Published in final edited form as:

J Fam Psychol. 2018 August ; 32(5): 588–598. doi:10.1037/fam0000418.

The Role of Father Parenting in Children's School Readiness: A Longitudinal Follow-Up

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Abstract

Mother autonomy support has been shown to predict child executive function (EF) and school readiness; however, little is known about the influence of father parenting on these child outcomes. The current study is a longitudinal follow-up examining the bidirectional relations between father parenting and child EF/school readiness across the preschool period. Eighty-nine father-child dyads participated at two time points (mean child ages of 38 and 58 months). The first time point was described in a previous paper by Meuwissen and Carlson (2015). At the second time point, we observed fathers' autonomy support in a dyadic puzzle task, and quality of parenting during free play in an indoor playground. School readiness included a battery of EF, literacy, and math measures. We found that father autonomy support at Time 1 predicted child school readiness at Time 2, mediated by child language at Time 1. Additionally, child EF at Time 1 inversely predicted father overstimulation during play at Time 2, mediated by father control at Time 1 and child school readiness at Time 2. These results indicate that father autonomy support has similar relations with child EF compared to what has been found with mothers, and that physical play might be an important context for father influence on child outcomes.

Keywords

Executive Function; School Readiness; Fathers; Autonomy Support; Play; Preschool

Parents are a primary force in shaping children's social environments in the first few years of life, which is known to be vital for brain development and neurocognitive skills, such as executive function (EF; Kiel & Kalomiris, 2015; Schneider-Hassloff et al., 2016). EF is a set of skills (including working memory, cognitive flexibility, and inhibitory control) that allow for the control of one's behavior to work toward a goal (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). EF is increasingly recognized as a crucial skill set in early childhood, as it is predictive of important outcomes across the lifespan such as educational attainment, wealth, health, and criminality (Mischel et al., 2011; Moffitt et al., 2011).

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EF is increasingly recognized as an integral part of the concept of school readiness (Blair & Raver, 2015), as it is a key predictor of early academic competence (Baptista, Osorio, Costa Martins, Verissimo, & Martins, 2016; Shaul & Schwartz, 2014). The ability to control one's behavior to learn in a classroom (e.g. sitting still, focusing on the teacher, persisting in difficult work) has been recognized as even more important than pre-literacy and pre-mathematics skills for success in kindergarten (McClelland et al., 2007), and EF skills predict increases in math and reading scores across elementary school (Blair & Razza, 2007; Hassinger-Das, Jordan, Glutting, Irwin, & Dyson, 2014). EF accounts for unique variance in academic measures even when controlling for intelligence (Blair & Razza, 2007) and speed of processing (Fitzpatrick, McKinnon, Blair, & Willoughby, 2014), and it is also key in explaining the early achievement gap between lower and higher income children (Blair & Raver, 2015; Fitzpatrick, et al., 2014).

Parenting is recognized as an important antecedent to EF and school readiness skills (Devine, Bignardi, & Hughes, 2016; Fay-Stammbach, Hawes, & Meredith, 2014; Russell, Lee, Spieker, & Oxford, 2016), but historically this research has focused almost exclusively on mothers (e.g., Grolnick & Farkas, 2002; Wood, 1980). Autonomy support is the dimension of mother parenting that has been most consistently associated with child EF, even over and above other dimensions such as sensitivity and mind-mindedness (Bernier, Carlson, & Whipple, 2010; Bindman, Pomerantz, & Roismann, 2015; Fay-Stammbach et al., 2014).

The concept of autonomy support arose from Vygotskian and self-determination theories (Grolnick & Farkas, 2002; Vygotsky, 1978). It is defined as guidance that supports the child's sense of competence and lets child use his/her own skills, as opposed to taking over the task or letting the child struggle (Grolnick & Farkas, 2002; Whipple, Bernier, & Mageau, 2011; Wood, 1980). To be autonomy supportive, the adult needs to respect the child's pace, organize the task so that the child can be successful, and give help contingent on the child's current abilitiy. Autonomy support has been related to increased learning about the task, persistence and motivation, EF skills, and academic competence (Bernier et al., 2010; Hammond, Muller, Carpendale, Bibok, & Liebermann-Finestone, 2012; Merz et al., 2015; Russell et al., 2016). Conversely, controlling parenting, when parents take on the responsibility and direct the child, has been associated with poorer cognitive outcomes (e.g. Meuwissen & Carlson, 2015).

In studies linking maternal autonomy support to child EF, child language has been an important mediator (Hammond et al., 2012; Landry, Miller-Loncar, Smith, & Swank, 2002). It seems that an increase in child language ability is an important mechanism for how autonomy support leads to better EF outcomes. Autonomy support may provide richer verbal guidance that allows children to engage in more advanced thinking about the problem. Because the early preschool years are a period of rapid change in the development of basic language skills, autonomy support may be especially important for younger preschoolers (Landry et al., 2002).

Early autonomy support also influences academic competence by way of promoting EF. Studies show that preschool EF mediates the effect of high-quality parenting on early school outcomes (Devine et al., 2016; Russell et al., 2016). Mother autonomy support appears to lay the foundation for academic competence because it supports the development of self-regulatory skills that allow for children's adaptive behavior during school (Neitzel & Stright, 2003).

Although most of this research has been done with mothers, recent studies have shown that father autonomy support is also important for early EF (Lucassen et al., 2015; Meuwissen & Carlson, 2015; Roskam, Stievenart, Meunier, & Noel, 2014). Multiple hypotheses about father influence on EF exist. First, mothers and fathers are likely to vary on the same dimensions of parenting (e.g., autonomy support), and high quality parenting from each should positively affect child outcomes (Grolnick & Farkas, 2002; Lucassen et al., 2015; Shannon, Tamis-LeMonda, London, & Cabrera, 2002). Indeed, recent research has shown that father autonomy support is related to concurrent child EF, when measuring parenting by self-report (Lucassen et al., 2015; Roskam et al., 2014) and observational ratings (Meuwissen & Carlson, 2015). Observed sensitive father parenting has also been related to child EF (Towe-Goodman et al., 2014).

Another hypothesis is that fathers have a unique role with their children as playmates, including play that is physical, exciting, and unpredictable (Grossman, Grossman, Kindler, & Zimmermann, 2008; Paquette, 2004). High quality father-child rough and tumble play has been associated with fewer conduct problems, better peer outcomes, and increased socioemotional competence in children (Dumont & Paquette, 2013; Fletcher, St. George, & Freeman, 2013; Lamb, 2004). Research on father-child play has primarily been conducted with directed tasks and with infants. Little research has been done on spontaneous physical play in father/preschool child dyads, and cognitive outcomes have been neglected.

Play involving high excitement and risk may be an important context for children learning to self-regulate, as they must continually balance between excitement and control, and between risk and safety (Fletcher et al., 2013). Research suggests that high quality rough and tumble play includes the father being involved in the play, contributing to the play in ways that make it more interesting or fun, and also being responsive to the child – perceiving and adapting to the child's needs (Fletcher et al., 2013; Grossman et al., 2008; Paquette, 2004). In contrast, fathers can overstimulate their child when they push the child to do things the child finds scary or overwhelming (Grossman, et al., 2008; Paquette, 2004). This may be particularly detrimental to children's ability to regulate their own emotions. In this study, we designed a novel coding scheme to measure these aspects of father play that are theoretically important for preschoolers' developing cognitive and regulatory skills to begin to explore these relations.

In addition to a lack of research on fathers, another gap in the research on parent-child interactions and EF is the examination of reciprocal processes. Although many researchers recognize bidirectional influences in parent-child relationships (e.g., Blair, Raver, & Berry, 2014), there has been little research on how child EF influences parenting. It is likely that children with lower EF would elicit more controlling parenting, as they are less able to regulate their own behavior. A few recent studies have shown effects of child EF on parenting behavior (Kiel & Kalomiris, 2015; Merz, Landry, Montroy, & Williams, 2016), but these bidirectional effects across time in the preschool years have not been fully examined.

The Current Study

The present study is the second wave of data in a longitudinal study of the relation between father parenting and preschool school readiness. The first wave of data was collected when the children were about three years old. Children completed a battery of EF tasks, and fathers and children completed a puzzle together, coded for father autonomy support and control. Results showed that father control was related to lower child EF (Meuwissen & Carlson, 2015). The current study followed up these dyads two years later, when the children were about five years old. Children completed a battery of school readiness tasks (including EF tasks), and the dyad completed a puzzle coded for autonomy support and control. They also participated in an episode of play in an indoor playground/gym, coded for multiple aspects of quality of father play.

This study had two aims. The first was to examine how father autonomy support at Time 1 (T1) was related to child school readiness at Time 2 (T2), with T1 child language and EF hypothesized as mediators. The second was an exploratory aim to examine a new measure of father-child physical play, and how quality of physical play was related to child behavior and father autonomy support/control across time. If reciprocal father-child relations were found, we were interested in the mediating processes of how the effects were carried through time.

Method

Participants

Participants were 89 (43 female, 46 male) children and their fathers from a Midwestern metropolitan area, who had previously participated in a study. From the 108 participants recruited, 19 did not participate in the follow-up due to scheduling ($N = 7$), moving ($N = 5$), no response ($N = 5$), a diagnosed developmental disorder ($N = 1$), or child refusal ($N = 1$). Participants who did not return for the second visit did not differ from those who returned in gender, race (Caucasian vs. other), father education, family income, child EF, child language, or father involvement at T1 (all ps > .05). However, participation in the follow up was less likely if at T1 the father had lower EF ($t = -.281$, $p = .006$), was more controlling ($t = 3.34$, $p = .001$), and marginally if he was less autonomy supportive ($t = -1.87$, $p = .065$).

At T2, child age ranged from 56 to 63 months, $M = 57.8$, $SD = 1.33$. Children were primarily White/Non-Hispanic Caucasian (88.6 %; other ethnicities were Black/African American, Hispanic, or multiple ethnicities). Family income ranged from $25,000 – 49,999 to $200,000 or more with the mean and median corresponding to $100,000-$124,999 (*Mode* = $75,000 - $99,999). Fathers averaged 37.8 years old (range = 28-54). Most (87.7 %) had an education of college degree or higher. All fathers were the child’s biological parent and currently lived with the child, and all but 4 were currently married to the child’s mother. When asked about the child’s primary caregiver, 52% reported mother, 11% reported father, and 29% reported equal mother and father care. Four fathers reported their job as at-home father. Most mothers of the children also worked out of the home ($N = 48$; at-home mothers

N = 19, missing *N* = 22). Twenty-eight children were currently enrolled in daycare and 55 were in preschool. The average length of time between the T1 and T2 visit was 20.1 months (*SD* = 1.91).

Procedure

This study was approved by the University's Institutional Review Board. Fathers provided informed consent and children provided assent.

At T1, the father-child dyad took part in one laboratory session, in which children were tested on the Peabody Picture Vocabulary Test and four EF measures: Bear/Dragon, Delay of Gratification, Minnesota EF Scale (MEFS), and Gift Delay. The father-child dyad also worked on a jigsaw puzzle together, coded for autonomy support and control. A full description of these measures and the results of T1 can be found in (Meuwissen & Carlson, 2015).

At T2, the father-child dyad took part in one 60 to 90-min videotaped laboratory session. Children were tested on the Woodcock-Johnson Letter Word and Applied Problems subtests, and three EF measures: the MEFS, Gift Delay, and Simon Says. An additional child EF task was given at the end for a project not discussed here. Fathers also completed the MEFS. The dyads worked together on a cube puzzle designed to be too difficult for the child to complete alone. Videos of this task were coded for autonomy support and control. The dyad also did a 10-min free play episode in a gym setting, and videos were coded on a number of scales measuring quality of father parenting. During both sessions, fathers could watch their child during solo testing from a laptop in another room. Children were tested by 1 of 2 female experimenters.

Measures

Child tasks

Woodcock-Johnson III (Woodcock, McGrew, Schrank, & Mather, 2007): Two subscales were given. In Letter-Word, children identified letters and then read increasingly difficult words. In Applied Problems, children counted, did arithmetic with pictures, and solved increasingly difficult word problems. Both ended once children answered incorrectly on 5 consecutive items.

Minnesota EF Scale (MEFS, Carlson & Zelazo, 2014): The Minnesota EF Scale is a standardized tablet-based measure that taps working memory, inhibitory control, and set shifting. Children were shown two virtual boxes with target cards on them. They were instructed to sort cards into the boxes by a dimension (shape or color) by dragging them on a touch screen. The MEFS consists of seven levels of increasing complexity. For each level, in part A children were instructed to sort cards based on a specific dimension, and for part B they had to switch the sorting rule. At the higher levels, children were required to switch flexibly multiple times. Children proceeded to easier or more difficult levels based on performance. The dependent variable was the total score of the trials adjusted for reaction time, scored between 0 and 100 using the MEFS software. Data are missing for one child due to internet malfunction.

Gift Delay with Bow (Imada, Carlson, & Itakura, 2013; Kochanska et al., 2000): The experimenter told the child that he/she would receive a present, but the experimenter wanted it to be a surprise, and so instructed the child not to peek while it was being wrapped. First the child's chair was turned away from the experimenter, who noisily wrapped the present for 1 min. Then the experimenter said she forgot the bow, and instructed the child to wait and not look at the present until she returned. The experimenter left the room for 3 min. Children were scored on their level of transgression while the experimenter was gone (0 = none, 1 = turns head, 2 = turns body, 3 = leaves chair, 4 = touches bag, 5 = looks in bag, 6 = removes prize from bag; reversed), how much time they spent transgressing (peeking or out of their chair; reversed), and latency until their first transgression. Correlations between these scales were all significant (*r*s = .483 to.748; Cronbach's alpha =.822), and were combined into one composite.

Simon Says (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996; Meuwissen & Carlson, 2015; Reed, Pien, & Rothbart, 1984): In this task, the child is instructed to do an action when the command was preceded by "Simon Says," but do nothing if "Simon Says" was not said. In the first level, the experimenter gave 5 Simon Says commands and then 5 Not Simon commands and modeled the correct answer. If the child got 8/10 correct on a level, they proceeded to a harder level. The levels became more difficult by the experimenter mixing up the commands, then modeling incorrectly, and finally reversing the meaning of "Simon Says". If children got fewer than 8 correct on the initial level, they proceeded to an easier version using bear and dragon puppets (see Meuwissen & Carlson, 2015). Number of correct trials was scored.

School Readiness Composite: Table 3 shows the intercorrelations among the 5 child tasks (MEFS, Simon Says, Gift Delay Composite, Woodcock-Johnson Letter-Word, Woodcock-Johnson Applied Problems). When submitted to a principal components analysis, all tasks loaded onto a single factor (first unrotated principal component) above .3, indicating satisfactory homogeneity (Costello & Osborne, 2005; Tabachnick & Fidell, 2001). Factor loadings were as follows: MEFS: .605, Simon Says: .621, Gift Delay Comp: .378, WJ Letter Word: .472, WJ Applied Problems: .763. This factor represented 34% of the total variance. Therefore, these measures were combined to form a child School Readiness (SR) composite variable (α = .493), with the standardized scores of all tasks with valid data averaged for each child.

Father tasks

Minnesota EF Scale (MEFS, Carlson & Zelazo, 2014): Fathers completed the same EF measure as the children, beginning on a more difficult level requiring them to rapidly switch rules multiple times. Total scores were based on accuracy and speed. Data were missing for 5 fathers due to tablet malfunctions or child behavior.

Surveys: Fathers again completed two surveys, one about demographic information and one about involvement with the child (see Meuwissen & Carlson, 2015).

Dyad tasks

Cube puzzle dyad task: The experimenter presented the dyad with a 12-piece cube puzzle. Each cube had a different picture on each face, so it was possible to make 6 different farm animals with the puzzle. Dyads were told they should complete the chicken picture first, and then could choose any animal if they finished the first one. Fathers were instructed "We would like to see what [child's name] can do by him/herself, but feel free to give him/her any help that you want to." The experimenter left the room and returned after 10 minutes or when the dyad had finished 2 pictures (this occurred for 7 dyads).

Puzzle task coding: Videos of the dyad puzzle task were coding using Whipple, Bernier, and Mageau's (2011) autonomy support coding scheme. Father behavior was coded on three scales reflecting the extent to which the father (a) intervened according to the child's needs and adapted the task to create an optimal challenge; (b) encouraged the child in the pursuit of the task, gave useful hints and suggestions, and used a tone of voice that communicated he was there to help; and (c) followed the child's pace, provided the child with the opportunity to make choices, and ensured that the child played an active role in the completion of the task. Each scale was rated for autonomy support (1 = not autonomy supportive to 5 = very autonomy supportive) and control (1 = not controlling to 5 = very controlling). Coders assigned an autonomy support and control rating for each of the 3 scales after watching the entire puzzle episode. Fathers were rated high on control if they exhibited behaviors such as intervening too early or excessively, using a stern or sarcastic tone of voice, and if they made the decisions and did much of the work themselves instead of allowing their children to do the work. All videos were coded by 2 independent coders (*ICC*s = .756-.929). Discrepancies were conferenced and the agreed upon codes used. The 3 autonomy support scales were all significantly intercorrelated (*r*s = .628- 825; Cronbach's alpha = .881), indicating they could be combined into one scale (Kline, 1999). For the control scales, all were significantly correlated (*r*s = .585-.813), with an alpha of .857.

Gym Play: The father and child were brought to a large room containing indoor playground equipment (e.g., slide, monkey bars, small basketball hoop). Four different pieces of equipment were identified by the experimenter, who asked them to try out each of those activities, in any order. The dyad was told to play together like they would at a playground. The experimenter left and returned after 10 min. Sixty-seven dyads participated in the gym play episode; 22 were missing due to scheduling conflicts with the gym.

Gym play coding: The authors developed a novel coding scheme for gym play episodes based on theoretical concepts (Fletcher et al., 2013; Grossman et al., 2008; Paquette, 2004) and observed tapes. Videos of the gym play episodes were coded on seven dimensions. The first 5 scales were rated on a 5-point scale, 1 = low, 5 = high. 1) Quality of Support: the degree to which the father contributed new suggestions and ideas to enhance the play, such as introducing goals, new uses for objects, or pretend play. 2) Child-focused/responsive: the degree to which the father focused on the child's ideas and prioritized making the play fun for the child, including positive feedback. 3) Understimulation: the degree to which the father lets the child become bored or uninterested in the play; does not provide appropriate stimulation, 4). Overstimulation: the degree to which the fathers' actions are overwhelming to the child. High scores indicated that the father pushed the child to do things that they were not comfortable with or did not want to do. 5). Level of synchrony: the degree to which the father and child communicated and were on the same page, sharing in the fun together. 6) Risky/Exciting Play: instances where the father introduced physical or risky elements to the play, such as tickling, lifting the child, or throwing things at the child. 1 = no instances, 2 = 1-2 instances, 3 = 3+ instances. 7) Father's primary role in the play: 1 = Uninvolved, not paying close attention to the child. 2 = Observer, attentive but not heavily involved in play. 3 = Supporter: has a supporting role in play, offers ideas but not physically involved. 4 = Partner: plays alongside child, they have roughly equal roles. All videos were coded by 2 independent coders (*ICC*s = .698-.858). Disagreements were conferenced. When entered into a factor analysis, all scales (except Overstimulation) loaded on the first unrotated principal component at .600 or higher, indicating satisfactory homogeneity. Therefore, a Gym Play Composite was made of 6 scales: Quality of Support, Risky/Exciting Play, Understimulation (reverse scored), Child Focused, Synchrony, and Father Role (alpha = .819). Overstimulation was examined as a separate score (loading < .3 on first unrotated principal component).

Results

Preliminary Analyses

Table 1 presents descriptive statistics for child school readiness and father parenting variables at T2. All variables showed acceptable variation, although Gift Delay Composite scores occurred most frequently around 1 and −.6 (bimodal distribution), father control showed signs of a floor effect (20% of fathers scored a 1 (the lowest score possible) and 69% scored a 2 or lower), and father overstimulation also showing signs of a floor effect (52% of fathers scored a 1 (the lowest score possible) and 85% scored a 2 or lower).

Demographics—We examined whether sociodemographic variables reported at T2 (child gender, child age, mother education, father education, father age, family income, father MEFS, and father involvement) were related to child School Readiness or father parenting variables (see Table 2). In our main analyses, we used family income and child gender as covariates, as these were associated with key child and father variables.

Main Analyses

Table 3 shows the bivariate correlations between child and father variables across both time points, as well as partial correlations controlling for family income and child gender.

The bivariate correlations show that child cognition had stability across time, as child EF at T1 and child SR at T2 were correlated ($r = .346$, $p = .001$). Father parenting also showed stability across time with father autonomy support at T1 being correlated with the following father variables at T2: autonomy support ($r = .312$, $p = .005$), control ($r = -.235$, $p = .035$), gym play ($r = .257$, $p = .044$) and overstimulation ($r = -.266$, $p = .037$). Similarly, father control at T1 was associated with the following father variables at T2: father autonomy support ($r = -.322$, $p = .003$), control ($r = .237$, $p = .003$), and overstimulation ($r = .361$, $p = .004$).

Child school readiness at T2 was not strongly associated with concurrent father parenting. The correlation between school readiness and T2 father overstimulation was significant ($r = -.313$, $p = .010$), but there were no relations with T2 father autonomy support, control, or gym play composite. This is in contrast to the finding that at T1 child EF was correlated with concurrent father autonomy support ($r = .232$, $p = .031$) and control ($r = .252$, $p = .023$). Child EF at T1 was correlated with father overstimulation at T2 ($r = -.326$, $p = .007$), but not to other measures of T2 father parenting (autonomy support, control or gym play composite).

Aim 1. Investigating paths from T1 father autonomy support to T2 school readiness—All regressions presented used Full Information Maximum Likelihood for missing data.

Father autonomy support at T1 was correlated with child SR at T2 ($r = .226$, $p = .043$). Father control at T1 was not related to later child SR. Regression analysis showed that father autonomy support was still a significant predictor ($\beta = .144$, $p = .031$) after controlling for income ($\beta = .077$, $p = .013$) and child gender (ns), and that this model accounted for 15.0% of the variance in child SR. We investigated two T1 mediators for this relation: child language and child EF. These were both bivariately correlated with the predictor (father autonomy support T1) and the outcome (child SR T2; See Table 3), indicating a possibility of mediation.

We first tested if the relation between father autonomy support at T1 and child SR at T2 was mediated by child language at T1, after controlling for child gender and family income (see Figure 1). The standardized regression coefficient between father autonomy support at T1 and child PPVT at T1 was statistically significant, as was the standardized regression coefficient between child PPVT at T1 and child SR at T2. The standardized indirect effect was .097. For all models, we tested the significance of the indirect effect using bootstrapping procedures (Efron & Tibshirani, 1994). Unstandardized indirect effects were computed for each of 1,000 bootstrapped samples. We calculated a 95% confidence interval by locating the 2.5th and 97.5th percentiles of this empirical distribution. The confidence interval for the unstandardized indirect effect ranged from .027 to .189. Because zero was not included in the range, we concluded that the indirect effect was statistically significant at the nominal .05 level, and that child PPVT mediated the relation. In this model, income was a significant predictor ($\beta = .138$, $p = .005$), but child gender was not. Overall, this model explained 26.4% of variance in school readiness.

We then tested child EF at T1 as an alternate mediator between father autonomy support at T1 and child SR at T2 (see Figure 2). The standardized regression coefficient between father autonomy support at T1 and child EF at T1 was statistically significant, but the standardized regression coefficient between child EF at T1 and child SR at T2 was only marginally significant. The standardized indirect effect was .067. The empirically derived bootstrapped confidence interval ranged from −.016 to .159, and thus EF at T1 was not a significant mediator of the relation. Income was a significant predictor ($\beta = .108$, $p = .050$), but child gender was not. This model explained 18.9% of variance in school readiness.

Aim 2. Exploratory analyses of father overstimulation—The father gym play composite was predicted by father autonomy support T1, but was not correlated with any child outcomes at T1 or T2 (see Table 3). Therefore, we did not further investigate this variable. The overstimulation variable, however, was related to child EF at T1 and child school readiness at T2, as well as father autonomy support and control at T1 (see Table 3). These correlations suggested that overstimulation could be another mediator to the previously examined path from autonomy support T1 to child school readiness T2. Additionally, we were interested in exploring the path from child EF T1 to father overstimulation as a child effect on parenting, which are often unexamined in research. We identified 3 possible mediators for this path: autonomy support T1, control T1, and school readiness T2.

We first tested father overstimulation as a third possible mediator between father autonomy support T1 and child school readiness T2 (see Figure 3). The standardized regression coefficient between father autonomy support at T1 and father overstimulation at T2 was statistically significant, as was the standardized regression coefficient between child SR at T2 and father overstimulation at T2. The standardized indirect effect was .054, with a confidence interval from −.002 to .150, indicating father overstimulation at T2 did not significantly mediate the relation. Income was a significant predictor ($\beta = .152$, $p = .003$), but child gender was not. This model explained 21.3% of variance in school readiness.

Table 4 shows a summary of the mediation models tested. Overall, father autonomy support at T1 was a significant predictor of child SR at T2, and this relation was mediated only by child language ability (PPVT) at T1.

We next investigated the relation between child EF at T1 and father overstimulation at T2. Regression analysis showed that father autonomy support was still a significant predictor ($\beta = -.481$, $p = .004$) after controlling for income (ns) and child gender ($\beta = -.376$, $p = .042$), and that this model explained 17.5% of the variance in child SR.

The relation between child EF at T1 and father overstimulation at T2 could be mediated by father autonomy support or control at T1, or by child school readiness at T2. All 3 of these variables were bivariately correlated with both the predictor (child EF T1) and the outcome (father overstimulation T2; See Table 3), and were therefore tested as possible mediators.

We first tested father autonomy support at T1 as a mediator between child EF at T1 and father overstimulation at T2 (see Figure 4). The standardized regression coefficient between child EF at T1 and father autonomy support at T1 was statistically significant, but the standardized regression coefficient between father autonomy support at T1 and father overstimulation at T2 was only marginally significant. The standardized indirect effect was −.066, with a confidence interval from −.159 to −.001. The confidence interval ended very close to 0, indicating father autonomy support at T1 marginally mediated the relation. Child gender was a significant predictor ($\beta = -.518$, $p = .019$), but income was not. This model accounted for 24.6% of variance in father overstimulation.

The second mediator we tested was father control at T1 (see Figure 5). The standardized regression coefficient between child EF at T1 and father control at T1 was statistically significant, as was the standardized regression coefficient between father control at T1 and father overstimulation at T2. The standardized indirect effect was −.096, with a confidence interval from −.213 to −.019, indicating father control at T1 significantly mediated the relation. Child gender was a significant predictor ($\beta = -.457$, $p = .039$), but income was not. This model accounted for 26.9% of variance in father overstimulation.

Finally, we tested child school readiness at T2 as a mediator of the relation between child EF at T1 and father overstimulation at T2 (see Figure 6). The standardized regression coefficient between child EF at T1 and child school readiness at T2 was statistically significant, as was the standardized regression coefficient between child school readiness at T2 and father overstimulation at T2. The standardized indirect effect was .087, with a confidence interval from −.205 to −.008, indicating child school readiness significantly mediated the relation. Child gender was a marginally significant predictor ($\beta = -.411$, $p = .055$); income was not significant. This model accounted for 25.5% of variance in father overstimulation.

Overall, the relation between child EF at T1 and father overstimulation at T2 was mediated by father autonomy support at T1, father control at T1, and child school readiness at T2. The model using father control as the mediator accounted for the most variance in father overstimulation (see Table 4).

Discussion

This study examined reciprocal effects between father parenting and children's EF and school readiness. The first main finding was that father autonomy support at age 3 predicted child school readiness at age 5, similar to previous findings regarding the importance of mothers for preschool children's cognitive development (e.g. Devine et al., 2016; Merz et al., 2015; Razza & Raymond, 2013). Also, the effect of early father autonomy support on later child school readiness was mediated by child language. This finding has been shown previously with mothers (e.g. Hammond et al., 2012; Landry et al., 2002), and suggests that autonomy support in the early preschool years is important for later EF and academic skills in part through its impact on language, a foundational skill for complex cognitive processes. These results support the hypothesis that fathers and mothers vary on similar parenting dimensions (in this case, autonomy support) and that high quality parenting from each parent is beneficial for child outcomes (Grolnick & Farkas, 2002; Lucassen et al., 2015; Shannon et al., 2002).

Executive function did not mediate the path from early autonomy support to school readiness, indicating that child cognition and father parenting may have independent effects on later child school readiness. This mediation pathway has been previously found with mothers, so it is not yet clear what differences in father parenting may have contributed to this result. More research needs to be done directly comparing mothers and fathers in the same study.

The second main finding was that low child EF at age 3 predicted increased father overstimulation in the gym play context at age 5. This result provides support for a bidirectional model, where father parenting and child EF mutually influence each other over

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time (Blair et al., 2014). Children who are less able to self-regulate may elicit father parenting that is less responsive to the child. Fathers who were overstimulating did not respect their children's boundaries and engaged in play that was overwhelming to the child. Children who had lower EF at age 3 tended to have fathers who were more controlling at age 3, which predicted overstimulation at age 5. Additionally, children who had higher EF at age 3 tended to have higher school readiness at age 5, which was related to lower father overstimulation at age 5.

Father overstimulation was the only parenting dimension measured at age 5 that was concurrently related to school readiness. At age 5, parenting in the gym may have been a more relevant measure than parenting during the puzzle task. Playmate is an important role for fathers, especially in contexts that involve risk or uncertainty for the child (Fletcher et al., 2013; Grossman et al., 2008; Paquette, 2004). At age 5, if fathers were able to sensitively interact with and not overstimulate their child when encountering exciting situations such as climbing on high objects or wrestling, this was more predictive of child skills than father behavior in the calmer, more predictable situation of doing the puzzle. This suggests that play-based interventions may be a unique opportunity for impactful interventions with fathers. It may be important to teach fathers how to promote healthy child outcomes in active, risky situations, which is a context overlooked by many interventions designed for mothers.

Some of the null findings in the study also are important. Father autonomy support and control at age 5 were not related to concurrent child school readiness, in contrast to the relation found between father parenting and child EF at age 3 in this sample. Previous studies have also found stronger relations between quality of caregiving and child EF in younger compared to older preschool children (Landry et al., 2002; Merz, Landry, Johnson, Williams, & Jung, 2016), Because early language is an important mediator of the relation between early autonomy support and later child school readiness, it is possible that autonomy support becomes less important for child outcomes as the foundational skill of language becomes more established.

Another factor that may have contributed to the null results is that fathers who were more controlling at T1 were less likely to participate in the follow-up session. Therefore, our range of fathering may have been more constrained at the second time point due to self-selection bias, and this could contribute to the lack of relations for father parenting variables at T2.

It is also important to note that although child EF at age 3 predicted later father overstimulation, it did not predict other aspects of father parenting measured at age 5 (autonomy support, control, or quality of gym play). However, these aspects of father parenting did show continuity with previous autonomy support and control. This suggests that some patterns of father parenting may be fairly established by age 3 or are less influenced by child behavior.

This study had a number of limitations. The sample size of 89 children was modest. The sample was primarily white, highly educated, and well-off financially. It will be important to replicate this study in larger and more diverse samples to assess if the results generalize more broadly. Additionally, this study only included fathers, it is not possible to directly compare to mother behavior. There have been no studies of mother gym play, so we cannot know what components of father play in a gym context may be unique influences. Also, we only measured father gym play at age 5, so we were not able to track changes over time for those variables.

The school readiness composite had only fair psychometric properties, and thus it is possible that analyzing each measure separately may have results in somewhat different patterns of relations. However, we felt that using the school readiness composite of both EF and academic skills was conceptually important for examining individual differences in school readiness. Most current educators agree that to be “school ready” involves not only literacy and numeracy skills but also executive function and socio-emotional skills (Rimm-Kauffman, Pianta, & Cox, 2000). The longitudinal design of the study was useful to assess reciprocal effects, but precluded an assessment of cause and effect. Also, mediation analyses are strongest in studies including at least three time points, but two-wave studies, where the mediator is assessed concurrently with predictors or outcomes, are preferable to cross-sectional designs and are an acceptable cost-effective method to examine mediation (Devine et al., 2016; Preacher, 2015). This study indicates it may be worthwhile to test these models using more rigorous methods.

Conclusion

This longitudinal follow-up study found that child school readiness (as measured by EF, early literacy, and early math skills) at age 5 was predicted by a variety of factors, including family income, previous child EF and verbal ability, previous father autonomy support, and concurrent father overstimulation. It is one of the first investigations to show that father parenting is an important predictor over time for child school readiness, which is known to be crucial for children’s long-term academic success (Baptista et al., 2016; Hassinger-Das, et al., 2014). The study also supported the idea of reciprocal relations between father parenting and child EF, indicating that fathers can shape children’s behavior, but father behavior is also a reaction to their children. These findings have implications for interventions targeting child school readiness, which often focus only on the child or the mother-child dyad. Including fathers in parenting interventions may be an important way to increase children’s success.

Acknowledgments

Funding was provided by an NIH Training Grant (T32 MH015755) to the first author.

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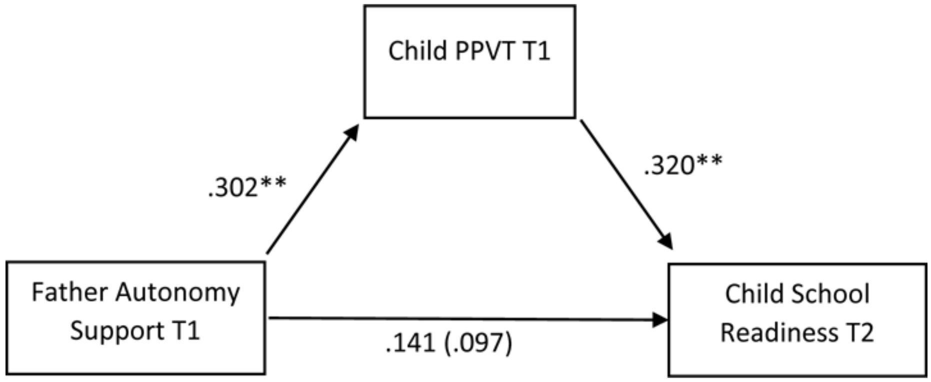

Fig 1.

Child PPVT mediated the relation between father autonomy support at T1 and child school readiness at T2; the indirect effect (standardized in parenthesis) was significant.

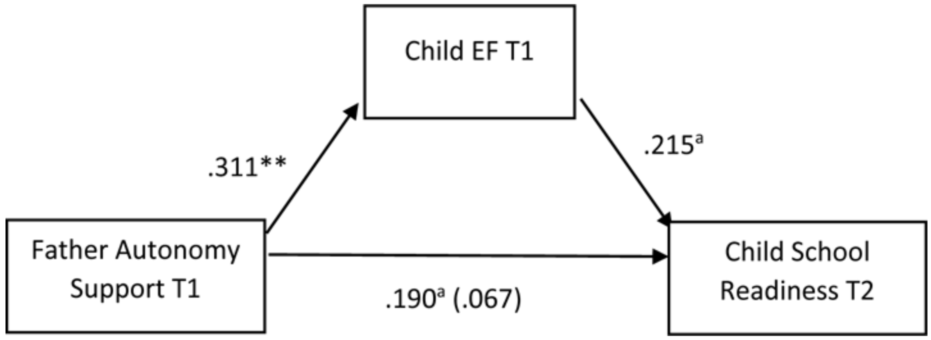

Fig 2.

Child EF at T1 did not mediate relation between father autonomy support at T1 and child school readiness at T2; indirect effect (standardized in parenthesis) was not significant.

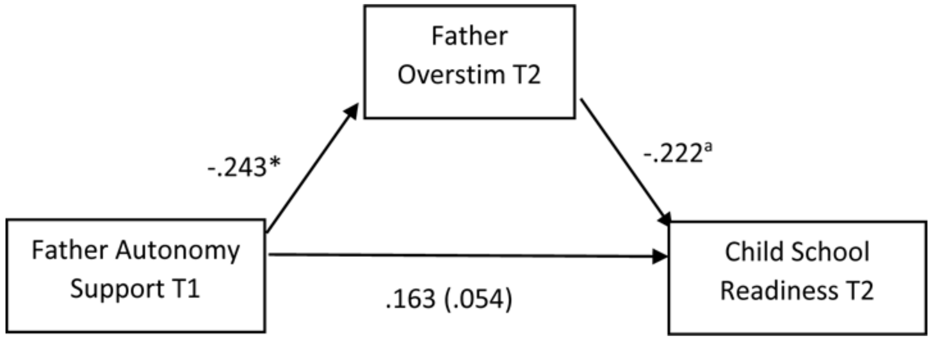

Fig 3.

Father overstimulation at T2 did not mediate the relation between father autonomy support at T1 and child school readiness at T2; indirect effect (standardized in parenthesis) was not significant.

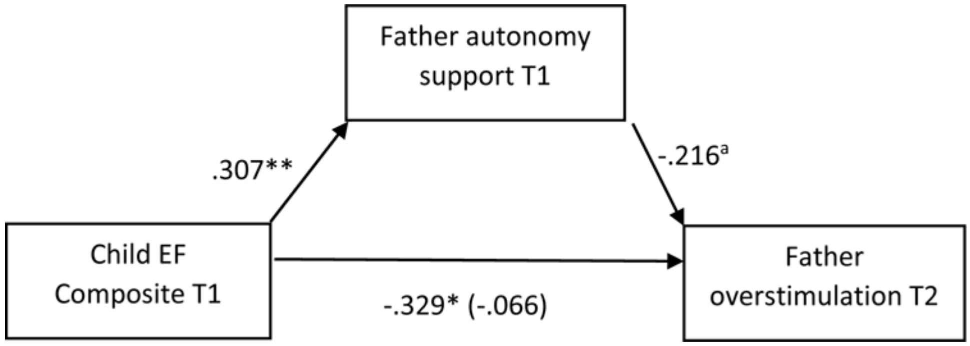

Fig 4.
Father autonomy support at T1 mediated the relation between child EF at T1 and father overstimulation at T2; indirect effect (standardized in parenthesis) was marginally significant.

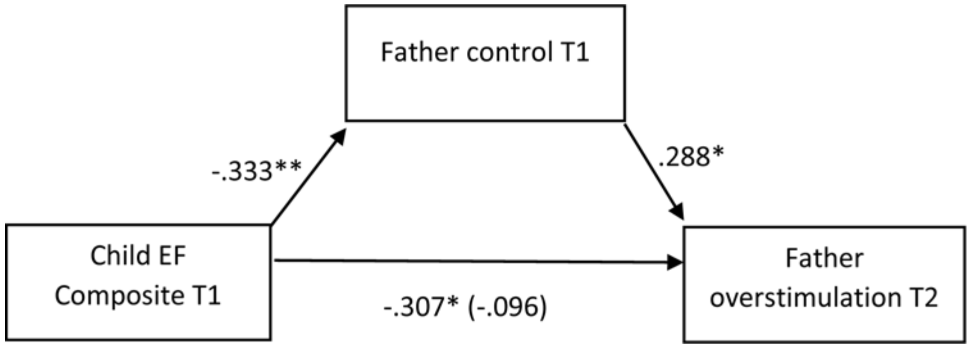

Fig 5.
Father control at T1 mediated the relation between child EF at T1 and father overstimulation at T2; indirect effect (standardized in parenthesis) was significant.

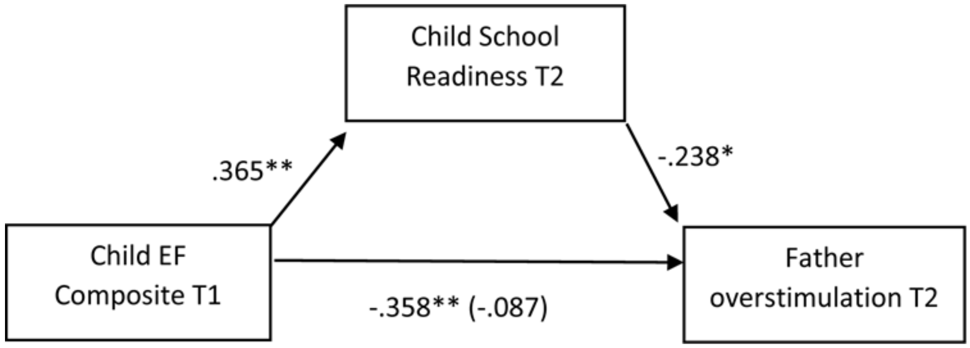

Fig 6.
Child school readiness at T2 mediated the relation between child EF at T1 and father overstimulation at T2; indirect effect (standardized in parenthesis) was significant.

Table 1

Mean, Standard Deviation, and Range for Child School Readiness and Father Parenting Measures at T2

Variable	N	Mean	Standard Deviation	Observed range	Theoretical range
Child School Readiness					
Simon Says	88	5.91	1.29	2 – 8	0 – 8
MEFS	87	51.53	10.09	28 – 90	0 – 100
Gift Delay Composite (*z*)	87	0.00	.859	-2.21 – .94	-1.00 – 1.00
WJ-Letter Word	89	15.78	9.65	2 – 53	0 – 76
WJ-Applied Problems	89	18.36	4.58	9 – 50	0 –63
Parenting Quality					
Father Autonomy Support	89	3.80	.835	1.33 – 5	1 – 5
Father Control	89	1.90	.809	1 – 5	1 – 5
Gym Play Composite (*z*)	67	.000	.725	−1.66 – 1.18	−1.00 –1.00
Overstimulation	67	1.64	.773	1 – 4	1 – 5

MEFS = Minnesota EF Scale. WJ = Woodcock Johnson

Table 2

Bivariate Correlations between Sociodemographic Variables and Child School Readiness and Father Parenting

	Simon Says	MEFS	Gift Delay Comp	WJ Letter Word	WJ Applied Probs	School Readiness Comp	Father Autonomy Support	Father Control	Father Gym Play	Father Overstim
Child Gender	.181[a]	.124	−.030	.108	−.040	.117	−.053	−.033	−.304*	−.213[a]
Child Age	.197[a]	.122	.071	.107	.012	.170	.088	.029	−.068	−.083
Mother Education	.155	.129	−.063	.022	.108	.117	.342**	−.261*	−.085	−.133
Father Education	.038	.183[a]	.266*	−.011	.058	.182[a]	.045	−.116	−.100	−.064
Father Age	−.034	.011	−.008	.032	−.030	.009	−.180	.142	−.264*	−.058
Family Income	.077	.315**	.001	.169	.209[a]	.268*	.022	−.036	−.159	−.022
Father MEFS	.215[a]	.047	−.118	−.249*	.022	−.043	−.033	.016	.013	.025
Father Involvement Total	−.198[a]	−.057	−.158	.001	−.094	−.180	.028	.041	.269*	−.004

[a] $p < .10$

* $p < .05$,

** $p < .01$.

Gender was scored Male = 1, Female = 2. MEFS = Minnesota EF Scale. WJ = Woodcock Johnson. Overstim = Overstimulation.

Table 3

Bivariate (bottom left) and Partial (controlling for family income and child gender, top right) correlations between main study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Child EF Comp1	–	.237*	.255*	−.220a	.275*	.201a	.125	.207a	−.109	.361**	.174	−.110	.134	−.330**
2. PPVT Raw1	.232*	–	.253*	−.133	.395**	.189a	.380**	.100	.209a	.266*	.166	−.126	.150	−.240a
3. Dad AS1	.252*	.246*	–	−.705**	.243*	.223a	.166	.019	.009	.275*	.309**	−.241*	.224a	−.333**
4. Dad Cont1	−.238*	−.135	−.708**	–	−.163	−.193a	−.038	.002	.080	−.311**	−.319**	.327**	−.118	.392**
5. Child SR Comp2	.346**	.384**	.226*	−.176	–	.578**	.555**	.522**	.492**	.695**	.110	−.162	.071	−.301*
6. Simon Says2	.224*	.187a	.176	−.179	.584**	–	.189a	.074	−.004	.365**	.040	−.068	−.108	−.238a
7. MEFS2	.225*	.366**	.157	−.061	.599**	.222*	–	.146	.103	.169	.081	.014	.151	−.102
8. Gift Delay2	.192a	.100	.026	−.001	.495**	.067	.134	–	.047	.183	.027	−.130	−.066	−.063
9. WJ Letter Word2	−.035	.209a	.002	.068	.519**	.029	.162	.043	–	.243*	.065	−.080	.108	−.028
10. WJ App Probs2	.399**	.266*	.293**	−.329**	.701**	.359**	.216*	.180a	.264*	–	.123	−.190	.108	−.443**
11. Dad AS2	.166	.166	.312**	−.322**	.105	.032	.076	.029	.061	.126	–	−.797**	.000	−.142
12. Dad Cont2	−.116	−.127	−.235*	.327**	−.164	−.070	.001	−.130	−.084	−.193a	−.796**	–	.044	.098
13. Dad Gym Play2	.041	.136	.257*	−.119	−.016	−.167	.044	−.053	.039	.077	.012	.048	–	.099
14. Dad Overstim2	−.326**	−.235a	−.266*	.361**	−.313**	.269*	−.128	−.055	−.054	−.420**	−.128	.097	.160	–

** $p < .01$

* $p < .05$

a $p < .10$.

PPVT = Peabody Picture Vocabulary Test. WJ = Woodcock Johnson. AS = Autonomy Support

Table 4

Summary of mediation models.

Model	Indirect Effect	R^2 for model
Father AS T1 → Child SR T2	–	15.0%
Mediator: Child PPVT T1	.097*	26.4%
Mediator: Child EF T1	.067	18.9%
Mediator: Father Overstim T2	.054	21.3%
Child EF T1 → Father Overstim T2	–	17.5%
Mediator: Father AS T1	−.066[a]	24.6%
Mediator: Father Control T1	−.096*	26.9%
Mediator: Child SR T2	.087*	25.5%

Note: All models include income and child sex as covariates.

*95% confidence interval for indirect effect did not include 0.

[a]95% confidence interval included .001.

AS = Autonomy Support. SR = School Readiness. PPVT = Peabody Picture Vocabulary Test.