

VOLUME 23 ISSUE 4

The International Journal of

Early Childhood Learning

SPARK Ohio

An Early Childhood Intervention Program
Description and Evaluation

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THE INTERNATIONAL JOURNAL OF EARLY CHILDHOOD LEARNING

www.thelearner.com
ISSN: 2327-7939 (Print)
ISSN: 2327-8722 (Online)
doi:10.18848/2327-7939/CGP (Journal)

First published by Common Ground Publishing in 2016
University of Illinois Research Park
2001 South First Street, Suite 202
Champaign, IL 61820 USA
Ph: +1-217-328-0405
www.commongroundpublishing.com

The International Journal of Early Childhood Learning is a peer-reviewed, scholarly journal.

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SPARK Ohio: An Early Childhood Intervention Program Description and Evaluation

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Abstract: While early intervention programs are designed to address the needs of vulnerable children from the ages of three to five, SPARK Ohio uses a home visitation model designed to prepare children, in cooperation with their parents/caregivers, to transition from home to school academically, physically, and socio-emotionally (e.g., interacting with others). Using cross-sectional data from the Ohio Education Management Information System, multiple regression models estimated the influence of SPARK on Ohio's kindergarten readiness scores (2012) with variables of interest, including SPARK Ohio and preschool participation. For children entering kindergarten in 2012, 578 participated in the early intervention SPARK Ohio program with families recruited from six counties, twelve districts, and twenty-nine schools across Ohio. After controlling for demographic, socioeconomic, and community-level variables, program participants demonstrated statistically significant higher readiness scores for kindergarten literacy relative to their non-SPARK Ohio peers. Readiness was moderated by preschool attendance, with program participants who also attended preschool having the greatest levels of readiness. By using student-level data, we are able to isolate and estimate treatment effects between comparable groups: SPARK Ohio participants and non-participants. This study provides practitioners with empirical results when investigating or proposing early childhood intervention programs and serves as a basic methodological model for early childhood intervention researchers. This study describes an early intervention experience aligned with kindergarten preparation standards that actively engage parents in the learning experience. Participants demonstrated significantly higher kindergarten readiness assessment scores compared to non-participants.

Keywords: Early Childhood, School Readiness, Parent Engagement, Early Childhood Intervention, Home Visitation

Introduction

In the state of Ohio, one-third of children enter kindergarten unprepared to learn the basic skills necessary to gain an appropriate education, thus perpetuating long-term inequities in academic achievement, mental and general health development, and social ability (Ohio State Board of Education 2006; Heckman 2011). Further, these types of educational inequities place a daunting burden on state and local resources, as well as on local economies, due to an underdeveloped workforce lacking the knowledge and skills necessary to fulfill individual productivity potential (Heckman 2011). It is within this context that this study investigates an Ohio early childhood intervention program designed to address these short- and long-term educational challenges.

Children who struggle academically frequently have backgrounds identified as being at-risk for facing long-term challenges in both school and life (e.g., single-parent households, lower SES, language acquisition delays) and lack the foundation that typically fosters success (Burger 2010; Heckman 2011). For example, Hart and Risley (1995, 198) studied language acquisition in children ranging in age from six months to four years and found that, "In four years, an average child in a professional family typically accumulates experience with 45 million words,¹ an

¹ Hart and Risley (1995) define these as the total number of words children heard (i.e., utterances), not unique words learned.

average child in a working class family ... 26 million words, and an average child in a welfare family ... 13 million words.” Again, these and other inequities potentially lead to an increased risk of grade level repetition, need for special education services, and withdrawn engagement or total enrollment from school (Burger 2010). However, Heckman (2011) found that these adverse conditions can be overcome through an investment of time and resources that focus on high-quality early childhood educational intervention programs.

Early Childhood Intervention Programs

Created in 1965 as part of the “war on poverty,” Head Start provided the nation’s first federally funded early childhood intervention program (Currie 2001; Deming 2009). Head Start was implemented using a comprehensive framework of participant cognitive, physical, and social development, as well as the enhancement of household well-being (Office of Head Start 2015). Duncan and Magnuson (2013) evaluated the program through the Head Start Impact Study of 2002 and found that the program’s three-year-old participants scored significantly better than the control group on the Woodcock-Johnson III oral comprehension assessment. Similarly, four-year-old participants demonstrated higher language outcomes on a vocabulary measure when compared to non-participants.

Multiple longitudinal studies designed to describe and estimate the influence of early childhood programs provide similar findings as Head Start. Some of these programs include the Perry Preschool Project, Carolina Abecedarian Project, and Chicago Longitudinal Program targeting at-risk infants and children in classroom and home-based interventions. These programs addressed projected academic shortcomings with some actively involving parents in the child’s early preparation process. From these studies, the findings show that relative to nonparticipants, program participants’ benefits include: short- and long-term increases in achievement test scores (Ramey and Campbell 1984; W. S. Barnett 2011; Duncan and Magnuson 2013), fewer required special education services (Schweinhart 2004; Reynolds, Temple, and Ou 2003), increased college enrollment (Duncan and Magnuson 2013), and higher rates of bachelor’s degree attainment (Campbell et al. 2012). In addition to academic benefits, research on these programs found long-term positive impacts with participants typically earning higher median incomes (Schweinhart 2004) and having lower arrest rates (Mann, Reynolds, and Temple 2001) compared to nonparticipants.

Importance of Parental Engagement

Active and on-going parental engagement plays a critical role in early childhood education outcomes. Achieving success in school, with success defined as a reduction in the achievement and social skill gap between at-risk children and their not at-risk peers, requires ongoing and active engagement within the family, such as providing children with encouragement, emotional support, and opportunities to demonstrate or display their hard work while actively pursuing community resources in support of the child’s development (Heckman 2011).

Providing services in the child’s home environment allows for the “development of skills that will help children reach their full potential” (National Center for Injury Prevention and Control Division of Violence Prevention, 2014, 7), thus serving as a critical element to promoting positive change in a child’s life (Isaacs 2008). For example, children participating in the Nurse-Family Partnership home visit study showed improvement in language and comprehensive functioning at follow-up for ages two, six, and nine. Not only did home visitation programs show improvement in children’s antisocial and academically focused behavior, they also correlate with higher math and reading scores, as well as higher grade point averages (Olds et al. 2007).

Home visits are also an integral component of the Parents as Teachers program, which emphasizes the effects of parental behavior on child development, particularly in low-income

households (Wagner and Clayton 1999; Wagner, Spiker, and Linn 2002). A standardized curriculum administered by trained parent educators from birth through age three incorporates verbal interactions, word play, and reading exercises into the daily parent-child routine. Curriculum “dosage” (i.e., home visits) is contingent upon family preference and demonstrated need (Wagner, Spiker, and Linn 2002; Zigler, Pfannenstiel, and Seitz 2008). Program participation has shown small, yet positive effects on social, language, and motor development compared to non-participants (Wagner, Spiker, and Linn 2002).

SPARK Ohio Study Context

The Supporting Partnerships to Assure Ready Kids Ohio (SPARK Ohio) initiative began with a five-year W. K. Kellogg Foundation grant awarded in 2003 to the Sisters of Charity Foundation of Canton, Ohio. SPARK Ohio was one of eight SPARK initiatives awarded across the United States designed to increase school readiness among at-risk children ages three to six (Greeley and Greeley 2011). The SPARK Ohio program focused on increasing school readiness and addressing the needs of at-risk children by engaging parents through a home visitation model. Sisters of Charity Foundation, Canton, developed the SPARK Ohio program in collaboration with a group of over forty early childhood experts and community providers as well as input from the Ohio Department of Education and the W. K. Kellogg Foundation. As shown in Table 1, SPARK Ohio serves as a catalyst to prepare children for school academically, physically, and socio-emotionally, as well as supporting and preparing school staff and enhancing community systems of care to at-risk children, ages three to six.

Table 1: SPARK Ohio Content

Categories	Sub-categories (incorporate the following)
Academic	Development of oral language skills Development of mathematical skills
Physical	Development of communication and fine/gross motor skills
Socio-emotional	Development of independence and self-help skills Capability to interact with other children and follow directions

This study provides an in-depth analysis of SPARK Ohio using student-level data to estimate the program’s influence on preparation for kindergarten entry as measured by the Ohio Kindergarten Readiness Assessment for Literacy (K-RAL).² Between its implementation in 2005 and 2012, this early education program has expanded to reach approximately 2,306 children throughout several of Ohio’s largest school districts.

² K-RAL was replaced in 2014–15 with the Kindergarten Readiness Assessment. The original KRA-L was required of all incoming kindergarteners and focused on six areas of literacy: 1) answering who, what, when, why and how questions; 2) repeating sentences; 3) identifying words that rhyme; 4) giving a word that sounds the same as another word (rhyming production); 5) identifying letters; and 6) listening and identifying the beginning sounds of words (Ohio Department of Education 2009).

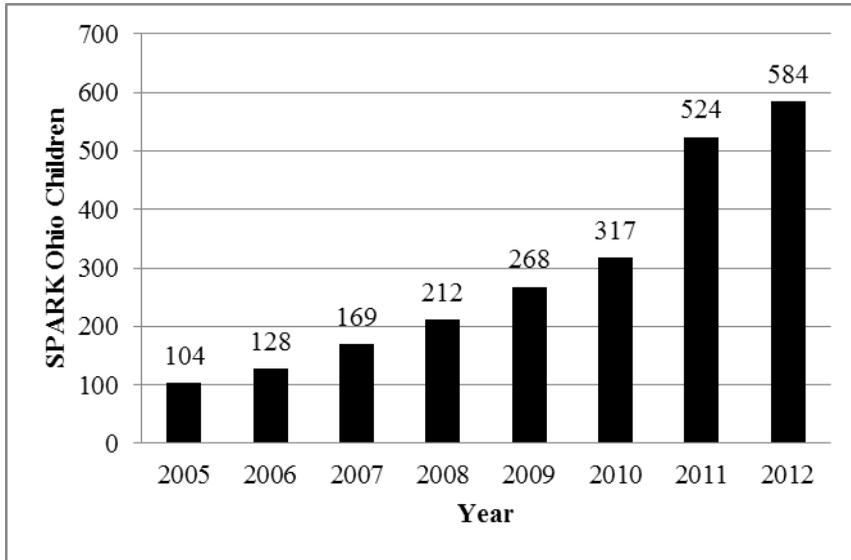


Figure 1: SPARK Ohio Participation, 2005–2012

SPARK Ohio Curriculum

The program identifies its staff as Parent Partners with the child’s parent(s)/caregiver(s) as Learning Advocates. For the purposes of this article, we will use the general terms *program provider* to describe the Parent Partners and *parent/caregiver* to describe the Learning Advocates. Program providers (PP) recruit families using multiple awareness initiatives (e.g., letters to parents, informational sessions). Primarily supported by community-based agencies,³ the ten-to-twelve month SPARK Ohio program uses individual home visits and group sessions to foster engaged learning for children and their parents/care givers. As families enroll in the program, they initially engage in two to three visits over the course of one month, during which the PP administers multiple assessments to develop individualized goals (see Table 2).

Table 2: SPARK Ohio Assessments

Assessment	Program Use
Home Observation Measurement of the Environment (HOME)	Measure of cognitive and emotion stimulation within child’s living environment (i.e. access to puzzles and books, parent receives daily newspaper)
Ages & Stages® Questionnaire (ASQ)	Tracks developmental progress and screens for areas of risk for children ages 1–5.5 years of age ^a
Woodcock Johnson	Measure of cognitive and intellectual abilities, oral language, and academic problem-solving skills

Responsive Services referral as needed, based on participant score

Lesson plans are built based on Ohio’s Early Learning Academic Content Standards. The PP recommends or provides multiple books and instructional or supporting resources to foster both parental and child skill development during the home and group sessions. For example, activity cards are incorporated into the visits to encourage parent/caregivers’ active involvement in the

³ SPARK Ohio is operated out of a variety of agencies and organizations including: early childhood and family community agencies; school districts; libraries; local foundations; children’s hospitals.

child's learning. The PP also encourages parents to engage children in additional learning opportunities, including enrollment in a certified preschool program. The SPARK Ohio curriculum's scope and sequence focus on the ultimate goal of children who complete the program being better prepared to enter kindergarten with skills they would not have otherwise gained.

Dosage

Prior research finds that a single intervention session is insufficient to impact early childhood educational outcomes and multiple monthly sessions typically demonstrate the best outcomes for child literacy (Tout et al. 2009). While the SPARK Ohio program is designed to provide eighteen sessions for three and four-year-old children, in practice, achieving intended dosage for all participants is often difficult to achieve for most home visitation programs (Daro et al. 2012). Despite these difficulties, setting minimum participation thresholds "can set an evidence-based standard against which dosage can be monitored and measured, instead of relying on the field's 'best guess' of how much of the intervention is essential" (Wasik et al. 2013, 10). However, even with an evidence-based standard, an appropriate dosage threshold may vary from program to program or from participant to participant. For example, Wasik et al. (2013, 11) reports communication from the designers of a randomized control trial of a home visitation intervention that completion of 45–62 percent of the program typically led to desired outcomes. Using this range as a baseline and for the purposes of this study, SPARK Ohio administrators have determined that children are considered to have received a minimal effective intervention dosage if they participated in at least eight lessons of the SPARK Ohio lessons, equating to approximately 44 percent of the total eighteen sessions.

Research Questions

Given the literature's broad early childhood intervention program descriptions and findings, this study focuses on Ohio's kindergarten entry assessments (i.e., KRA-L scores). This research estimates the influence of the SPARK Ohio early intervention program by comparing program participants to similarly situated non-participants using student-level data for children who participated in SPARK Ohio and entered kindergarten in fall 2012. The following research questions will be addressed through this research:

1. How do children participating in SPARK Ohio differ from those who do not?
2. To what extent do children participating in SPARK Ohio program achieve different results on the KRA-L from non-participating children with comparable backgrounds?
3. To what extent does preschool enrollment moderate these findings?

Methods

Sample

Using student-level data for children participating in the SPARK Ohio program (n = 578), this study describes and analyzes outcomes for children who entered kindergarten in fall 2012. While fall 2012 is the kindergarten enrollment date (and KRA-L assessment date), children may have participated in SPARK Ohio for one to three years (2009–2012) prior to fall 2012. However, rather than focusing on duration, this study uses total dosage as a controlling factor, irrespective of the chronological duration of participation. The data represent children from six counties, twelve school districts, and twenty-nine schools across Ohio and was filtered to include only those who participated in at least eight monthly sessions, thus reducing the sample to 454 participants (78.5 percent of total). Further, an additional 1,983 children who did not participate

in SPARK Ohio but enrolled in kindergarten in the same twenty-nine schools during fall 2012 are included and serve as the comparison control group when estimating the SPARK Ohio program’s influence. Finally, this research was first approved in May 2013 by the Kent State University institutional review board.⁴

Data Collection

Student-level and administrative data were collected from the Ohio Education Management Information System (EMIS) system and were organized within Stata 14. As shown in Table 3, economic disadvantaged status is classified using a dummy variable where 1 indicates either a) the child or household member is eligible for free or reduced price lunch, b) it is known that the child receives public assistance, or c) the child’s parents completed a Title I application (ODE 2012), with a 0 indicating the child/family is not eligible for any of these financial support programs. Also, as individual preschool attendance is not a required field and, therefore, not reported consistently in the Ohio EMIS, preschool status is classified as 1 = Yes and 0 = Unknown. School district information such as median income and rural/suburban/urban status, were gathered from 2013 typology data provided by from the Ohio Department of Education (2013).

Table 3: Variable Descriptions

Variable	Description
Student ID	Uniquely identifies each student
Gender	1 = Male; 0 = Female
Race	1 = White; 2 = Black; 3 = Multi; 4 = Hispanic; 5 = Other
Quarter of birth	1 = Jan-Mar; 2 = Apr-Jun; 3 = Jul-Sep; 4 = Oct-Dec
Learning Disability Status	1 = Yes; 0 = No
Econ disadvantaged	1 = Eligible for financial support; 0 = Not eligible
SPARK Ohio	1 = Yes; 0 = No
Preschool	1 = Yes; 0 = Unknown
KRA-L Scores	Assessment results
Median Income	School district-level median income
Urbanicity	1 = Rural; 2 = Suburban; 3 = Urban

Dependent Variable

The KRA Readiness Assessment-Literacy (KRA-L) is an assessment of kindergarten children’s literacy readiness and is administered at the beginning of the school year and includes the following: rhyming, letter recognition, oral language, and alliteration. Scores can range from zero to twenty-nine, with higher scores indicating greater literacy readiness.

Analyses

We introduce our analysis with descriptive statistics of demographic and background variables for the treatment and comparison groups (see Table 4). T-tests and chi-square tests were performed to measure the statistical significance of the differences between the groups. Next, we

⁴ Kent State University is the IRB of record for this project. The University of Kansas has entered into an IRB Authorization Agreement with Kent State University IRB on behalf of Dr. Thomas DeLuca’s participation in this research.

performed hierarchical multiple regression analyses to estimate whether participation in SPARK Ohio influences subsequent KRA-L scores using Stata 14.

Descriptive Statistics

Demographic and background variables were examined separately for SPARK Ohio and comparison children using t-tests and X^2 results to identify significant group differences. Frequencies were calculated for the following demographic and background nominal variables: gender, quarter of birth, race, learning disability, economically disadvantaged status, preschool attendance and urbanicity. Means were calculated for the continuous variables: school district-level median income and KRA-L scores. Chi-square tests and t-tests were conducted to explore for differences between the two samples: SPARK Ohio and comparison children.

Hierarchical Multiple Regressions⁵

Although the descriptive statistics suggest SPARK Ohio has a positive influence on kindergarten preparation (KRA-L scores of 18.9 vs. 17.1 for non-participants), it does not hold constant a variety of other factors that likely influence children's preparation levels. To address this limitation, a series of hierarchical multiple regression models were estimated, with each model adding control variables to further isolate SPARK Ohio's influence. The dependent variable in each of these models was the KRA-L score. Cases with missing data were deleted using listwise deletion, reducing the sample size to 1,968 for the five hierarchical multiple regression analyses. The five models are described briefly below:

- *Model 1* focuses on KRA-L scores, while only controlling for student-level characteristics for all students entering kindergarten in fall 2012: $KRA-L_i = \alpha_i + StChar_i \beta_1 + \mu_i$
- *Model 2* adds community control variables to Model 1, again estimating KRA-L scores for all students who entered kindergarten in fall 2012: $KRA-L_i = \alpha_i + StChar_i \beta_1 + CommChar_i \beta_2 + \mu_i$
- *Model 3* introduces Preschool participation as the variable of interest: $KRA-L_i = \alpha_i + \beta_1 Preschool + StChar_i \beta_2 + CommChar_i \beta_3 + \mu_i$
- *Model 4* introduces SPARK Ohio participation as the variable of interest: $KRA-L_i = \alpha_i + \beta_1 SPARK\ Ohio + \beta_2 Preschool + StChar_i \beta_3 + CommChar_i \beta_4 + \mu_i$
- *Model 5* adds the interaction with SPARK Ohio and Preschool participation: $KRA-L_i = \alpha_i + \beta_1 SPARK\ Ohio + \beta_2 Preschool + StChar_i \beta_3 + CommChar_i \beta_4 + \beta_5 (SPARK\ Ohio \times Preschool) + \mu_i$

In each of the five models, the equations' variables indicate where:

- KRA-L = individual scores on the KRA-L assessment
- i = child ($i = 1-1,968^6$)
- *Preschool* = child participated in ($1 = yes, 0 = unknown$)
- *SPARK Ohio* = child participated in SPARK Ohio ($1 = yes, 0 = no$)

⁵ Hierarchical multiple regression should not be confused with hierarchical linear modeling. Hierarchical multiple regression involves a series of separate regression models in which control variables are added to each subsequent model until the last model contains control variables and the variable of interest. Hierarchical multiple regression allows researchers to determine the improvement in predicted variance in the dependent variable with each subsequent model. Hierarchical linear modeling accounts for clustering or nesting within groups (e.g., nesting children within schools) to predict variance in the dependent variable due to random (individual) and fixed effects (group).

⁶ Sample size for the multiple hierarchical regression is reduced to 1968 due to listwise deletion for missing data.

- StChar = a vector⁷ of student characteristics (controls)
 - birth month (by quarter)
 - gender
 - minority status (categorical)
 - disability status (1 = yes, 0 = no)
 - receiving free/reduced lunch
 - CommChar = a vector of community characteristics (controls)
 - median school district income
 - urbanicity (1 = rural, 2 = suburban, 3 = urban)
- μ = unobserved error

Adjusted Cell Means

Adjusted cell means, also known as least squares means, are predicted means based on the results of a multiple regression analysis. Examining adjusted cell means can be useful when interpreting results obtained from an interaction between two or more independent variables.

Results

Descriptive Findings

Of the total number of SPARK Ohio participants (n = 573), approximately 79 percent of children completed the minimum dosage threshold of eight sessions (n = 454), with these children completing an average of fourteen sessions before entering kindergarten. As shown in Table 4, we used Chi-square estimations to test the independence of categorical variables and a t-test to compare means of continuous variables. SPARK Ohio and comparison children demonstrated no significant differences in gender, economic disadvantage status, or learning disability. However, significant differences emerged in race with a greater percentage of non-SPARK Ohio children being African American and more SPARK Ohio children attending preschool than comparison children whose preschool status is unknown. In addition, the median school district income was significantly higher among non-SPARK Ohio children and a greater proportion of SPARK Ohio students were from rural communities while a smaller proportion was from urban communities.

Table 4: Comparison of SPARK Ohio and Non-SPARK Ohio children on Demographic and Student-level Variables

	SPARK Ohio (n = 454)	Comparison (n = 1983)	Statistic
<i>Gender (%)[†]</i>			$X^2(1) = 2.02, p = .16$
Male	222 (48.9%)	1043 (52.6%)	
<i>Quarter of Birth</i>			$X^2(3) = 5.01, p = .17$
January-March (%)	109 (24.0%)	387 (24.7%)	
April-June (%)	101 (22.3%)	375 (24.0%)	
July-September (%)	120 (26.4%)	454 (29.0%)	
October-December (%)	124 (27.3%)	350 (22.4%)	
<i>Missing</i>	—	417	

⁷ Vectors of related variables organize control variables into logical groups and provide a simplified model equation and in this study, the use of vectors should not imply anything more than an equation documentation method.

	SPARK Ohio (n = 454)	Comparison (n = 1983)	Statistic
<i>Race (%)</i>			$X^2(4) = 12.19, p = .01$
African American	196 (43.2%)	994 (50.1%)	
Caucasian	183 (40.3%)	701 (35.4%)	
Multi-Racial	51 (11.2%)	150 (7.6%)	
Latino/Hispanic	19 (4.2%)	150 (7.6%)	
Other	5 (1.1%)	27 (1.4%)	
<i>Learning Disability Status</i>			$X^2(1) = 5.60, p = .02$
Yes	45 (9.9%)	133 (6.7%)	
<i>Economically Disadvantaged (%)</i>			$X^2(1) = .09, p = .76$
Yes	205 (45.2%)	880 (44.8%)	
<i>Preschool (%)</i>			$X^2(1) = 36.4, p = .00$
Yes	147 (32.4%)	385 (19.4%)	
<i>Urbanicity</i>			$X^2(2) = 22.58, p = .00$
Rural	106 (23.5%)	285 (14.4%)	
Suburban	145 (32.2%)	702 (35.5%)	
Urban	200 (44.4%)	992 (50.1%)	
Missing	3	4	
<i>Median Income</i>			$t(2428) = 2.48, p = .01$
2010\$ Mean (SD)	24,500 (4,287)	25,089 (4,603)	
Missing	3	4	
<i>KRA-L Scores</i>			$t(2388) = 4.66, p = .00$
Score Mean (SD)	18.9 (6.8)	17.1 (7.2)	
Missing	47	—	

[†]Percentages are based on non-missing values

Hierarchical Multiple Regression Models

Five hierarchical multiple regression models were estimated using the KRA-L score as the dependent variable, with each successive model adding control variables. As shown in Table 5, variables for all five models, except for preschool and SPARK Ohio participation in Model 5, were statistically significant and had the expected sign, though the interaction of preschool and SPARK Ohio in Model 5 was significant. Model 1 included student level variables for quarter-based birth ranges, gender, disability status, and economic disadvantage. Model 2 adds community-level variables such as median school district income and community type; Model 3 adds preschool status and suggests that children who attended preschool score 1.27 points higher than children whose preschool status is unknown. Model 4 adds participation in SPARK Ohio and shows that SPARK Ohio children score approximately 1.6 points higher than comparison children, while Model 5, which includes the interaction between preschool attendance status and SPARK Ohio participation, shows that the interaction was statistically significant. Further, analyses of adjusted means for the interaction, as shown in Figure 2, reveal that students who attend both SPARK Ohio and preschool have the highest predicted KRA-L scores (margin mean = 21.15). Students who attend SPARK Ohio but do not attend preschool are predicted to receive

the next highest KRA-L scores (marginal mean = 18.43). Interestingly, regardless of preschool status, children who did not participate in SPARK Ohio are predicted to receive the lowest overall KRA-L scores (marginal means = 17.75 and 17.63, respectively). For students who participated in preschool, this suggests that children who participate in the SPARK Ohio program score, on average, 3.39 points higher on the KRA-L, or 19.1 percent higher than those who do not.

Table 5: Summary of Hierarchical Regression Analysis for Variables Predicting Kindergarten Readiness—Literacy Scores

Variable	Model 3 [†]		Model 4		Model 5	
	B	t	B	t	B	t
Constant	18.25	18.30**	17.50	17.54**	17.34	17.38**
<i>Student Variables</i>						
<i>Quarter of Birth</i>						
January-March	-1.18	-2.71**	-1.11	-5.77**	-1.14	-2.64**
April-June	-2.55	-5.88**	-2.50	-5.77**	-2.55	-5.88**
July-September	-2.77	-6.64**	-2.70	-6.48**	-2.72	-6.54**
October-December (referent)	—	—	—	—	—	—
Male	-.91	-2.97**	-.87	-2.87**	-.86	-2.82**
Minority	-.68	-2.00*	-.67	-1.98*	-.72	-2.14*
Learning Disability	-4.38	-6.97**	-4.49	-7.19**	-4.47	-7.11**
Economically Disadvantaged	-2.44	-6.14**	-2.55	-6.44**	-2.57	-6.49**
<i>Community Variables</i>						
Median Income	.00	1.90	.00	2.29*	.00	2.62**
<i>Urbanicity</i>						
Rural	1.72	3.17**	1.78	3.29**	1.81	3.35**
Suburban	3.03	6.25**	3.34	6.77**	3.43	6.98**
Urban (referent)	—	—	—	—	—	—
Preschool	1.27	3.07**	.89	2.08*	.12	.23
SPARK Ohio Participation			1.59	4.24**	.79	1.74
SPARK Ohio x Preschool					2.60	3.42**
R-Squared	0.12		0.13		0.13	
F for change in R-Square	9.32**		16.85**		10.21**	

[†]Models 1 and 2 are not displayed and are available upon request; N = 1968; * = p < .05; **p = < .01

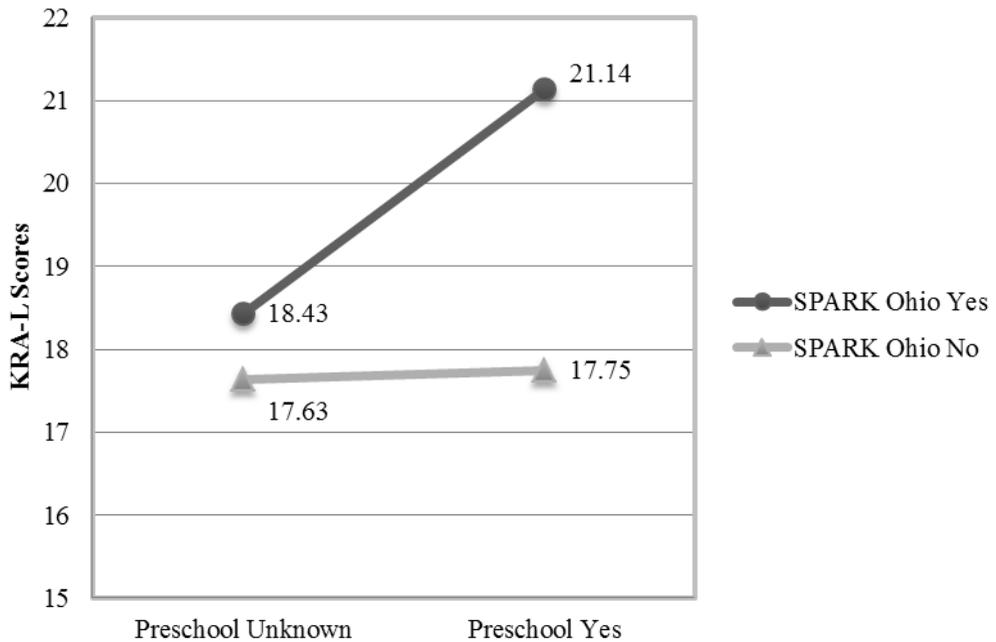


Figure 2: Adjusted Means for Interaction of SPARK Ohio Participation and Preschool Attendance Status

Discussion

This study's results show SPARK Ohio's strong positive influence in preparing children for kindergarten, even when controlling for individual and community factors. The results further demonstrate that preschool attendance may moderate the influence of SPARK Ohio participation, suggesting that SPARK Ohio students who attended preschool may be significantly better prepared for kindergarten in terms of literacy than SPARK Ohio students who may not have attended preschool (preschool status unknown) *and* comparison students, regardless of their preschool status. This study's results are similar to the findings reported in an evaluation of Parents as Teachers (PAT), another home visitation-based intervention program, which revealed that 75 percent of children with low-income status were assessed as ready for preschool when the children participated in the PAT intervention in combination with preschool (Zigler, Pffannenstiel, and Seitz 2008).

While some researchers question the lasting impact associated with early childhood educational experiences (Lipsey, Farran, and Hofer 2015), the vast majority of studies show that high quality early childhood educational experiences, especially in children with additional personal development or socialization needs, leads to long-lasting positive outcomes for children and society (Camilli et al. 2010; Barnett 2011). Further, the literature describes the additional benefits of an early educational experience aligned with educational standards that includes parents in the learning process that prepares children for success, especially in kindergarten literacy.

Policy Implications

Current levels of early childhood funding and program quality vary dramatically across the United States (Barnett et al. 2015). While this study does not address early childhood program funding issues, this program was implemented in Ohio, which, based on 2013 and 2014 data, ranks poorly across most preschool indicators, with this study demonstrating both a need and one

possible solution; i.e., SPARK Ohio. Given that the state is ranked twenty-sixth in state funded preschool, \$4,000 per student, has low quality ratings meeting only four out of ten preschool benchmarks, and ranking thirty-sixth in state preschool rates with only 4.1 percent of four-year-olds attending state preschool (Barnett et al. 2015), the need for high-quality early intervention programs is evident. Finally, less than half of Ohio's public school districts (45 percent) offer state funded preschool. With these many challenges, opportunities to provide statistically significant positive short- and potentially long-term outcomes with programs such as SPARK Ohio may serve as a viable option (and program model) in districts and states when funding and access to high quality preschool is limited or non-existent.

Future Research

One common benchmark when studying early childhood programs and their efficacy is a cost-benefit analysis. As in most educational and social science research however, one of the challenges of cost-benefit analyses is the ability to monetize the benefit (Levin and McEwan 2002). While the available data do not support a SPARK Ohio-based cost-benefit analysis, future research of other programs might examine the cost-benefit of home-based early childhood interventions, possibly using *cost avoidance* of outcomes such as grade retention, unexcused absences, and reported discipline, as a monetized benefit. In addition, recent research challenges the long-term impact of early educational experiences (Lipsey, Farran, and Hofer 2015), therefore future research may examine the longitudinal influence of SPARK Ohio on academic performance in multiple subjects (e.g., reading, math) and transitions between special education, at-risk, and gifted programs as compared to students who did not participate in SPARK Ohio. Likewise, future research may examine other outcomes such as truancy, discipline, graduation rates, and college enrollment among SPARK Ohio participants as compared to non-participants. Finally, while the study focused on children who completed a minimum of eight sessions as suggested in the literature to be a likely optimal dosage (Tout et al. 2009; Boller et al. 2004), one question remains beyond the scope of this study as an area for future research: Are there unmeasured benefits for parents and children who do not complete the minimum of eight sessions, such as parents' recognition of their child's additional needs or increased awareness of possible resources and potential interventions?

Limitations

While the research design used only post-test data to examine differences in KRA-L scores, it is possible that there are fundamental differences between parents and children who participate in SPARK Ohio and those who do not. Although most of the identified differences between SPARK Ohio and comparison groups were not statistically significant, four key variables were: preschool attendance status, race, urbanicity, and median school district income. Relative to comparison children, SPARK Ohio participants were significantly more likely to have a preschool attendance status of "yes," to be non-minority, live in rural areas, and have lower median school district income. Because of the non-experimental nature of this study and data limitations requiring that preschool data from the Ohio Education Management Information System be only classified as "yes" or "unknown" rather than a dichotomous yes or no, it is impossible to determine if the significant differences in preschool attendance between SPARK Ohio and comparison groups were 1) simply a result of missing data; 2) a result of SPARK Ohio attendance, one component of which is to encourage preschool attendance; or 3) due to measurable underlying differences between SPARK Ohio and comparison children and families.

In terms of the impact of these differences, our model showed that race was not a large predictor of KRA-L scores and, therefore, the differences between these two groups are not overly concerning. Median school district income, urbanicity and preschool status all appeared to have significant impacts on KRA-L. However, given that parents of non-SPARK Ohio children

had higher median school district income would suggest that our analyses were more conservative or favorable towards non-SPARK Ohio children. Lastly, preschool status appeared to have a strong positive effect on KRA-L scores. However, despite concerns regarding missing data, results were consistent with what would be expected from an effective program: SPARK Ohio children who attended preschool were predicted to score higher than non-SPARK Ohio children with unknown preschool status, whose KRA-L scores were predicted to be the lowest.

Conclusion

The findings and conclusions of this study provide several state and local policy and practice implications. For example, based on the statistically significant results showing increased KRA-L scores among SPARK Ohio participants, state policy makers might investigate funding options for programs like SPARK Ohio, either independently or in cooperation with charitable foundations. Further, at the local level, school district administrators responsible for allocating their available funds might consider budgeting a portion of those funds for early childhood programs such as SPARK Ohio. In addition, with programs such as SPARK that focus on parental engagement, parents may be better prepared to actively participate in their children's education. Given increased levels of parental engagement, educators will be better informed and more prepared to meet the individual needs of their pupils. Early intervention programs such as SPARK Ohio provide a classic example of *early investment for long-term gains*, with children's lives as the currency. Future research into the long-term benefits of early childhood intervention programs like SPARK Ohio may provide policy makers with sufficient evidence to promote or even require offering local early intervention programs in an effort to not only improve student outcomes, but also prepare children to become successful young adults equipped with the skills necessary to achieve their full potential.

Acknowledgement

This research was funded by the Sisters of Charity Foundation, Canton and Early Childhood Resource Center (ECRC) who are responsible for design and administration of the SPARK Ohio program. We wish to express our gratitude to Joni Close, Sisters of Charity Foundation, Scott Hasselman, ECRC, and Angela Moses, ECRC, for their support and guidance.

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ISSN: 2327-7939

