
The Abecedarian Experience

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Early child development (ECD) programs are not a fully established and accepted activity of societies, as are general health care or public education. Yet, early educational intervention through ECD programs is often cited as a remedy for failures in health or educational systems and as a means to economic growth. To substantiate these claims, research on the efficacy of these programs is needed.

Data on the efficacy of ECD programs are accumulating. They support the goal of making early educational intervention a well-established activity that societies can and do believe in. To believe in early educational intervention through early child development, one must also believe that society's educational programs for parents and children should:

- Be more comprehensive
- Start earlier in life
- Give as much attention to prevention as to treatment.

ECD policies and programs that embrace these three attributes can significantly help to prevent children's failure in school and foster their development for a lifetime.

This fact is clearly demonstrated by the Abecedarian Project, which was initiated in North Carolina in the early 1970s. Researchers in the Abecedarian Project followed young children, beginning at age 3 months, through young adulthood, until age 21. The three decades of this evaluation research document the benefits of comprehensive, early, and preventive interventions and provide insight on strategies for intervention research.

**Preventing Failure and Promoting Development
The Abecedarian Project
Recommended Strategies for Intervention Research**

Preventing Failure and Promoting Development

Being comprehensive, starting early, and emphasizing prevention as well as treatment prevents failure in school and promotes healthy social-emotional development.

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Readiness for School Is a Key Indicator

Consider the relationships among school readiness, school achievement, and social development. In the United States, unprecedented numbers of children start public kindergarten at age 5 years with major delays in language and basic academic skills—and with an increased likelihood of developing conduct disorders during their school years. This problem is not unique to the United States, for each country has its own version of this problem.

Waiting until unprepared children “fail” and then providing them remedial, “pull-out,” or compensatory programs—or requiring them to repeat grades—does not help them catch up and then achieve at grade level. Instead, scientific evidence affirms that children who do not have positive early transitions to school—that is, children who experience failure early in school—are most likely to become inattentive, disruptive, and/or withdrawn. These same students are later the most likely to drop out of school early; engage in irresponsible, dangerous, and illegal behaviors; become teen parents; and depend on public assistance programs for survival.

What can be done to end this predictable decline?

The scientific evidence that this negative cascade can be prevented is compelling. The facts show that prevention of school failure and promotion of children’s cognitive and social-emotional development cannot wait until kindergarten or until children show signs of developmental delay or conduct disorder. Rather—

The commitment to improve children’s achievement in grades K–12 must begin with providing children a rich array of effective learning opportunities *in the first 5 years of life*.

Early Learning Is Essential and Has Quantitative Effects

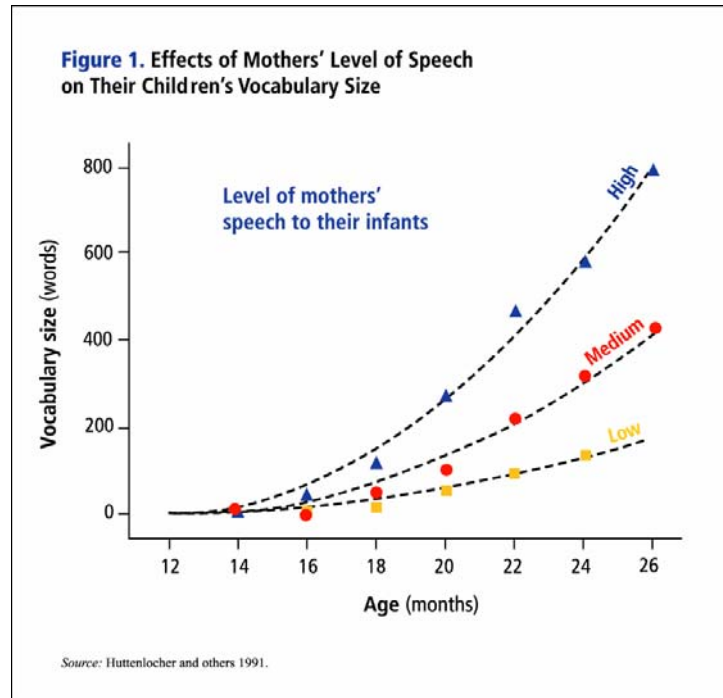
One might ask: What crucial experiences are needed in the early years of life? Do all children need the same learning opportunities? Does early caretaking or experience really affect brain development? Are these effects important or lasting?

Right from birth, babies are actively learning throughout the day. Their learning occurs through the types, amounts, and predictability of visual, auditory, sensory, and social-emotional experiences they have with their parents and other caregivers. That these early learning experiences are causally linked to many aspects of brain functioning and child development is becoming increasingly clear.

These essential formative experiences come from transactions that parents and other caring individuals have and can provide children in any culture. They do not depend on money or special toys or equipment—but, they do involve parents’ and caregivers’ time, skill, and active commitment.

There is a positive quantitative relationship between children’s receiving more (or less) of these essential early experiences and children’s development—including their later achievement in reading and mathematics. Figure 1 illustrates this quantitative relationship for young children’s acquisition of language.

During the first 24 months of life, children’s acquisition of language is highly associated with their mothers’ speech. By 2 years of age, children whose mothers speak to them the most have vocabularies that are eight times greater than those whose mothers speak to them the least.



This strong relationship between the amount of a parent’s language stimulation, as well as a parent’s active teaching, and a child’s language and cognitive development has been documented in hundreds of studies. But the most compelling findings are those that demonstrate the significant benefits of providing enriched learning opportunities to children who do *not* receive these on a regular basis in their homes.

When given the right types and amounts of language and cognitive experiences, particularly within a warm and responsive social context, children *from all walks of life* gain in their intellectual and social-emotional competence.

- See “*Experience-based Brain Development: Scientific Underpinnings of the Importance of Early Child Development in a Global World*,” by J. Fraser Mustard in this publication.

The Toll of Limited Learning Opportunities Is Cumulative

The toll of limited learning opportunities and low expectations for children from “high-risk” home environments is undeniably cumulative. Extrapolations from several studies comparing the course of development for children who do and do not receive positive learning experiences in the first 5 years of life (Campbell and Ramey 1995; Hill, Brooks-Gunn, and Waldfogel 2003) show that—

Children who do not have a solid pre-kindergarten foundation are likely to start kindergarten approximately 2 years or more behind children of similar ages and environments who do have a firm pre-kindergarten foundation. This difference in developmental age, or developmental competence, is even greater between children from high-risk environments and children from learning-enriched environments.

Delays of this magnitude constitute a serious challenge for classroom teachers and school districts, as well as for the children themselves. In addition, the developmental delays may be accompanied by conduct disorders during the children's school years.

Catching Up

Scientific studies confirm that when children who are developmentally delayed enter *good* schools, they learn and benefit—at rates which indicate that their learning ability is not truly impaired. Within 9 months of good schooling, the children can advance approximately 9 months developmentally in cognitive and language skills. However, this rate of learning is *not* sufficient to compensate for their entry-level delays or to allow the children to “catch up” fully.

That is, 5-year old children whose cognitive and language skills resemble those of a 3-year old are ready to learn at their own level—and will progress at a normal rate in a first-rate educational kindergarten environment that promotes learning. However, the delayed children are not likely to be able to advance a full 33 developmental months in only 9 calendar months—the amount needed to close the achievement gap.

Summer Losses

Scientific studies also demonstrate, importantly, that during the 3 months of summer, children from homes that do not actively promote learning fail to progress in their academic or language skills, whereas children from families that provide ongoing cognitive supports progress an additional 3 months developmentally. This difference in children's learning during the summer months further increases the achievement gap between disadvantaged and advantaged children—even when they are both in highly supportive school programs during the academic year (Alexander, Entwistle, and Olson 2001).

By the end of 2nd grade, children from high-risk environments who do not benefit from solid learning opportunities during the summer will be even further behind than their classmates from more advantaged homes—despite their participation for 3 years in a solid school-based program.

Children's Total Experience Lays the Foundation for a Lifetime

Children's learning is not restricted solely to the hours of formal schooling. Their achievement during the school years, as during the first 5 years of life, results from all of their learning opportunities—at home, in formal programs, on the playground, and in the community. It is the totality of a child's experience that lays the foundation for a lifetime of greater or lesser competency.

While schools are vitally important, schools alone cannot close the gaps in children's achievement.

Rather, strategic investments are needed in programs and community supports which will ensure that children's developmental needs are met in a timely, consistent, and responsive way. The goal is to have all children become increasingly caring, cooperative, creative, and contributing young citizens by providing them the "daily essentials" that will enable them to:

- Explore their worlds actively
- Learn new skills and ideas
- Be celebrated for their actual achievements
- Be taught a great deal about language and be encouraged to express themselves
- Be protected from harsh and inappropriately punitive treatment
- Be supported in their play (Ramey and Ramey 1999a).

The facts presented above derive from a number of evaluation studies and are informative for planning future ECD programs. The research includes an important series of experimental studies conducted during the past 30 years within and in relation to the Abecedarian Project.

The Abecedarian Project

The Abecedarian Project was launched in the early 1970s in North Carolina, U.S.A. (Ramey and others 2000). From Latin, "Abecedarian" means "one who learns the basics, like the alphabet."

Study Design

The Abecedarian Project was a longitudinal, randomized controlled trial to test the efficacy of early childhood education for high-risk children and their families. The study involved 111 children who at 3 months or earlier were randomly assigned to two groups: an experimental, or treatment, group (57 children) and a control group (54 children).

All 111 children in the study were healthy, full-term infants with a normal birthweight, but they lived in families that were extremely challenged. Their family characteristics included:

- Very low incomes (below 50 percent of the federal poverty line)
- Very low levels of education (approximately 10 years) among mothers
- Low intellectual attainment [average Intelligence Quotient (IQ) near 80]
- Single parenthood (in approximately 75 percent of the families)
- Unemployed parents.

The study was designed to focus on the value added of a high-quality, supportive educational program for young children. The researchers sought to answer the question, "Can the cumulative developmental toll experienced by high-risk children be prevented or reduced significantly by providing systematic, high-quality, early childhood education from birth through kindergarten entry?"

Table 1 summarizes the treatment received by the treatment and control groups. Both groups received:

- Adequate nutrition (i.e., free, unlimited supply of formula)—none of the mothers chose to breastfeed.
- Supportive social services for the family with referrals as needed (e.g., for housing, job training, mental health and substance abuse problems).
- Free or reduced-cost medical care (consistent with the highest levels of professionally recommended pediatric care) for the children’s first 5 years of life.

With this design, the control group was not untreated. Rather, the children and families’ basic nutrition, health, and social service needs were addressed systematically during the children’s first 5 years of life.

The treatment group received, in addition, enrollment in a specially created early childhood center by the time the children were 3 months old and lasting until they entered public kindergarten. The preschool program was intensive, full day, and 5 days a week for 50 weeks a year.

Table 1. Description of Program for Treatment and Control Groups, Abecedarian Project

The Abecedarian preschool program	
Treatment group	Control group
<ul style="list-style-type: none"> Adequate nutrition Supportive social services Free primary health care <p>Preschool treatment:</p> <ul style="list-style-type: none"> • Intensive (full day, 5 days/week, 50 weeks/year, 5 years) • <i>LearningGames Curriculum</i> <ul style="list-style-type: none"> • Social/Emotional • Early Literacy • Oral Language • Cognitive • Motor • Individualized pace 	<ul style="list-style-type: none"> • Adequate nutrition • Supportive social services • Low-cost or free primary health care

Source: Campbell and Ramey 1995.

The Abecedarian Curriculum

In the early childhood center, the children in the treatment group received a specially developed curriculum, *LearningGames, The Abecedarian Curriculum* (Sparling and Lewis 2000, 2001, 2002, 2003, 2004) (see box 1). This curriculum—

- Is based on the burgeoning scientific evidence about how infants and toddlers learn

- Derives from Vygotskian theory (Vygotsky 1978)—which holds that the fundamental way a child’s higher mental functions are formed is through mediated activities shared with an adult or another more competent peer.

Box 1. Key Features of *LearningGames*, The Abecedarian Curriculum

- Covers the first 60 months of life
- Can be used in the home or in a childcare center
- Involves mainly one-on-one interactions and some small group experiences
- Is based on a broad-spectrum approach and has many specific goals (e.g., enhancement of early literacy skills) embedded
- Is described on individual, self-contained pages
- Is focused on adult-mediated play
- Consists of game-like episodes
- Can be integrated into the daily routine of a home or childcare center
- Teaches both child skills and adult skills.

The curriculum’s instructional model takes into account the abilities of the preverbal child. The model is organized around three principles, or instructional strategies, that are used sequentially: *Notice*, *Nudge*, and *Narrate*.

If these strategies are present in the adult’s behavior, he or she typically finds it easy to implement a selected curriculum episode or to think of variations and invent new educational activities throughout the day. By having these skills, the teacher, parent, or caregiver can assist in all aspects of a child’s development and learning, including even aspects that may not be considered core parts of the curriculum.

The three parts of the instructional model are followed cyclically (figure 2), and many iterations of the cycle may be made during a single instructional episode (Sparling 2004). *Noticing* what a child is doing is always an adult’s point of departure. What the adult observes guides his or her selection of an appropriate *nudge* to “get things going.” Once the child begins to respond, initiate, or talk, the adult assumes the role of *narrator*.

The adult’s narration often tracks what the child is doing and, at other times, guides the child’s action in new directions. Whenever the adult notices a change in the child’s behavior, the three-part cycle renews itself and begins again.

Figure 2. Three-Part Instructional Model for *LearningGames*, *The Abecedarian Curriculum*



Source: Sparling 2004.

Each *LearningGames* activity is a series of mediated learning experiences in which an adult surrounds a child's efforts with subtly supporting and enabling behaviors—a process known as *scaffolding*. Key among an adult's scaffolding behaviors is oral language, which provides the critical link between the social and the psychological planes of human mental functioning.

For example, an adult's narration of a child's actions and decisionmaking in a *LearningGames* activity gives the child a template on which to build his or her own private speech (in the Vygotskian view, private speech is the primer mechanism for a child's self-regulation).

The *LearningGames* curriculum consists of more than 200 specified activities in social-emotional, literacy, oral language, cognitive, and motor development. Each activity has multiple levels of difficulty. Teachers individualize the program for each child so that children are continuously challenged to progress to the next level. A child is not placed in a rigid group curriculum, which may be too advanced or too basic for the child.

Preschool Results

In the Abecedarian Project, researchers measured many aspects of the Abecedarian children's growth and development during their preschool years. The assessments included cognitive and social-emotional outcomes for children and benefits for mothers.

Cognitive and Social-Emotional Outcomes

Highly qualified psychologists who did not know about the children's preschool treatment administered or scored individual cognitive assessments for all the children ages 3–54 months. The findings are as follows.

- For the first 12 months, the treatment and control group performed similarly and essentially at the national average.
- After 12 months, the control group's scores declined precipitously and, by 18 months, these children were performing at the low end of the normal range (at a Developmental Quotient of 90)—in contrast to the treatment group, whose scores did not decline.
- For the remaining preschool years, the treatment group scored 10–15 points higher, on average, than did the control group, on three different types of developmental assessments (Ramey and others 2000).

In the education field, an effect size of 0.25 or more is widely accepted as the basis for changing practice and policy. In the Abecedarian study, the effect size ranged from 0.73 to 1.45 for children ages 18 months–4.5 years. These differences are highly likely to be practically meaningful in the children's everyday lives.

IQ Range

A clinical perspective offers another view. Table 2 shows the percentage of children in each group who scored in the normal range of intelligence (i.e., earning IQ scores of 85 or higher on tests that have a national average of 100) at ages 6 months–4 years. The findings are as follows (Martin, Ramey, and Ramey 1990):

- For the control group, more than 90 percent were in the normal range at age 6 months, but this percentage dropped to 45 percent at age 4 years—clearly, a cumulative toll.
- For the treatment group, 95 percent and more were in the normal range at all the ages tested.

Table 2. Percent of Sample in Normal IQ Range (> 84) by Age, Control and Treatment Groups, Abecedarian Project

Group	Age of child/percent of children			
	6 Months	18 Months	36 Months	48 Months
Control	93%	78%	49%	45%
Treatment	100%	100%	95%	95%

Source: Martin, Ramey, and Ramey 1990.

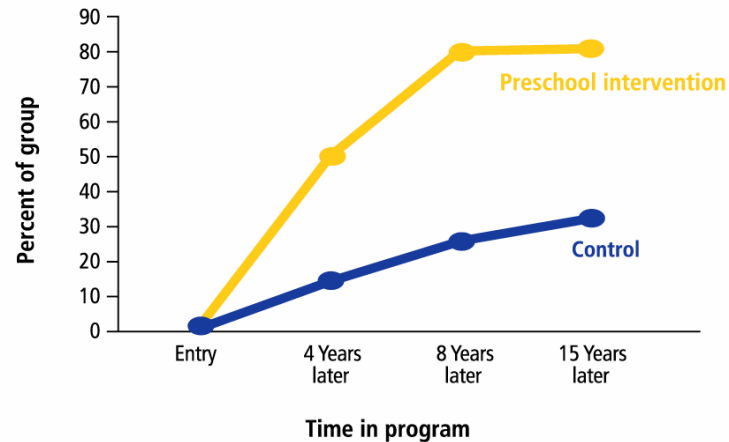
Benefits for Mothers

The Abecedarian preschool intervention had other benefits as well, which included advantages for the children’s mothers. For example:

- During the preschool years, the teenage mothers of children in the treatment group were significantly more likely to continue their own education.
- The teenage mothers’ seeking of additional education continued throughout their children’s school years and, by the time the children were 15 years old, 80 percent of their mothers had some post-high school education, compared with only 30 percent of the teenage mothers of children in the control group (Ramey and others 2000).

The project staff encouraged the mothers of children in both groups to seek additional education through the social services component, but no formal educational program was implemented for the mothers. Figure 3 shows the percentage of teenage mothers in both groups who sought additional education.

Figure 3. Percent of Teenage Mothers Who Sought Post-High School Education Beginning When Their Infant Entered the Intervention (Treatment) or Control Group and During the Subsequent Years of the Program, Abecedarian Project



Source: Ramey and others 2000.

Replication: Project CARE, Infant Health and Development Program

The hallmark of good science is replicability of procedures and findings. The Abecedarian Project was replicated in two additional longitudinal studies conducted in nine different sites:

- Project CARE (Wasik and others 1990)—initiated in 1978 in North Carolina
- Infant Health and Development Program (IHDP) (IHDP 1990)—initiated in 1985 and comprising eight sites, in Arkansas, Connecticut, Florida, Massachusetts, New York, Pennsylvania, Texas, and Washington.

Researchers at all nine sites documented the benefits of preschool educational intervention for children—higher performance on tests of intelligence, language, and social-emotional development at 3 years of age. A follow-up study of the eight IHDP sites showed higher performance on vocabulary, math, and social measures at age 18 years (McCormick and others 2006).

Targeted ECD Programs

One of the most pressing policy issues is whether all young children need early educational enrichment. For instance, do all premature and low-birthweight infants need a special early educational intervention program?

The findings from the IHDP, which focused on 985 low-birthweight, premature infants, are informative. The findings support the:

Well-established effects of maternal education on children’s intellectual and cognitive performance.

Among the control group of 608 children, those whose mothers had not graduated from high school performed at the very lowest level (i.e., had the lowest IQs), followed sequentially by those whose mothers had graduated from high school, had attended college, and had graduated from a 4-year college. This stepwise and orderly difference reflects the “achievement gap” when children are in school. The children who scored the lowest had an average IQ of approximately 85—the same as seen in almost all inner-city schools in the United States.

Among the treatment group of 377 children, the pattern was very different. Essentially, the Abecedarian preschool program “leveled the playing field” for these children and enabled them to perform at a slightly higher level (IQs of 104–107) than the national average (Ramey and Ramey 1998).

The only children in either group who did not display noticeable benefits of the preschool treatment were those whose parents were college graduates. These children performed well above the national average—even if they were born premature and with a low birthweight and regardless of whether they received the Abecedarian treatment or other natural stimulation and programs that their parents arranged for them.

Table 3. Children’s IQ at Age 36 Months as a Function of Maternal Education, Infant Health and Development Program

Group	Maternal education/children’s IQ			
	Some high school	High school graduate	Some college	College graduate
Control	85	93	95	107
Treatment	104	104	105	107

Source: Ramey and Ramey 1998.

This finding confirms similar findings from a number of other studies. That is, not all children need additional education or enrichment in the form of a planned preschool program. Rather—

The children whose families have the least amount of resources, as may be estimated best by parents’ educational and intellectual skills, are those who most need and would most benefit from systematic provision of enriched learning opportunities.

In countries where governments have limited economic resources and many demands for these resources, this strong finding is important to consider when deciding whether to provide universal, free preschool education or invest selectively in programs to reach children who are truly at high risk and who will likely demonstrate measurable gains.

Process Data

The IHDP data provide important insights into the *process*, as well as outcomes, of early educational interventions. The extensive data collected about implementation of the IHDP point to a variety of process factors that are predictive of a child’s developmental progress in an ECD intervention. The factors include, for example:

- Level of children’s participation
- Amount of curriculum activities
- Rate of delivery of curriculum activities
- Degree of active experience for parents and children.

Level of Participation

One outcome demonstrated in the IHDP was a 9-point difference in IQ between the control and treatment groups at age 3 years. To explore a possible relationship between this 9-point difference in IQ and the level of children’s participation in the intervention, the IHDP researchers devised a participation index. This index represented the number of contacts between each family and the intervention, as measured by number of days a child was in attendance at the child development center, number of home visits completed, and number of group meetings attended by parents.

Table 4 shows the percentage of children who had borderline intellectual performance ($IQ \leq 85$) and retarded intellectual performance ($IQ \leq 70$) at age 3 years (i.e., after approximately 3 years of the intervention) according to three levels of participation (low, medium, and high) and in comparison with the control group.

The differences in the percentage of children at borderline or lower IQ at age 3 years across the three levels of participation are dramatic and definitively show the relative benefit of higher participation in an early educational intervention (Ramey and others 1992).

Table 4. Percent of Children (at Age 36 Months) with Borderline Intellectual Performance ($IQ \leq 85$) and Retarded Intellectual Performance ($IQ \leq 70$) in the Control Group and in the Treatment Group (at Three Levels of Participation), Infant Health and Development Program

IQ	Control group	Treatment group		
	Percent of children	Level of participation/	percent of children	
		Low	Medium	High
$IQ \leq 70$	16.9%	13.0%	3.5%	1.9%
$IQ \leq 85$	18.6%	6.6%	8.4%	5.0%

Source: Ramey and others 1992.

Amount of Curriculum Activities

Another consideration is how much curriculum each child receives. Table 5 shows the mean IQ of children in the treatment group at age 36 months matched to birthweight and level of curriculum activities (low, medium, high) received in the child development center and at home.

The data show a correlation between mean IQ and level of curriculum activities for both birthweight groups. The higher the number of activities, the higher the level of IQ.

Furthermore, among the children who received a low level of activities, those who had a lighter birthweight (≤ 2000 g) had a 10-point lower IQ than did those who had a higher birthweight (2001–2005 g) (Sparling and others 1991).

Obviously, some children (such as those with birthweight ≤ 2000 g) are especially vulnerable, and special attention is needed to ensure that intervention activities are delivered frequently.

Table 5. Mean IQ at Age 36 Months for Three Levels of Curriculum Activity Received by Children at Two Birthweight Ranges, Infant Health and Development Program

Birthweight (grams)	Level of curriculum activity/mean IQ		
	Low	Medium	High
$\leq 2,000$	82	95	97
2,001–2,500	92	98	100

Source: Sparling and others 1991.

Rate of Curriculum Delivery and Active Experience

Table 6 shows a multiple regression analysis using children and families' initial characteristics, the active experience of children and parents, and the rate of curriculum delivery (i.e., number of activities per home visit and per day in the child development center) to predict children's IQ at age 3. Active experience is defined as parents' high interest in the curriculum activities and children's mastery of these activities.

The table shows that active experience (i.e., parents' interest and children's mastery) is a more significant predictor of children's developmental progress (IQ at age 36 months) than are the rate and amount of curriculum delivery (Liaw, Meisels, and Brooks-Gunn 1995).

To significantly help children and parents, early educational interventions should place first priority on maintaining parents' interest in and children's mastery of activities and second priority on maintaining a substantial rate and amount of curriculum delivery.

Longitudinal Results

The long-term outcomes from the Abecedarian Project are equally informative. The children in the treatment group continued to receive benefits from their participation in the ECD program—lasting throughout their school years and into early adulthood.

Table 6. Increment of the Variance Accounted for (R^2 Change) by Initial Characteristics and Various Experience Indicators in Predicting Children’s 36-Month IQ, Regression Analysis, Infant Health and Development Program

Initial characteristics and experience indicators, regression step	Prediction to 36-month Stanford-Binet IQ	
	R^2 change	beta
1. Initial child and family characteristics	0.535***	
2. Active experience	0.117***	
% of high-interest parent activities		0.08
% of activities mastered by child		0.41***
3. Rate of curriculum delivery	0.011*	
No. of activities per home visit		0.14**
No. of episodes per day at CDC		0.01
	Total $R^2 = 0.66$	$F = 23.29$ ***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.
 CDC, Child development center.
 Source: Liaw, Meisels, and Brooks-Gunn 1995.

School-age Results

During the school years, and in comparison with the control group, the children who participated in the Abecedarian preschool intervention had:

- Significantly higher achievement in reading and math (according to the Woodcock-Johnson Tests) at ages 8, 12, and 15, and even later at 21 years (Campbell and others 2001)
- A lower rate of grade retention (i.e., failing at least one grade) that was almost half the rate for the control group (30 percent of children versus 56 percent of children)
- A lower rate of placement in special education by age 15—only 12 percent of the treatment group versus 48 percent of the control group. The placement for children in the control group often occurred after repeated academic failures, social-adjustment problems, or conduct disorders (Ramey and Ramey 1999b).

The standardized tests for reading and math were individually administered by highly qualified assessors who did not know about the children’s preschool treatment or their performance on earlier tests. Although the sustained benefits for reading and math are encouraging, they did not raise the children to the high levels of performance typical of children in their community whose parents had college degrees.

Yet, children’s “real-world” school performance is of paramount interest and the fact that the treatment group had a much lower rate of grade retention argues well for preschool interventions.

The reduced need for special education is an important outcome, and it has both fiscal implications for governments and personal consequences for children and families.

The cost of Special Education programs is approximately 2.5 times the cost of regular education, and children in special education are entitled to free public education until age 22. The U.S. average for placement in Special Education programs is approximately 11 percent.

For many children, the stigma associated with attending a Special Education program is considerable. This stigmatization is particularly difficult for children whose need for special education derives from their families' low-income or minority status, rather than from medically diagnosed disabilities.

Early Adulthood Results. The researchers in the Abecedarian Project had the rare opportunity to be able to follow 99 percent of the children living into adulthood. At age 21, the children who participated in the preschool intervention still benefited from their participation, in comparison with the control group. These long-term data show the following:

- Of the treatment group, 67 percent were engaged in a skilled job (i.e., Hollingshead category 4 or higher) or were enrolled in higher education, in contrast with only 41 percent of the control group [$\chi^2(1) = 6.72, p \leq 0.01$].
- The young adults from the treatment group were three times more likely to have attended, or to be attending, a 4-year college than were those from the control group (35.7 percent versus 13.7 percent) [$\chi^2(1, n = 104) = 6.78, p < 0.01$].
- The mean age for having a first child was delayed by almost 1.5 years in the treatment group, compared with the control group (19.1 years of age versus 17.7 years of age) [$F(1, 41) = 5.26, p < 0.05$].
- The percentage of teen parents (defined as having a first child at or before age 19) was significantly reduced in the treatment group compared with the control group (25 percent versus 45 percent [$\chi^2(1, n = 104) = 3.96, p < 0.05$].
- The use of illegal substances (i.e., marijuana within the past 30 days) was significantly different between the treatment group and the control group (18 percent versus 39 percent, respectively) [$\chi^2(1, n = 102) = 5.83, p < 0.05$].
- The use of legal substances (i.e., tobacco smoking) and the number of criminal convictions were less for the treatment group than for the control group, but the differences were not statistically significant (Campbell and others 2002).

The data on use of legal and illegal substances (i.e., tobacco, marijuana) and on participation in violence and crime (i.e., misdemeanor and felony convictions) were self-reported by the young adults and are indicators of their social adjustment at age 21. Table 7 presents the details.

Table 7. Self-Reported Use of Legal and Illegal Substances and Criminal Activity by Age 21, Abecedarian Project

Group	Percent of young adults who:			
	Recently used marijuana*	Smoke regularly	Have a misdemeanor conviction	Have a felony conviction
Control	39%	55%	18%	12%
Treatment	18%	39%	14%	8%

* $p < 0.05$.

Source: Campbell and others 2002.

Summary: Abecedarian Results

The key findings from the Abecedarian Project are encouraging and are consistent within themselves and with the findings from other studies. The benefits—from 18 months through 21 years—for the children who participated in this early educational intervention include, in summary:

- Higher IQ, reading, and math scores
- Children’s improved understanding of their role in the educational process, as reflected in their improved “academic locus-of-control” scores—whereby the children equated their effort and learning with their grades and achievement (rather than attributing them to factors such as teacher bias, chance, or luck)
- Increased social competence
- Additional years of education
- Greater likelihood of full-time, higher-status employment
- Significantly lower rates of grade repetition, placement in special education, early teen pregnancy, and smoking and drug use.

The only other early academic intervention study in the United States that has followed children into their adult years—the High/Scope Perry Preschool Study—similarly reports long-term benefits *and* dramatic benefits of reduced involvement with crime (Barnett 1996, Schweinhart and others 2004). It is likely that the Abecedarian Project did not detect differential crime rates between the treated and control groups because the project was conducted in a small-town environment where low levels of crime were typical of both groups.

➤ See “Outcomes of the High/Scope Perry Preschool Study and Michigan School Readiness Program,” by Lawrence J. Schweinhart in this publication.

Intervention Research: Recommended Strategies

Based on more than 30 years of intervention research experience, the authors recommend the following four research strategies, which have been proven effective or have shown high promise for future utility:

- Use randomized controlled trials when strong evidence is needed.
- Create programs with broad goals that can provide benefits to children across major domains—cognitive, language, and social competence.
- Include the reporting of process data as a standard part of intervention programs.
- Include (create, if necessary) measures of program quality and fidelity—that is, measures that indicate the degree to which programs have met broadly agreed-upon standards and measures that tell how faithfully the program followed its intended educational plan.

The Abecedarian intervention relied on broad strategies and achieved long-lasting results. Broad, inclusive early intervention strategies are essential for enhancing the basic social skills and general cognitive development of children at high risk. Children’s ongoing and optimal long-term achievement in school is one of the basic pathways to every country’s economic growth. The only way to support this pathway is by providing children with a strong social-cognitive foundation—the hallmark of successful ECD programs.

Web Resources [as of November 2006]

Abecedarian Project: <<http://www.fpg.unc.edu/~abc/>>

LearningGames resources and training: <<http://www.mindnuture.com/>>

Joseph Sparling’s e-mail: <sparling@unc.edu>

Craig T. Ramey’s e-mail: <ctr5@georgetown.edu>

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