing data was handled using maximum likelihood estimation in primary analyses, it may have affected bivariate correlations. A full sample of teacher respondents at T2 and comparable teacher-rated data at T1 with which to examine continuity in mastery motivation over time would have yielded more complete information.

Despite these limitations, the present findings parallel other work showing that children's self-regulation supports the development of adaptive behaviors in the school setting (Denham, Warren-Khot, Bassett, Wyatt, & Perna, 2012); that adaptive parent-child coregulation supports children's competence in preschool (Lunkenheimer et al., 2013); and that children need to experience both success and occasional (small) failures to develop the regulatory and mastery skills that help them to navigate the school context (Pomerantz, Wang, & Ng, 2005). These findings imply that children's early parent-child interactions and their abilities to persist at a task even when they fail may be useful targets for school readiness programming.

Acknowledgments

Research reported in this publication was supported by the National Institute of Child Health and Human Development of the National Institutes of Health under grant number K01HD068170. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

References

Allison PD. Missing data techniques for structural equation modeling. Journal of Abnormal Psychology. 2003; 112:545–557. DOI: 10.1037/0021-843X.112.4.545 [PubMed: 14674868]

Barrett, KC., Morgan, GA. Continuities and discontinuities in mastery motivation during infancy and toddlerhood: A conceptualization and review. In: MacTurk, RH., Morgan, GA., editors. Mastery motivation: Origins, conceptualizations, and applications. Westport, CT: Ablex; 1995. p. 57-93.

Berhenke A, Miller AL, Brown E, Seifer R, Dickstein S. Observed emotional and behavioral indicators of motivation predict school readiness in Head Start graduates. Early Childhood Research Quarterly. 2011; 26(4):430–441. [PubMed: 21949599]

Bjørnebekk G. Reinforcement sensitivity theory and major motivational and self-regulatory processes in children. Personality and Individual Differences. 2007; 43:1980–1990.

Browne, MW., Cudeck, R. Alternative ways of assessing model fit. In: Bollen, KA., Long, JS., editors. Testing structural equation models. Newbury Park, CA: Sage; 1993. p. 136-162.

Chan LK, Moore PJ. Development of attributional beliefs and strategic knowledge in years 5–9: A longitudinal analysis. Educational Psychology. 2006; 26(2):161–185.

Chang F, Burns BM. Attention in preschoolers: Associations with effortful control and motivation. Child Development. 2005; 76(1):247–263. DOI: 10.1111/j.1467-8624.2005.00842.x [PubMed: 15693770]

De Castella K, Byrne D, Covington M. Unmotivated or motivated to fail? A cross-cultural study of achievement motivation, fear of failure, and student disengagement. Journal of Educational Psychology. 2013; 105:861–880.

Denham SA, Warren-Khot HK, Bassett HH, Wyatt T, Perna A. Factor structure of self-regulation in preschoolers: Testing models of a field-based assessment for predicting early school readiness. Journal of Experimental Child Psychology. 2012; 111(3):386–414. [PubMed: 22104321]

Drake K, Belsky J, Fearon RMP. From early attachment to engagement with learning in school: The role of self-regulation and persistence. Developmental Psychology. 2014; 50(5):1350–1361. [PubMed: 23647414]

Gickling EE, Armstrong DL. Levels of instructional difficulty as related to on-task behavior, task completion, and comprehension. Journal of Learning Disabilities. 1978; 11(9):559–566.

Gilmore L, Cuskelly M. A longitudinal study of motivation and competence in children with Down syndrome: Early childhood to early adolescence. Journal of Intellectual Disability Research. 2009; 53:484–492. [PubMed: 19302472]

Haimovitz K, Dweck C. What predicts children's fixed and growth intelligence mind-sets? Not their parents' views of intelligence but their parents' views of failure. Psychological Science. 2016; 27:859–869. DOI: 10.1177/0956797616639727 [PubMed: 27113733]

Harter S. Effectance motivation reconsidered: Toward a developmental model. Human Development. 1978; 21(1):34–64.

Hollenstein T. State space grids: Analyzing dynamics across development. International Journal of Behavioral Development. 2007; 31(4):384–396.

Hoza B, Waschbusch DA, Owens JS, Pelham WE, Kipp H. Academic task persistence of normally achieving ADHD and control boys: Self-evaluations and attributions. Journal of Consulting and Clinical Psychology. 2001; 69(2):271–283. [PubMed: 11393604]

Hu, L., Bentler, PM. Evaluating model fit. In: Hoyle, RH., editor. Structural equation modeling: Concepts, issues, and applications. Thousands Oaks, CA: Sage; 1995. p. 76-99.

Jeon HJ, Peterson CA, DeCoster J. Parent–child interaction, task-oriented regulation, and cognitive development in toddlers facing developmental risks. Journal of Applied Developmental Psychology. 2013; 34(6):257–267.

Kelley SA, Brownell CA, Campbell SB. Mastery motivation and self-evaluative affect in toddlers: Longitudinal relations with maternal behavior. Child Development. 2000; 71(4):1061–1071. [PubMed: 11016566]

Kochanska G, Kim S. A complex interplay among the parent–child relationship, effortful control, and internalized, rule-compatible conduct in young children: Evidence from two studies. Developmental Psychology. 2014; 50:8–21. [PubMed: 23527491]

Kochanska G, Murray KT, Harlan ET. Effortful control in early childhood: continuity and change, antecedents, and implications for social development. Developmental Psychology. 2000; 36(2): 220–232. [PubMed: 10749079]

Kochanska G, Murray K, Jacques TY, Koenig AL, Vandegeest KA. Inhibitory control in young children and its role in emerging internalization. Child Development. 1996; 67:490–507. [PubMed: 8625724]

Lamey, A., Hollenstein, T., Lewis, MD., Granic, I. GridWare (Version 1.1). [Computer software]. 2004. http://statespacegrids.org

Lehto JE. A test for children's goal-directed behavior: A pilot study. Perceptual and Motor Skills. 2004; 98(1):223–236. [PubMed: 15058885]

Little RJA. A test of missing completely at random for multivariate data with missing values. Journal of the American Statistical Association. 1998; 83:1198–1202. DOI: 10.2307/2290157

Lobel TE, Bempechat J. Socialization of achievement: Influence of mothers' need for approval on children's achievement cognitions and behavior. Journal of Educational Psychology. 1992; 84(4): 529–536.

Lunkenheimer, E. Dyadic Interaction Coding Manual. Fort Collins, CO: Colorado State University; 2009. Unpublished manual

Lunkenheimer ES, Kemp CJ, Albrecht EC. Contingencies in parent-child teaching interactions and behavioral regulation and dysregulation in early childhood. Social Development. 2013; 22:319–339. [PubMed: 23645973]

Lunkenheimer E, Kemp CJ, Lucas-Thompson RG, Cole PM, Albrecht EC. Assessing biobehavioral self-regulation and coregulation in early childhood: The Parent-Child Challenge Task. Infant and Child Development. 2016; Advance online publication. doi: 10.1002/icd.1965

Martens BK, Witt JC. Competence, persistence, and success: The positive psychology of behavioral skill instruction. Psychology in the Schools. 2004; 41(1):19–30.

Maslin-Cole, C., Bretherton, I., Morgan, GA. Toddler mastery motivation and competence: Links with attachment security, maternal scaffolding, and family climate. In: Messer, DJ., editor. Mastery motivation in early childhood: Development, measurement, and social processes. New York: Routledge; 1993. p. 205-229.

McClelland MM, Cameron CE, Connor CM, Farris CL, Jewkes AM, Morrison FJ. Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. Developmental Psychology. 2007; 43(4):947–959. [PubMed: 17605527]

McDermott PA, Rikoon SH, Fantuzzo JW. Tracing children's approaches to learning through Head Start, kindergarten, and first grade: Different pathways to different outcomes. Journal of Educational Psychology. 2014; 106(1):255–267.

Morgan, GA., Busch-Rossnagel, NA., Barrett, KC., Wang, J. The Dimensions of Mastery Questionnaire (DMQ): A manual about its development, psychometrics, and use. Fort Collins, CO: Colorado State University; 2009.

Morgan, GA., Busch-Rossnagel, NA., Maslin-Cole, CA., Harmon, RJ. Individualized assessment of mastery motivation: Manual for 15 to 36 month old children. Fordham University, Department of Psychology; 1992. Unpublished manuscript

Morgan GA, Harmon RJ, Maslin-Cole CA. Mastery motivation: Definition and measurement. Early Education & Development. 1990; 1:318–339.

Mulvaney MK, McCartney K, Bub KL, Marshall NL. Determinants of dyadic scaffolding and cognitive outcomes in first graders. Parenting: Science and Practice. 2006; 6(4):297–320.

Muthén, LK., Muthén, BO. Mplus user's guide. 5. Los Angeles, CA: Muthén & Muthén; 1998–2007.

Padilla-Walker LM, Nelson LJ. Black hawk down?: Establishing helicopter parenting as a distinct construct from other forms of parental control during emerging adulthood. Journal of Adolescence. 2012; 35(5):1177–1190. [PubMed: 22503075]

Paunesku D, Walton GM, Romero C, Smith EN, Yeager DS, Dweck CS. Mind-set interventions are a scalable treatment for academic underachievement. Psychological Science. 2015; 26:784–793. DOI: 10.1177/0956797615571017 [PubMed: 25862544]

Pomerantz, EM., Wang, Q., Ng, F. The role of children's competence experiences in the socialization process: A dynamic process framework for the academic arena. In: Kail, R., editor. Advances in child development and behavior. San Diego, CA: Elsevier; 2005. p. 193-227.

Redding RE, Morgan GA, Harmon RJ. Mastery motivation in infants and toddlers: is it greatest when tasks are moderately challenging? Infant Behavior and Development. 1988; 11(4):419–430.

Robinson JB, Burns BM, Davis D. Maternal scaffolding and attention regulation in children living in poverty. Journal of Applied Developmental Psychology. 2009; 30:82–91.

Rothbart, MK., Bates, JE. Temperament. In: Damon, W.Lerner, R., Eisenberg, N., editors. Handbook of child psychology, Vol. 3: Social, emotional, and personality development. 6. New York: Wiley; 2006. p. 99-166.

Ruff, HA., Rothbart, MK. Attention in early development: Themes and variations. New York: Oxford University Press; 1996.

Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist. 2000a; 55(1):68–78. [PubMed: 11392867]

Ryan, RM., Deci, EL. When rewards compete with nature: The undermining of intrinsic motivation and self-regulation. In: Harackiewicz, CSJM., editor. Intrinsic and extrinsic motivation: The search for optimal motivation and performance. San Diego, CA: Academic Press; 2000b. p. 13-54.

Ryan, RM., La Guardia, JG. What is being optimized?: Self-determination theory and basic psychological needs. In: Abeles, SHQN., editor. Psychology and the aging revolution: How we adapt to longer life. Washington, DC: American Psychological Association; 2000. p. 145-172.

Segrin C, Woszidlo A, Givertz M, Montgomery N. Parent and child traits associated with overparenting. Journal of Social & Clinical Psychology. 2013; 32(6):569–595.

Vygotsky, LS. Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard Press; 1978.

Walker AK, MacPhee D. How home gets to school: Parental control strategies predict children's school readiness. Early Childhood Research Quarterly. 2011; 26(3):355–364.

Wang J, Morgan GA, Biringen Z. Mother–toddler affect exchanges and children's mastery behaviors during preschool years. Infant & Child Development. 2014; 23(2):139–152.

Wechsler, D. The Wechsler Preschool and Primary Scale of Intelligence. 3. San Antonio, TX: The Psychological Corporation; 2002.

Wigfield, A., Eccles, JS. The development of competence beliefs, expectancies for success, and achievement values from childhood through adolescence. In: Wigfield, A., Eccles, JS., editors. Development of achievement motivation. San Diego: Academic Press; 2002. p. 91-120.

Zhou Q, Hofer C, Eisenberg N, Reiser M, Spinrad TL, Fabes RA. The developmental trajectories of attention focusing, attentional and behavioral persistence, and externalizing problems during school-age years. Developmental Psychology. 2007; 43(2):369–385. [PubMed: 17352545]

Zimmerman, BJ. Attaining self-regulation: A social cognitive perspective. In: Boekaerts, M.Pintrich, PR., Zeidner, M., editors. Handbook of self-regulation. San Diego, CA: Academic Press; 2000. p. 13-39.

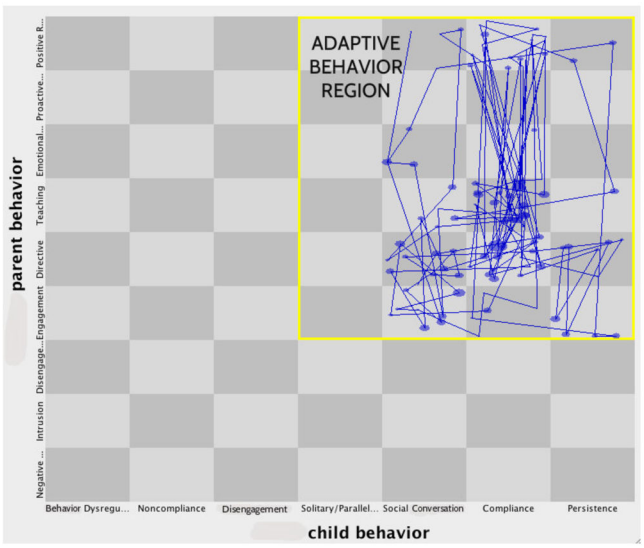

Figure 1a.

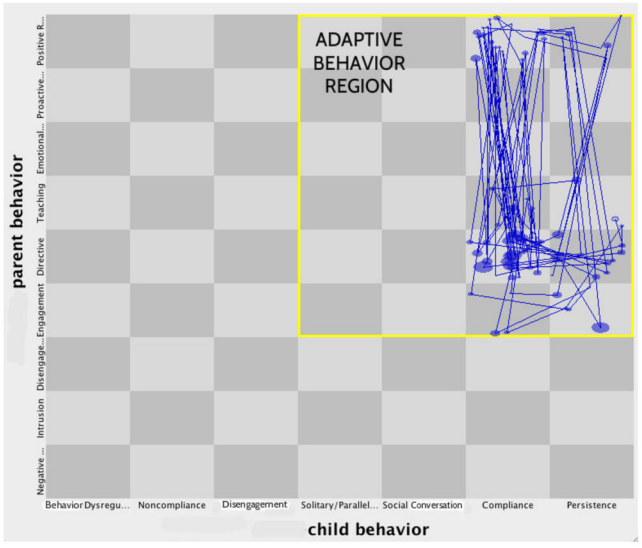

Figure 1b.

Figure 1.

Examples of parent-child dyads showing lower (a) and higher (b) dyadic persistence as measured with State Space Grids.

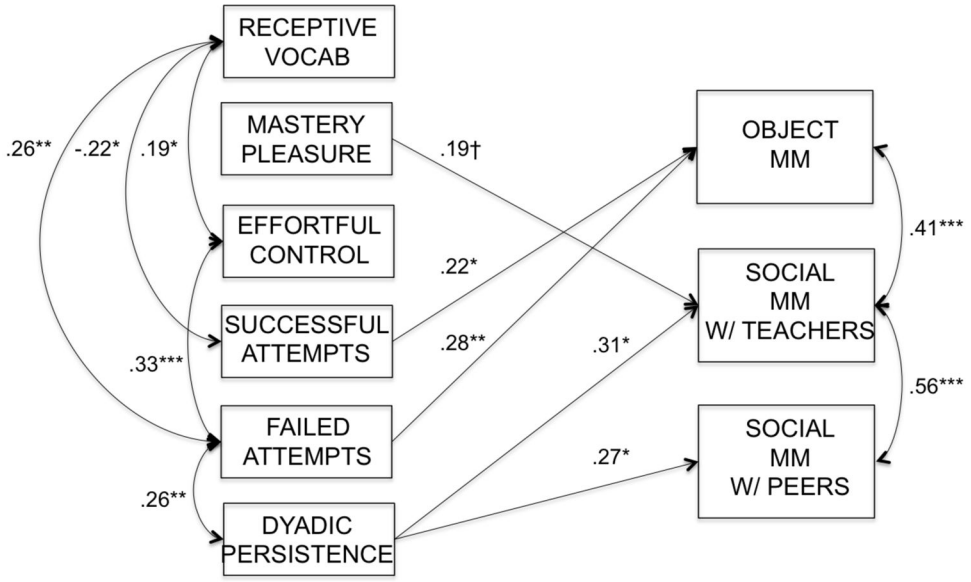

Figure 2.

Dyadic persistence, effortful control, and children's successful and failed attempts at an object mastery task at age 3 ½ years predicting later teacher-rated mastery motivation in preschool. Note: MM = Mastery motivation

Table 1

Descriptive Data

Time 1 Variables	M	SD	Range
Receptive Vocabulary Skills (*n*=98)	20.73	5.85	8.00–29.00
Mastery Pleasure (*N*=100)	4.59	.56	1.80–5.00
Effortful Control (*n*=98)	−.01	.70	−2.56–1.36
Dyadic Persistence (*n*=96)	7.97	4.37	1.00–30.00
Successful Attempt Rate (*n*=89)	2.14	1.03	.36–6.01
Failed Attempt Rate (*n*=89)	1.60	1.02	0.00–5.56
Time 2 Variables			
Object MM (*n*=66)	2.94	.81	1.00–4.67
Social MM with Teachers (*n*=66)	2.98	.66	1.00–4.57
Social MM with Peers (*n*=66)	3.07	.74	1.00–4.43

Note: MM = Mastery motivation

Table 2

Correlations

Variable	1	2	3	4	5	6	7	8	9
1. Receptive Vocab T1	----								
2. Mastery Pleasure T1	−.08	----							
3. Effortful Control T1	.19†	.09	----						
4. Dyadic Persistence T1	.07	−.02	.15	----					
5. Successful Attempts T1	−.24*	.01	−.16	.00	----				
6. Failed Attempts T1	.27*	.13	.34**	.29**	−.08	----			
7. Object MM T2	.20	.19	.21†	.13	.18	.34**	---		
8. Social MM w/ Teachers T2	.17	.19	.16	.31**	−.01	.14	.43***	---	
9. Social MM w/ Peers T2	.12	.09	.08	.25*	.20	−.08	.20	.57***	---

Note: T1 = Time 1; T2 = Time 2; Vocab = Vocabulary; MM = Mastery motivation;

† $p < .10$,

* $p < .05$,

** $p < .01$,

*** $p < .001$