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ABSTRACT

Parent engagement with their children plays an important role in children's eventual economic success and numerous studies have documented large gaps in parent engagement between low- and higher-income families. While we know remarkably little about what motivates parents to engage in their children's development, recent research suggests that ignoring or discounting the future may inhibit parental investment, while certain behavioral tools may help offset this tendency. This paper reports results from a randomized field experiment designed to increase the time that parents of children in subsidized preschool programs spend reading to their children using an electronic reading application that audio and video records parents as they read. The treatment included three behavioral tools (text reminders, goal-setting, and social rewards) as well as information about the importance of reading to children. The treatment increased usage of the reading application by one standard deviation after the six-week intervention. Our evidence suggests that the large effect size is not accounted for by the information component of the intervention and that the treatment impact was much greater for parents who are more present-oriented than for parents who are less present-oriented.

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A randomized controlled trials registry entry is available at:
https://www.socialscienceregistry.org/trials/804
An online appendix is available at:
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1. Introduction

A large research literature documents the substantial differences in parental engagement between advantaged and disadvantaged parents and the importance of parental engagement to children's future economic outcomes. Yet, existing programs intended to increase parental engagement have at best met with little success and sometimes at a high per child cost.

To address these issues we developed an experimental intervention designed to increase the amount of time that low-income parents spend reading to their children using an app on an electronic tablet. The intervention is based on principles from behavioral science that have been shown to be successful in changing behaviors such as financial savings, smoking cessation, and weight loss.

Over the past few decades, a growing research literature has demonstrated that decision-making is influenced by a variety of cognitive biases. A cognitive bias is a type of thinking that occurs when people focus too much on the present or adhere too much to routine such that opportunities for greater expected lifetime welfare are missed (Gilovich, Griffin, and Kahneman 2002; Lavecchia, Liu, and Oreopoulos 2014). For example, a substantial research literature has established that, in a variety of settings, individual responses deviate from those predicted by a time-consistent intertemporal utility model that assumes a constant discount rate (Stanovich, West, and Toplak 2012): future gains are discounted more than future losses; small changes to outcomes are discounted more than large changes (Frederick, Lowenstein, and O'Donoghue 2002); small probability events, when emphasized, are discounted less than when not emphasized; and responses depend on context, emotional state (Rick and Loewenstein 2008) and perceived social identity (Benjamin, Choi, and Strickland 2010; Galvan 2012). These cognitive biases result in suboptimal decision-making. In the case of parenting, decisions made today have associated payoffs in the distant future, expressed in terms of the child's future economic and social success. In this behaviorally-informed intervention we were especially focused on the cognitive biases in decision-making resulting from discounting the future.

Our main results indicate that the treatment increased the number of minutes that parents read to their children using an electronic application by one standard deviation, which equals twice as much reading time compared to the control group mean. The increase was much greater for parents with a high discount rate for the future as measured on a time preference task that we

administered. Our findings are suggestive of substantial promise for the application of behavioral tools to parenting interventions that promote investments in children's human capital.

The remainder of this paper proceeds as follows. Section 2 provides background on differences between advantaged and disadvantaged parents in both children's skills and parental engagement. Section 3 provides details about the intervention. Section 4 describes the results and Section 5 concludes.

2. Background

2.1 Socio-economic Gaps in Children's Skills and in Parenting

Substantial differences between the skill development of economically advantaged and disadvantaged children emerge well before the start of formal schooling. For example, pre-school age children from families in the poorest income quintile score on average at the 34th percentile in a test of literacy compared to children in the richest quintile who score at the 69th percentile (Waldfogel and Washbrook 2011). These gaps remain through the school years. In addition, conventional measures of school quality (teacher/pupil ratios and teacher salaries) have small effects on creating or eliminating gaps after the first few years of schooling (Carneiro and Heckman 2003; Cunha and Heckman 2007). It is perhaps not surprising that differences in measured school quality account for little of the difference in adult incomes because the variance in school quality is relatively small in the United States (Mayer 2010). Children spend the vast majority of their time from birth to adulthood in a family or other environment selected by parents and not in schools. For example children in the United States will spend only about 15-18 percent of their waking hours in school between birth and age 18.[1] Finally the intergenerational persistence of schooling reflects parent-child similarities in traits influencing educational attainment, such as orientation towards the future, sense of personal efficacy, work ethic, and other characteristics sometimes referred to as "non-cognitive skills" (see e.g. Cunha and Heckman 2007; Carneiro and Heckman 2003; Heckman and Kautz 2012). These skills are largely shaped by family influences and not by schools.

[1] In the United States the average length of the school day was 6.4 hours in the 2009-2010 school year and the average length of the school year was 180 days according the National Center Educational Statistics, Schools and Staffing Survey for that year. If we assume that this number is constant over all the years that a child attends school and that he number of years including kindergarten is 13, then (6.4*180)13 =14,976 is the total number of hours spend in school over the first 18 years of a child's life. If we assume that children average 16 hours awake each day the number of waking hours in the first 18 years is 18(16*364) = 104,832. Thus 14,976/104,832 = 13.2 percent of a child's waking hours in the first 18 years is spent in school.

Children's experiences prior to the start of primary school clearly play a large role in their futures. This insight has led to an emphasis on pre-kindergarten programs for disadvantaged children. Benefit-cost assessments of the Perry Preschool and the Abecedarian program and recent research in brain science showing the importance of early brain development support the notion that early child development is crucial to children's eventual success (Knudsen, Heckman, Cameron and Shonkoff 2006). However, although small-scale model preschool programs have resulted in important gains in children's educational attainment, earnings, and lower rates of getting in trouble with the law, Head Start, which is the primary preschool program for disadvantaged children in the United States, has produced at best small benefits for children. This is partly because even children enrolled in full-day preschool programs will spend only about 22% of waking hours from the age of 3 to 5 in preschool, and virtually no time at all between the ages of 0 and 3. Adding a program like Early Head Start will still leave parents with much more influence on children's development than school settings. Consequently attempts to substitute school-based programs for parents' engagement with their children cannot alone succeed in diminishing the effects of family background unless they are very intensive, extensive and expensive.

Across disciplines, dozens of studies have demonstrated many differences in the way advantaged and disadvantaged parents engage their children and how these differences matter to children's adult success. Among other things, advantaged parents spend more time, in particular on educational activities, with their children (Guryan, Hurst, and Kearney 2008; Kalil, Ryan, and Corey 2012) and produce more cognitively stimulating home learning environments (Harris, Terrel, and Allen 1999). In observational data these types of parenting practices explain large shares of the gaps between poor children and their more advantaged counterparts in cognitive and non-cognitive skills (Waldfogel and Washbrook 2011). In several papers James Heckman and his colleagues conclude that more engaged parents have greater success in producing both cognitive and non-cognitive skills in their children, and that both types of skills are crucial to social and economic success (see e.g. Cunha, Heckman, Lochner, and Masterov 2006; Heckman and Masterov 2004).

The gaps in parental time investment are important because research suggests that spending time with a child has a direct and causal effect on children's cognitive test scores (Villena-Rodán and Ríos-Aguilar 2012) and that it is the most productive input for cognitive skill

development (Fiorini and Keane 2014). Price (2010) finds that an additional year of daily mother–child reading would increase children's reading test scores in the early school grades by 41 percent of a standard deviation on average. By comparison, the Perry Preschool Program, which is widely upheld as a model preschool program, had effect sizes on arithmetic achievement at age 14 equal to 34% of a standard deviation but at a cost of $20,500 (in 2013 dollars) for each participant (Schweinhart et al. 2005). Yet substantial numbers of parents do not read to their children on a regular basis. In 2007, 16% of all parents of a child aged 3-5 years and 29% of parents living below the poverty line reported that neither they nor other family members read to their children at least three times per week (Noel, Stark, and Redford 2015). This represents an *increase* since 2001 when the number was 26% of poor parents. In addition, the gap in the amount of time that parents spend with their children overall and in educationally relevant activities has widened over the last 20 years because the rate at which highly educated mothers have increased amount of time in they spend in educational activities with their children has exceeded the rate at which mothers with less education increased such time with their children (Altintas 2012; Ramey and Ramey 2010; Hurst 2010).

Many parenting interventions have aimed to increase the amount of time that disadvantaged parents spend in educationally enriching activities with their children. However, these programs at best have had modest success. For example, many practitioners and policy makers believe that home visiting programs are the best way to improve parental engagement in disadvantaged families. Yet evaluations of these programs find little improvement in parent engagement or other aspects of the home environment (Olds, Henderson, and Kitzman 1994; Wagner, Spiker, and Linn 2002). This is important because the average cost to serve a family for 45 weeks in a home visiting program is about $6,500; the Nurse Family Partnership program is on average more expensive and can cost up to almost $14,000 for each participant (Zaveri, Burwick, and Maher 2014).

The lack of parental participation and persistence in home visiting programs is an important problem that is also found with other programs intended to increase parental engagement with their children. For example, almost half of families left the home-based Early Head Start program before their child was 30 months old (the program was designed to last until the child was 36 months old), and more than a third dropped out before they had been enrolled for 18 of the 36 months (Roggman, Boyce, and Innocenti 2008). Only 40% of families stayed

enrolled in Early Head Start home-based programs until graduation or transition. Other programs intended to change parenting behaviors experience similarly high attrition rates (Baker, Piotrkowski, and Brooks-Gunn 1999; Gomby 1999). Even if parents are motivated to invest in their children, many are apparently not motivated to participate in programs intended to increase their investment.

2.2 Obstacles to Parent Engagement: Insights from Behavioral Science

There are multiple theories that try to explain the difference in parental engagement with their children. Perhaps the dominant explanation for differences in parenting by family advantage is that disadvantaged parents expect a lower return for the time they spend with their children. Agee and Crocker (1996) use parent's decision about whether to treat high levels of lead found in their children's blood as an instrument for the parents' discount rate for child investments. They find that less educated and lower income parents discount their investments at about twice the rate as more advantaged parents and that both have discount rates that are high compared to other investments. Cunha, Culhane, and Elo (2013) find that the median subjective expectation about the elasticity of child development with respect to investments is between 4% and 19% for mothers of very young children who receive Medicaid. In comparison, the "true" elasticity estimated from CNLSY/79 data is between 18% and 26%. This means that on average disadvantaged parents underestimate the return to their investment in their children but still estimate a substantial positive return. Differences in expected returns could account for some of the difference in the amount of time that parents spend with their children, although a lower expected return could lead to either less or more investment.

It is also possible that the difference between advantaged and disadvantaged parents in time investments in their children stems from disadvantaged parents' experiencing less positive affect from interacting with their children. But Kalil, Mayer, Delgado, and Gennetian (2015) show that in fact mothers with less than a college education report more enjoyment from spending time with their children than do mothers with at least a college education. Disadvantaged parents could also be time constrained. However, as we noted above factors such as work hours or number of children account for little of the SES-based differences in time investments in children.

It could be that disadvantaged parents engage their children less because they lack information about how to invest or lack the resources (e.g. books, games) to engage their

children in educational activities. York and Loeb (2014) used a text-messaging program for parents of preschoolers designed to convey to parents specific steps they could take to increase their child's literacy skills. Their year-long intervention increased primary school students' scores on assessments of early literacy at the end of the intervention by between 0.21 to 0.34 standard deviations. They conclude that specific and repeated information on what to do, perhaps combined with reminders on how to use that information, may be effective at improving that outcome, at least in the short run. However, it is unclear whether the text messages were effective because of the information content of the messages or because they focused parents' attention in a way that increased their literacy engagement with their children.

Our approach is based on a rapidly growing research literature in psychology and behavioral economics that has focused on understanding why adults often fail to do things that they know they should do such as exercise, save, eat healthy foods, and how to change these behaviors. A leading explanation focuses on problems related to discounting the future such as impatience and present-bias (Thaler 2015). It is well known that future outcomes are under-emphasized (discounted) relative to immediate outcomes. This means that it is hard for people to give up things they enjoy today for the (under-valued) future and the result is problems of self-control. In the context of parenting it is hard to give up leisure today for a distant return on children's human capital. Discounting the future induces procrastination and impatience, which affects activities in many domains, such as in financial choices (savings and credit card borrowing, e.g. Meier and Sprenger 2010; Eckel, Johnson, and Montmarquette 2005), health-related behaviors like dieting and exercising, smoking and nutrition intake (e.g., Chabris et al. 2008), or education-related behavior like investments in human capital, studying, or behaving at school (Sutter et al. 2013; Castillo et al. 2011).

Some research has documented that low-income individuals discount the future more heavily than higher income individuals (Golsteyn, Grönqvist, and Lindahl 2013; Lawrance 1991; Dohmen et al. 2010). Other research suggests that this might help account for differences in child rearing behavior. For example Pabilonia and Song (2013) find that even after controlling for parental differences in income, employment, and education, single mothers who are more present-oriented spend significantly less time with their children overall and less time engaged with their young children in educational activities. Their children also have lower scores on reading comprehension tests.

Differences in time preferences may arise because disadvantaged parents face a host of stressors such as income instability, child care problems, car breakdowns, and the like, all of which place cognitive and emotional demands on their attention in the present and leave little energy for thinking about the future (Spears 2011; Mani et al. 2013; Gennetian and Shafir 2015). Differences in time preferences may arise for other reasons and may contribute to disadvantaged parents having lower education and income. Impatient individuals may prefer jobs with flat wage paths, as opposed to careers that promise high wages only after a period of training or education. Research has shown that certain behavioral tools such as commitment devices, reminders, and social rewards can help overcome impatience and procrastination and lead to better decisions.

Behavioral scientists have proposed a number of approaches for addressing present-bias. A *commitment* is a pledge to carry out a specific behavior or take actions necessary to achieve a specific goal (see Ashraf 2013; Bryan, Karlan, and Nelson 2010 for recent relevant studies). People are strongly motivated to be consistent with their own past actions, especially actions taken publicly. For this reason, when a commitment formalizes a person's pledge to do something or achieve an objective, it increases the chance that he or she will do it by increasing the psychological cost of not doing the behavior to which the individual committed. Research suggests that even the act of writing down a commitment to doing an activity can increase the likelihood of actually doing it (Giné, Karlan and Zinman 2010). Commitment devices reduce procrastination and impatience by focusing attention on the actions that the individual pledged to take.

Reminders can also reduce procrastination and impatience by inducing people to attend to tasks by refocusing attention on the task. A reminder can change time allocation today by focusing attention on the relationship between future outcomes and current choices. Text messages are the most common way to communicate reminders and they are now a common feature of many interventions (Richburg-Hayes et al. 2014). Castleman and Page (2013) and Bergman (2015) also show that text message reminders to parents and adolescents can improve educational outcomes.

Immediate incentives are designed to shift preferences by increasing the utility of the current behavior, often by increasing its monetary value but sometimes by increasing the cost of the alternative behavior. While a large research literature documents the importance of monetary incentives for changing behavior, a growing body of research also documents the importance of

nonmonetary incentives for changing behavior. This is not surprising because most people recognize that both praise and disapproval can be powerful motivators. Nonmonetary incentives may be at least as effective as monetary incentives at changing a behavior that an individual believes is pro-social or normatively desirable (Gneezy and Rustichini 2000; Benabou and Tirole 2003, 2006; Besley and Ghatak 2005; Dixit 2002). Parenting is more like a social than a monetary market and the time parents spend in educational activities with their children is generally believed to be a pro-social and normatively desirable behavior. Social incentives, like commitment devices, can reduce procrastination and impatience by focusing attention on the rewarded behavior.

3. The Parents And Children Together Intervention

We called our intervention the Parents And Children Together (PACT) program. Parents with children aged 3-5 enrolled in a subsidized preschool program (e.g. Head Start) in Chicago were given an electronic tablet to borrow for the six-week intervention. The tablet had an application pre-loaded on it that included over 500 children's books in English and Spanish. Within each preschool center, parents were randomized to either a treatment group or control group.[2] [3] The treatment included three behavioral tools (a commitment device, reminders and a social incentive) plus information on the importance of parents' reading to their children. The intent of the intervention was to increase the time that parents spent reading to their children using the app on the electronic tablet.

We use what Bryan, Karlan, and Nelson (2010) call a soft commitment device. At the beginning of each week a research assistant asked each parent in the treatment group to set a goal for how much time he or she would spend using the reading app during the next week. The research assistant recorded this number in the "virtual goal keeper" (VGK), which is a web site that we developed for the project. At the end of the week the research assistant showed the parent a bar chart on the VGK (or sent a text message with the information) that displayed the parent's

[2] We recruited parents when they dropped off or picked up their children at the centers. We spent between 6-10 hours in each center inviting parents to participate. Parents received different tablets depending on whether they were in the treatment or control group. The tablet number indicated the group to which they belonged. The recruitment process is explained in detail in the Online Appendix.

[3] Together the preschool programs served about 965 children at the time we began recruiting. Based on conversations with the staff of the preschools we estimate that about 15 percent of the 965 children were not eligible due to the language condition. We estimate that an additional 15 percent are siblings of another child in the center and only one sibling could be a focal child in PACT. Therefore, across the 8 centers, about 580 children were eligible to participate in PACT.

goal relative to how much the parent actually read. Parents were then asked to set a goal for the next week. This was repeated for every week during the intervention.

Parents in the PACT treatment group received a text message reminder every weekday. Text messages combined reminders to work toward the parent's goal of using the tablet to read to their child and messaging about the importance of reading. There were a variety of texts that repeated after the third week. Some examples were, "Are you working towards your goal this week? Remember that reading with your child is very important to your child's future." "What's your child's favorite book? Find some books your child loves and have fun reading them tonight!"

As a social reward if a parent met her reading goal she received a congratulatory text message, and if she viewed her reading minutes and goal on the Virtual Goal Keeper a cartoon bear did a celebratory dance. In addition, each week a text message went to all parents in a center saying, "This week in your group, the parent with [tablet number] did the most reading with their child! Congratulations to that parent!" The parent with that tablet number would therefore know that she had done the most reading but other parents would not know who that parent was.

We provided information on the importance of reading to treated parents while parents in the control group received `placebo' information. In particular, tablets for parents in the treatment group included 13 videos and 2 .pdf documents about parenting, language development and the importance of parents' reading to their children. Tablets for parents in the control group included 14 videos and 1 .pdf document about nutrition, health and dental hygiene. If a document was opened this information was stored on the tablet so we could identify whether parents opened the documents.

Parents in both the treatment and control group were asked to designate a "focal" child in case they had more than one child in preschool and they were instructed to use the reading app with this child. Parents were told that other children could be present when they used the app but that we were most interested in their use of the app with the focal child.

We observed parents using the app to read to their child over a six-week period. When a book from the app was opened on the tablet an audio and video recording of the parent reading to the child automatically began and continued until the parent finished the book or closed the app.

We identified the number of minutes that parents read to their children by using the time stamps provided in the reading application. We implemented the intervention in two six-week

rounds to minimize the number of electronic tablets that we needed to purchase. The first round was in the autumn semester of the preschool programs and the second was in the winter semester. As we describe below, we implemented two short follow-ups with participants to test whether the effect of PACT persisted after the intervention ended.

Parents whose primary language was either English or Spanish, who had a child enrolled in one of eight subsidized preschool programs in Chicago, Illinois, who were willing to sign a consent form and a pledge to borrow, safeguard, and return an electronic tablet at the end of the program were eligible for the intervention. [4] The preschool programs were located throughout the city and have a racially and ethnically diverse population. [5]

We collected data in 3 surveys. Survey 1 was administered when parents first received the electronic tablets. It asked parents to report general characteristics of the child, the household, and themselves. Survey 2 was administered in the middle of the intervention period and consisted of a time preference assessment that we discuss below. Survey 3 was administered at the end of the six-week intervention. It asked questions about parenting beliefs and practices.

4. Results

4.1 Do Parents Read More to Their Children?

A total of 169 parents participated in the PACT intervention. Among this group about half were randomized to the treatment (N=84) and half to the control (N=85) group. Of these, 160 took the first survey (80 treated, 80 control). Overall the parents participating in the PACT intervention are similar to a national sample of parents of children in Head Start programs on characteristics collected in the Head Start Family and Child Experiences Survey (FACES) except that a higher proportion of PACT families are Spanish speaking. Table 1 describes the main characteristics of the total sample and the treatment and control samples. No differences between the treatment and control group is statistically significant at the 5% level. Three differences were significant at the p=0.10 level, which is about what we would expect by chance.[6] The focal child from the treatment group was more likely to have been born early (p=.07). Treatment group parents were more likely to have a GED (p=.10) while control group parents were more likely to

[4] Besides the instructional videos, all tablets had 6 instructional videos (each in Spanish and English) pre-loaded on them. Two of these were on how to use the reading app and four were an introduction to the PACT study, the consent form, and the tablet agreement form that participants were asked to sign.

[5] A map of the City of Chicago with the geo-referenced preschool can be found in the Online Appendix.

[6] We compare differences in 22 variables in Table 1, so we expected 2.2 of them to be significant at the 10% level due to chance.

have some college (p=.10). Conditioning on these observed variables makes virtually no difference to the results.

Our main outcome of interest is the time parents spend reading to their children using the reading app on the tablet.[7] We also have information on related outcomes like the number of stories read by the parents; the average time spent reading each story, and whether parents read the same or different stories. We estimate the following equation:

$$(1) \quad Y = \alpha + \delta T + \varepsilon$$

where Y is an outcome variable, and T is an indicator for random assignment to our treatment. Our parameter of interest if δ, which equals the average difference for parents randomized to the treated group compared to those randomized to the control group. Below we add relevant covariates to this model to test the robustness of the results to their inclusion.

Column 1 in Table 2 shows results for the estimation of equation (1) with the number of minutes parents read to their children using the app as the outcome. On average, the treatment group read 88.3 minutes more than the control group over the six weeks of the intervention, more than doubling the amount of time spent read to the child using the app (an increase from an average of 63.3 to 151.7 minutes). This represents a one standard deviation difference. Column 2 shows that the average number of books read during the 6-week period was 14.8 for the control group and 31.4 for the treatment group. In other words, parents in the treatment group read an average of almost one book per weekday compared to two or three books per week for the control group.[8] The last column in Table 2 shows that the treatment also increased the fraction of parents ever using the app to read a story to a child from 84 percent for the control group to 96 percent for the treatment group.

We conducted short-term follow-ups of parents who participated in PACT. One group of parents kept the tablets for an additional three weeks immediately after the intervention ended and another group got the tablets back for three weeks three months after the intervention ended.

[7] Some parents may "outsource" the time investment to another family member, such as an older sibling, father, a grandparent or someone else. While in principle we could distinguish who was reading to a child in practice this became burdensome. In addition, there is no reason to expect that there would be differences between the control and treatment group in the tendency to outsource reading to others. Therefore, we counted all minutes in which the app was being used for actual reading. We spot checked videos to assure that there was both an adult and a child in them.

[8] We also found that there was no statistically significant difference in the average time spent reading each story, or in the number of different books read by parents. These results suggest that the treatment effect occurred mostly through reading more books.

No behavioral tools were used during either of the three week follow-ups. We then compared the amount of time that treatment and control group parents spent using the reading app during the follow-up period. Although the effect sizes remained very large for the follow-ups, these results were inconclusive because of the small sample sizes and selection into the follow-up groups. These results are available in the Online Appendix.

4.2 Do Parents Who Discount the Future Respond More to Reminders?

As noted, reminders and commitment devices are designed to overcome the procrastination that arises from discounting the future. If discounting the future reduces parents' engagement with their children and if these behavioral tools mitigate the discount rate on the future then we should observe that the parents who discount the future more read less to their children and respond more to the intervention. To explore this hypothesis, we implemented a time-preference task designed to measure parents' time discount rate.[9] We use the Convex Time Budget (CTB)[10] method (first introduced by Andreoni and Sprenger 2012) to estimate both a discount rate for parents and their present bias, which have been shown to best predict outcomes in previous research (Burks et al. 2012). We then examine whether parents with a higher discount rate read less and responded more to our treatment.

Parents were asked to choose between an amount of money that they could receive immediately or a different amount that they could receive later. In total, each parent answered 15 of these questions with four choices each (two inner solutions and two corner solutions), as in Andreoni, Kuhn, and Sprenger (2013). The first five questions gave parents the choice of receiving payments immediately or three weeks later, the next five questions gave parents the choice of receiving payments immediately or six weeks later, and the last five questions offered the choice of receiving payments in three or six weeks. Within each time horizon, each question presented an increasing price for the earlier payment. The set of choices is shown in the Online Appendix. The 3- and 6-week time horizons were chosen because the intervention lasted six weeks so the payout could be made during or at the end of the intervention. Comparing decisions with a delay of 21 days to those with a delay of 42 days allows us to identify the discount rate, or

[9] The time preference task was administered on electronic tablets after random assignment to parents in both the treatment and control groups. See the Online Appendix for more on details, procedures and the questionnaire.

[10] The CTB method identifies the curvature in the utility function over time by estimating a respondent's sensitivity to changing interest rates. The key in using this approach is to vary the implicit interest rate in the options presented across subsequent sets of options. The sensitivity to changing interest rates across the question sequences identifies the utility curvature; the time preference is identified through the stated preference over the timing of payments.

degree of "patience." Less patient (more patient) parents are defined as those with an estimated discount rate above (below) the sample median. The degree of patience among parents is balanced by treatment status.

Of the 169 participants who were eligible to participate in the time preference task, 112 participated. Of these, 59 were in the treatment group and 53 were in the control group and participation was not correlated with treatment status.[11] To understand how representative of our original 169 parents these 112 parents are, we first repeat the treatment regression shown in Table 2 for the 112 parents who participated in the time preference task. The first column of Table 3 repeats the result from Table 2 and the second column shows the results for the 112 parents who participated in the time preference task. The coefficient on the treatment condition is 82.1 in that model compared to 88.3 for our baseline estimation (the difference between these coefficients is not statistically significant).[12] We also compared parents who did and did not participate in the time preference task on the characteristics shown in Table 1. On these 22 characteristics no difference between the two groups was statistically significant at p=0.05.

Column 3 in Table 3 shows that the treatment effect for less patient parents was 124.52 minutes and column 4 shows that the treatment effect for more patient parents was only 42.26 minutes. The constant indicates the amount of reading net of the treatment. It shows that more patient parents read 97.26 minutes compared to less patient parents who read only 68.33 minutes. Thus, absent the treatment more patient parents read more than less patient parents but the treatment has a greater effect for less patient than for more patient parents. These results are consistent with the theory that parents who discount the future more invest less in their children's future but that the behavioral tools in PACT help these parents more.

4.3 Did Parents Learn from Goal-Setting?

Each week parents were asked, "How many days and how many minutes per day do you commit for your goal this week?" Anecdotally we know that parents in PACT attended to the goals that they set because they often told members of the research team that they were sorry that they did not meet their goal and expressed determination to meet the goal. In theory, goal setting

[11] 70% of the treated parents participated in the time preferences task, while 62% of the control group parents did. The mean difference of eight percentage points (pp.) has a standard error of 7.3 pp., and is therefore not significant at the .05 level.

[12] The z-test for the difference is given by z = (B1 - B2) / √(seB1^2 + seB2^2) = .203, and hence non-significant.

both focuses attention on the behavior that is the object of the goal thus reducing procrastination or impatience and by imposing a psychological cost to not meeting the goal.

If not meeting the goal is psychologically costly then we would expect that over the six weeks of the intervention the difference between the goal and the actual amount of reading time would decline. This in fact happened. In week one the average actual reading time for parents in the treatment group was 23 percent of the average goal. By week 6 the average actual reading time was 65 percent of the average goal. The convergence mainly occurred because the goals decreased each week (from an average of 93 minutes in week 1 to an average of 49 minutes in week 6). The actual reading time varied from 26 minutes per week to 34 minutes per week but there was no clear trend in the amount of reading over the intervention period.[13] Although parents became more realistic about how much they would actually read in the coming week, after six weeks the difference between the goal and actual reading time was still sizable.

4.4 Did Information about Reading Matter?

We explore whether information about the importance of parental engagement and reading in particular was an important part of the treatment effect by examining the responses to the survey that was administered at the end of the intervention. As noted the electronic tablets for parents in the treatment group had videos and .pdfs on the importance of parental engagement and especially reading while the tablets for the control group had placebo videos and .pdfs. However, only 15 parents in the treatment group and 15 in the control group ever opened a video or .pdf during the six-week intervention. Informal discussions with parents suggest that they mainly opened these as part of their exploration of what was on the tablet and not to engage in the content.

In addition, the survey that we administered at the end of the intervention asked three questions about parental engagement that were the subject of the informational material on the treatment group tablets. These questions were on parents' expected return to the time they spend reading to their children, their beliefs about whose job it is to teach reading to their children, and whether they think their child's ability is set at birth or not.

If the information on the tablets made a difference we would expect parents in the treatment group to report a higher expected return to their time compared to the control group

[13] The Online Appendix describes the process for estimating the average weekly goals and the average weekly actual amount of reading time.

parents. In the survey at the end of the intervention we asked the following question: "If you were to spend 15, 30, 45 or 60 more minutes per day in educational activities with your child, how do you think your child's reading skills would compare to all other children of the same age across the United States, on a 0-10 scale?" Figure 1 shows that parents in both the treatment and control group believe that investing more time in educational activities would increase their children's skills. However, we found no statistically significant differences between treated and control parents on this measure.

In the same survey we also asked parents, "Whose job is it to teach math and reading to preschool children." [14] If parents think it is mainly the job of the preschool to teach math and reading it implies that they do not believe that they need to spend educational time with their child in order to improve these skills. But only 1 percent of parents in the treatment and control groups combined reported that it was "only" or "mostly" the job of the preschool to teach math and reading to preschoolers and there were no differences between the treatment and control group on this measure.

In the same survey we also asked, "Think about a child's ability to talk and use language. How much do you think this ability is set from birth and how much is based on what parents teach the child?" If the information provided on the tablets is an important part of the treatment effect we would expect that parents in the treatment group would be less likely to answer that they believe ability is set. Only 6% of the parents indicated that child ability was set all or mostly at birth and there was again no difference between the treatment and control group.

The survey results suggest that parents in both the treatment and control groups believe that spending educational time with their child will increase their child's skills and that it is the parents' job to do this. A fuller description of these results can be found in the Online Appendix. It is perhaps not surprising that there is so little difference in the responses to these questions given that an important mission of Head Start is to convey to parents the importance of engaging their children and especially the importance of reading to their children. Parents clearly hear the message but many do not act on the information that they receive. From this we conclude that additional information about reading and parental engagement as presented in the PACT intervention played almost no role in the treatment effect.

[14] In a pretest we asked separately about math and reading. Because parents almost always gave the same answer for math as they did for reading we combined them in the survey for the whole PACT sample.

4.5 Robustness Checks

To test the robustness of our estimates we estimate several different specifications for our main outcome of interest. In the Online Appendix, we estimate the same specifications for additional outcomes.

4.6 Drop-Outs

Of the 169 parents, eleven returned their tablets and stopped their participation in PACT before the end of the intervention. Six of these parents belonged to the control group and all of them stopped during the first week of the intervention. Two of them recorded some reading. Of the five treated parents who stopped, three did so during the first week and two did so during the second week. We asked all eleven parents why they dropped out. The reasons included that they did not enjoy the check-ins (when we downloaded data from the tablets); that the child was too young to use the tablet; that the child was not interested in reading on a tablet; that the children in the home were fighting over the tablet; that the intervention felt like an invasion of privacy; and that the child was sick.

The results in Table 2 include the parents who dropped out and count them as not spending any time on the app after they dropped out. If we omit the eleven parents who dropped out, the treatment effect on the number of minutes spent reading with the app increases from 88.3 to 92.3 minutes.

4.7 Outliers

Figure 2 shows the distribution of reading time in 10-minute intervals, by treatment status. It shows that the control group's average total minutes of reading over the six weeks is clustered at the lower end of reading time. It also shows that for both the control and treatment groups there are individual parents who are on the far right tail of the distribution. Table 4 shows the sensitivity of our results on reading time to the omission of outliers. Column 1 shows our estimation for the effect of the treatment on reading time for the full sample. Columns 2, 3 and 4 exclude parents who read more than 600 minutes (three standard deviations (SD) above the treated group mean), 450 minutes (two SD) and 300 minutes (one SD), respectively.[15] Not surprisingly the coefficient on the treatment declines as we omit outliers. However, the effect sizes remain very large, ranging from 1.38 in the second column to 1.00 in the fourth column.

[15] The standard deviation for the treated group is 148 minutes.

We also tested the sensitivity of the results to omitting those who did not read at all, as shown in Column 5 in Table 4. Among parents who read at all, parents in the treatment group read 83.4 more minutes than those in the control group, which equals an effect size of .92.

4.8 Covariates, School Fixed Effects and Clustering

Of the 169 parents, 160 answered our initial survey. From those 160 parents, 151 have complete information (i.e., non-missing values) for the set of covariates described in Table 1 (except family income and race and ethnicity because these had a large number of missing data). The 18 parents with some missing information include 10 in the treatment group and 8 in the control group. The first column in Table 5 shows the baseline estimation for the 169 parents (from Table 2). The second column shows the results for the sample with complete information in the set of covariates in Table 1. The coefficient on treatment drops from 88.3 to 79.5. Column 3 adds school fixed effects, column 4 controls the covariates from Table 1 and column 5 adds school clusters. The results in column 5 show that the treatment effect and its statistical significance remains virtually unchanged when we condition on a large set of covariates, use school fixed effects and when we cluster on schools.

5. Conclusions

The PACT intervention increased the amount of time that parents in the treatment group read to their children by over 88 minutes over six weeks. We speculated that one reason that disadvantaged parents do not read more to their children is that they discount the future, resulting in impatience. Our evidence that less patient parents read the least to their children but that the intervention had the greatest impact on less patient parents supports this hypothesis.

A primary motivation for this intervention was the fact that programs to help parents engage with their children have largely been unsuccessful in either encouraging parents to participate in the program or in changing their level of engagement with their children. Consequently we were mainly interested in motivating parents to engage in the specific task of using the app to read and not necessarily in increasing parents' total reading time. However, increasing total reading time is also an important goal and as such it raises the question of whether parents substituted reading on the tablet for reading non-electronic books. For many parents and children the tablets may have been new and fun and the number and variety of books on the tablet may also have made substitution of the tablet for paper books likely. Such substitution is possible and we have no direct evidence of the degree of substitution. However,

some evidence suggests that little substitution occurred overall or at least that it did not occur differentially for treatment and control group parents. First, the amount of time that the parents in our sample spend reading to their children is very small. As Table 2 shows the control group read only 63.3 minutes over the entire six-week intervention. This equals about 1.5 minutes per day of reading. Parents in the control group all had the tablet with the reading app, so if these were enticing the amount of reading absent the behavioral tools must be close to zero leaving little room for substitution. We have no reason to believe that the pre-intervention reading time of the treatment group was any greater than the control group's reading time during the intervention. Thus it does not seem unreasonable to assume that prior to the intervention the amount of time that parents who participated in PACT read to their children was extremely small, and therefore that there was little room for substitution.

Assuming little or no substitution we can put the results from PACT in perspective using the results from Price (2010) in which he used an instrument for reading time based on birth order. Using the sample of mothers in the NLSY he estimates that an extra half hour of parents' reading to a child per week would raise children's reading scores by about 5% of a standard deviation per year and consequently that over 10 years the difference would be half a standard deviation. Over a six-week period parents in the PACT treatment group read on average 14.5 more minutes per week than the parents in the control group. Using Price's estimates this would imply that if these differences were maintained over a year the difference in reading scores would be about 2.5% of a standard deviation and over 10 years .25 standard deviations. However, Price's sample is all mothers in the NLSY so the sample probably has a higher mean for reading time. If we assume that the relationship between reading time and test scores is concave downward, then the effect of the PACT treatment on test scores would be much greater than is suggested by Price's results.

This paper has demonstrated that low-cost goal setting and reminders can motivate parents to do things that they want to do but often fail to do. This is important because many interventions have tried to change parental behavior with little success. Because these behavioral tools can be cost effective, they provide a promising way to help parents engage their children more often and more productively.

Supplemental Material

An Online Appendix for this paper can be found at NBER online (www.nber.org).

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Table 1. Summary statistics: Total sample, treatment and control groups

Variable	Total Sample	Treatment	Control	Difference	*p*
Mother's characteristics					
Female (%)	0.92	0.91	0.94	-0.03	0.63
Single (No Husband/ Wife/Partner) (%)	0.61	0.62	0.60	0.03	0.78
Age (years)	31.13	31.55	30.71	0.96	0.39
Black or African American (%)	0.32	0.29	0.36	-0.03	0.72
Hispanic (%)	0.66	0.71	0.59	0.08	0.32
Less than high school (%)	0.28	0.25	0.30	-0.06	0.36
High school diploma (%)	0.12	0.15	0.09	0.06	0.30
GED (%)	0.06	0.10	0.01	0.09	0.10
Some college (%)	0.29	0.24	0.34	-0.10	0.10
Associate's degree (%)	0.13	0.14	0.12	0.02	0.78
Bachelor or higher (%)	0.13	0.12	0.14	0.00	0.97
Focal child's characteristics					
Age (years)	3.76	3.74	3.77	-0.02	0.89
Boy (%)	0.44	0.47	0.41	0.07	0.28
Born early (%)	0.16	0.20	0.13	0.08	0.07
Born late (%)	0.13	0.11	0.15	-0.04	0.46
Born on time (%)	0.70	0.69	0.72	-0.04	0.41
<5 pounds at birth (%)	0.24	0.24	0.24	-0.01	0.90
Has disability (%)	0.12	0.13	0.11	0.02	0.71
Household characteristics					
Number of children in the household	1.99	1.94	2.05	-0.12	0.45
Number of adults in the Adults in household (besides parent)	1.28	1.38	1.18	0.18	0.28
Household income last year ($1,000s)	20.85	18.82	22.59	-3.42	0.31
English spoken at home (%)	0.65	0.62	0.67	-0.01	0.71
Observations	160	80	80		

Notes: Of the 169 parents, 160 answered our initial survey. From those 160 parents, 151 have complete information (i.e., non-missing values) for the set of covariates described in Table 1 (except family income and race and ethnicity because these had a large number of missing data). The 18 parents with some missing information include 10 in the treatment group and 8 in the control group.

Table 2. The effect of the PACT treatment on measures of parents' reading using the electronic app

	Dependent Variable:		
	(1)	(2)	(3)
	Minutes Read	Number of books	Any Reading
Treatment ($\hat{\delta}$)	88.32*** (18.79)	16.66*** (4.50)	0.12** (0.05)
Constant ($\hat{\alpha}$)	63.34*** (9.49)	14.78*** (3.00)	0.84*** (0.04)
SD Control Group	87.48	27.68	.37
Effect Size	1.01	.60	.31
Observations	169	169	169

Notes: Robust standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01. The table shows results for the estimation of equation (1) using "Minutes Read", "Number of Books" and "Any reading" as outcomes, each of which are explained as follows. Column 1: "Minutes read" is the number of minutes parents read to their children using the app. Column 2: "Number of books" is the number of books parents read to their children using the app. Column 3: "Any reading" is the fraction of parents who read at all to their children using the app. SD Control Group is the standard deviation of the control group for the respective dependent variable. The effect size is the ratio of the coefficient for the treatment group to the standard deviation of the control group.

Table 3. Treatment effects by level of patience

	Dependent Variable: Reading Time			
	(1)	(2)	(3)	(4)
	Baseline: All PACT Parents	Participated in time preference task	Less patient parents	More patient parents
Treatment ($\hat{\delta}$)	88.32*** (18.79)	82.12*** (24.08)	124.52*** (33.25)	42.26 (33.95)
Constant ($\hat{\alpha}$)	63.34*** (9.49)	83.61*** (14.11)	68.33*** (12.57)	97.26*** (24.19)
SD Control Group	87.48	102.76	62.95	128.08
Effect Size	1.01	.80	1.98	.33
Observations	169	112	54	58

Notes: Robust standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01. The table shows results for the estimation of equation (1) using "Minutes Read," as the outcome, on different samples, each of which are explained as follows. Column 1: considers all PACT parents. Column 2: considers parents that participated in the time preference task. Column 3 and 4: considers the sample of less and more patient parents, respectively. More patient (less patient) parents are those whose score on the time orientation task is below (above) the median. SD Control Group is the standard deviation of the control group for the respective dependent variable. The effect size is the ratio of the coefficient for the treatment group to the standard deviation of the control group.

Table 4. Treatment effects, excluding outliers

	Dependent Variable: Reading Time				
	(1)	(2)	(3)	(4)	(5)
	Baseline: All PACT Parents	Excludes parents who			
		read more than 600 minutes	read more than 450 minutes	read more than 300 minutes	did not read at all
Treatment $(\hat{\delta})$	88.32*** (18.79)	86.48*** (15.57)	72.48*** (13.74)	51.30*** (10.75)	83.42*** (19.77)
Constant $(\hat{\alpha})$	63.34*** (9.49)	56.69*** (6.85)	56.69*** (6.85)	52.67*** (5.62)	75.82*** (10.76)
SD Control Group	87.48	62.78	62.78	51.16	90.68
Effect Size	1.01	1.38	1.15	1.00	.92
School Fixed Effects	No	No	No	No	No
Covariates	No	No	No	No	No
Observations	169	167	164	155	151

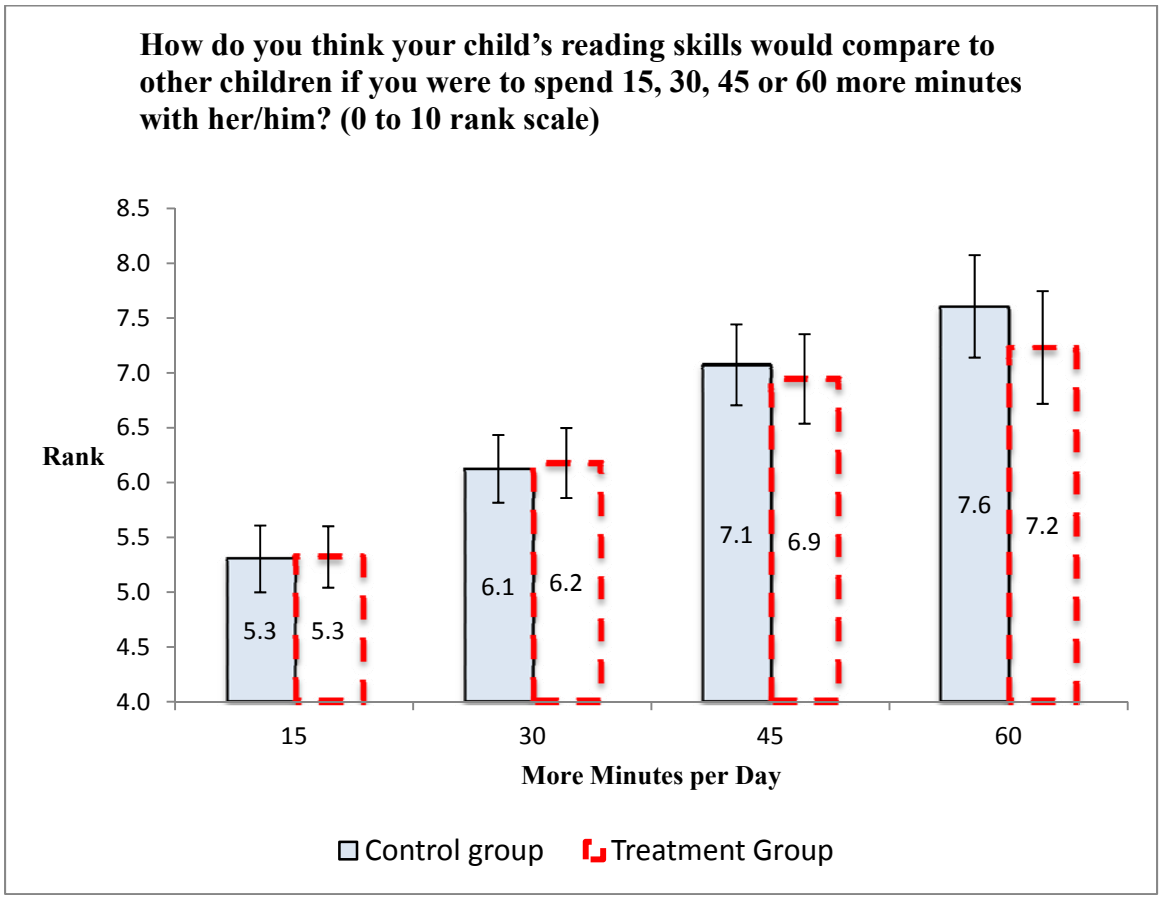
Notes: Robust standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01. The table shows results for the estimation of equation (1) using "Minutes Read", as outcome, on different samples, each of which are explained as follows. Column 1 includes all the total sample of 169 parents. Column 2 excludes parents who read more than 600 minutes (1 from the control group, 1 from the treatment group). Column 3 excludes parents who read more than 450 minutes (1 from the control group, 4 from the treatment group). Column 4 excludes parents who read more than 300 minutes (2 from the control group, 12 from the treatment group). Column 5 excludes parents who did not read at all (14 from the control group, 4 from the treatment group). SD Control Group is the standard deviation of the control group for the respective dependent variable. The effect size is the ratio of the coefficient for the treatment group to the standard deviation of the control group.

Table 5. The effect of the treatment on minutes read using covariates, preschool fixed effects, and preschool clustering

	Dependent Variable: Reading Time				
	(1)	(2)	(3)	(4)	(5)
	Baseline: All PACT Parents	Sample with complete information	+Preschool Fixed Effects	+Covariates	+Preschool clustering
Treatment $(\hat{\delta})$	88.32*** (18.79)	79.50*** (20.00)	80.09*** (19.27)	83.03*** (21.07)	83.03** (26.06)
Constant $(\hat{\alpha})$	63.34*** (9.49)	66.87*** (10.25)	44.98*** (14.26)	-40.30 (89.86)	-40.30 (103.61)
SD Control Group	87.48	89.89	89.89	89.89	89.89
Effect Size	1.01	.88	.89	.92	.92
Complete Information	No	Yes	Yes	Yes	Yes
School Fixed Effects	No	No	Yes	Yes	Yes
Covariates	No	No	No	Yes	Yes
Clustering	No	No	No	No	Yes
Observations	169	151	151	151	151

Notes: Robust standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01. The table shows results for the estimation of equation (1) using "Minutes Read", as outcome, using covariates, preschool fixed effects, and preschool clustering, explained as follows. Column 1 includes all 169 parents. Columns 2-5 exclude parents with missing covariates. The covariates included in column 4 and 5 are all those listed in Table 2. SD Control Group is the standard deviation of the control group for the respective dependent variable. The effect size is the ratio of the coefficient for the treatment group to the standard deviation of the control group.

Figure 1. Parental expectations: Change in child's rank in kindergarten for each additional time investment



Notes: The data represents answers to the question: **"**If you were to spend 15, 30, 45 or 60 more minutes per day in educational activities with your child how do you think this would change your child's reading skills compared to all children of the same age across the United States (on a 0-10 scale)?"

Figure 2. Distribution of reading minutes by control and treatment groups in 10-minute intervals