Long-term Impact of a Verbal Interaction Program for At-Risk Toddlers: An Exploratory Study of High School Outcomes in a Replication of the Mother-Child Home Program

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High school graduation is a major long-term goal of cognitive programs for preschoolers at risk for educational disadvantage. One hundred twenty-three young adults who had been in five yearly cohorts of at-risk toddlers eligible for a replication of the Mother-Child Home Program, a play-filled and non-didactic home-based intervention promoting parent-toddler verbal interaction, were studied 16 to 20 years later for their high school performance. Subjects who had completed this program replication, the Pittsfield Parent-Child Home Program, as toddlers were significantly less likely than randomized controls to drop out of school (15.7% vs. 40.0%, $p = 0.03$), and more likely to have graduated (84.1% vs. 53.9%, $p = 0.01$). On an intention-to-treat basis, 76.9% of all subjects who enrolled in the program and 53.9% of controls graduated from high school ($p = 0.07$). With adjustment for baseline IQ scores the advantage of program subjects persisted (multivariate Odds Ratio 2.12, $p = 0.28$). The dropout rate of program enrollees was lower than the mean for all Pittsfield students, while program completers matched the national graduation rate for middle-income students. The results of this exploratory study suggest that long-term improvement in academic performance may be achieved by using the Mother-Child Home Program's approach; indicate the exportability of this program; and appear to justify further controlled long-term studies of the program.
The links between academic problems and poverty first won the attention of child development specialists decades ago (Bloom, 1964; Chilman, 1966; Findlay & McGuire, 1957). With his studies of human cognitive potential, Hebb (1949) had laid the groundwork by questioning whether family poverty could carry a threat to optimum cognitive development (p. 302), while Hunt's impressive review of the effects of early environmental stimulation on the cognitive growth of children (1961) and Hess & Shipman's classic study of low-income mother-child dyads (1965) launched the first systematically investigated early interventions for preschoolers at risk for educational disadvantage (Barnett, 1995; Berrueta et al., 1984; Caldwell, Wright, Honig, & Tannenbaum, 1970; Consortium for Longitudinal Studies, 1983; Madden, Levenstein, & Levenstein, 1976; Ramey & Gowan, 1986). The ultimate aim of all early childhood intervention programs was to improve the at-risk preschoolers' chances of avoiding an underclass (Myrdal, 1962; Wilson, 1996) or criminal future (McCord & McCord, 1959; Yoshikawa, 1995).

Most early childhood intervention programs that started in this country in the mid-sixties were conducted in preschool centers, but a few were based in the children's homes (Gordon, 1969; Levenstein, 1970; Schaefer, 1969). Investigations of family influences on child development (Laosa, 1983; Sameroff, 1978/1982; Scott-Jones, 1984) have supported the concept that families, especially parents, can play a crucial role in disadvantaged children's acquisition of literacy and school readiness (Allessandri, 1992; Bee, Van Egeren, Streissguth, Numan, & Leckie, 1982; Bradley & Caldwell, 1984; Clarke-Stewart, Vanderstoep & Killim, et al., 1979; Garrett, Ng’andu, & Ferron, 1994; McClaren, 1988; Sameroff & Seifer, 1982).

Like center-based preschools, home-based literacy-oriented early intervention programs for at-risk families hope not only to enhance the school performance of their toddler-participants but ultimately to facilitate their escape from the joblessness that may otherwise entrap them in poverty. High school graduation is a vital step in this process (Campbell & Ramey, 1994). Yet few early childhood intervention programs have investigated whether their methods lead to high school graduation, and those rare reports have come from center-based rather than home-based preschool programs (Berrueta-Clement, Schweinhart, Epstein, & Weikart, 1984; Gray, Ramsey, & Klaus, 1983).

The Mother-Child Home Program

The Mother-Child Home Program (MCHP), a home-based parent-toddler verbal interaction method, is the only one remaining of the three wholly home-based, literacy-focused interventions for at-risk toddlers started in the 1960's in the United States (Gordon, 1972; Levenstein, 1970; Schaefer, 1969). Created by the Verbal Interaction Project (VIP) in 1965, it was based on a broad theoretical and empirical foundation drawn from the fields of anthropology/linguistics (Sapir, 1962), philosophy (Cassirer, 1944), psychology (Baumrind, 1967; Bruner, 1964; Deutsch, 1965; Findlay & McGuire, 1957; Hunt, 1961; Sigel, 1964; Vygotsky, 1962), and sociology (Bernstein, 1961). Central to this foundation is the concept that humankind is the "animal symbolicum," uniquely capable of conceptual-symbolic thought (Cassirer, 1944), and that this capability begins in the latter part of the second year of life (Piaget, 1952; Vygotsky, 1962; Bruner, 1964), although Hebb considered the learning of "percepts" and simple associations to begin even earlier.
LONG-TERM IMPACT OF A VERBAL INTERACTION PROGRAM

(Hebb, 1949), mirroring Piaget’s sensory-motor stage of “preoperational thought” (Piaget, 1952).

A body of supportive empirical research evolved along with these ideas (Beasley, 1958; Bernstein, 1961; Brown, 1958; Bruner, Oliver, & Greenfield, 1966; Murphy, 1968), suggesting that the promotion of ludic (from the Latin ludere: to play) verbal interaction between parents and children within their reciprocally attached relationship could strengthen symbolic/conceptual development (Levenstein & O’Hara, 1993). Parent-toddler verbal interaction gives young children the opportunity to develop concepts, “the intellectual tools for organizing the environment, for reducing ambiguity and imprecision, for ordering diversity into classes or categories” (Sigel, 1964). Low-income families are often characterized by curtailed conceptual verbal interaction between toddlers and parents, which limits cognitive growth and is likely to increase the toddlers’ risk of later school failure (Deutsch, 1965; Hess & Shipman, 1965; Lewis, 1963; John & Goldstein, 1964). Recent research has succeeded in showing a correlation between the amount of verbal parent-child interaction when the child is ten to 36 months old, and the child’s cognitive performance at age eight years (Hart & Risley, 1995). Verbal interaction with parents offers young children a golden opportunity to develop basic concepts necessary for cognitive growth and later school competence.

The MCHP’s method for meeting the challenge of increasing low-income children’s early cognitive growth was to motivate their mothers (or other primary nurturers) to act as facilitators for embedding conceptual verbal interaction into toddlers’ early positive experiences within the family home. This was accomplished by exposing low-income two and three-year-olds to home-based stimulation of verbal interaction with their mothers (or parenting persons), around program gifts of attractive, commercially available toys and books. Home visitors called Toy Demonstrators would show (not teach) the parent, usually the mother, playful techniques of positive verbal interaction—conversation—in ways designed to support weaving such interaction into the fabric of family experience and to encourage an autonomy which could eventually make the parent’s behavior independent of the MCHP.

The program’s cognitive curriculum was derived from theories and empirical studies of investigators whose work had influenced the program at its inception. At its core are Vygotsky’s links between thought and language (Vygotsky, 1962); Bruner’s construct of “instrumental conceptualism,” the idea that concept formation is fostered in the two- and three-year-old child through the interaction of the child’s experience with language (Bruner, 1966); and Sigel’s “distancing hypothesis” (Sigel, 1971) in which the promotion of representational competence is given tangible meaning through the child’s and parent’s play focused around books and 3-dimensional toys as representations of reality, besides being intrinsically motivating curriculum materials.

After a small pilot study of the MCHP in 1965 demonstrated significant short-term effects (Levenstein & Sunley, 1968), and the fully developed program was named one of the two best early childhood programs in the country by the American Institutes of Research for the Behavioral Sciences under contract with the U.S. Office of Education (Wargo, Campeau, & Tallmadge, 1971), a number of subsequent in-house experimental subject-randomized and location-randomized studies evaluated the MCHP. In these early studies the short-term cognitive gains of several yearly cohorts of MCHP children lasted into third grade where they showed significant academic superiority to similarly disadvan-
taged control and comparison children with similarly limited preprogram cognitive test scores (Madden et al., 1976; Levenstein, O’Hara, & Madden, 1983; Barnett, 1995). Program children continued to be superior to nonprogram children in their scores on cognitive measures and/or standardized academic achievement tests through fifth (Lazar & Darlington, 1982, Table 14), and seventh grades (Royce, Darlington, & Murray, 1983). The comparisons of baseline characteristics among children with and without follow-up showed that attrition did not account for the attained effects. Randomization procedures were adequate in the Verbal Interaction Project’s in-house research, so that assignment to program or control groups was independent of self-selection. These studies counted as MCHP children all who had enrolled in the MCHP, regardless of whether they had completed the full program (Madden et al., 1976; Levenstein et al., 1983).

A follow-up study of verbal interaction during videotaped play sessions between disadvantaged children and their mothers two years after completion of the program demonstrated a lasting superiority of program mothers’ verbal interaction with the child over that of nonprogram mothers (Levenstein & O’Hara, 1983, 1993). This followed a previous follow-up study (Levenstein, 1979), which showed a significant correlation, in one cohort, between mothers’ verbal responsiveness near the program’s termination and several aspects of the child’s first grade cognitive skills and emotional stability (“enjoys mastering new tasks”; “is well-organized”; “is creative but knows difference between facts and fantasy”; “seems cheerful and content”; and “is spontaneous without being explosive”).

These encouraging findings evoked Bronfenbrenner’s speculation as to factors within the MCHP that might have been responsible for the results (1974), i.e., that one major catalyst might be the depth of parental involvement in the program:

Levenstein’s strategy has as its target not the child as an individual, but the mother-child dyad as an interactive system [italics his]....Moreover, since it is the product of mutual adaptation and learning, the system exhibits a distinctive hand-in-glove quality, and thereby an efficiency, that it would be hard to achieve in non-enduring relationships. Finally, since the participants remain together after intervention ceases, the momentum of the system insures some degree of continuity for the future.

Four early replications of the MCHP (Levenstein, 1975) tested the exportability of the program, a “replication” having been defined by the VIP as an exact duplication of the method, curricula and delivery of the Mother-Child Home Program. The VIP chose “replication” over “close approximation” to emphasize the importance of authenticity in those three program basics. The VIP then opened the door—with safeguards for program standards—to training replication staff nation-wide.

Research suggests that the MCHP is likely to have little or no effect on children who enter the program with normal cognitive ability and relatively well educated parents. In one subject-randomized experimental study conducted by the VIP involving low-income children with normal preprogram IQ and with mainly high school graduate mothers, the short term results significantly favored the program children, but by third grade both groups of children had similar above-average IQs (Madden, O’Hara & Levenstein, 1984). In another subject-randomized experiment, in Bermuda, two-thirds of the parents of both program and randomized control children had a middle or upper class income and a better than twelfth grade education (Scarr & McCartney, 1988); part-time or full-time “group
care programs...of varying quality” (p. 533) attended by three-quarters of the children were another potentially leveling experience. Children’s baseline IQ scores in both groups were normal and rose to 106.6 for the MCHP children and 103.1 for controls (p > 0.05). As one of us commented on the Bermuda experiment, “Scarr and McCartney....have shown through their research the futility and even wastefulness of using replication of the Verbal Interaction Project’s MCHP to prevent educational disadvantage in children who are not in fact at risk for such disadvantage” (Levenstein, 1988).

The previous evaluations of the MCHP have shown that the program does influence the child’s subsequent intellectual functioning over a relatively short time (Barnett, 1995; DeVito & Karon, 1984; Lazar & Darlington, 1982, Table 14; Levenstein, 1975; Levenstein, 1976; Levenstein, & Levenstein, 1971; Levenstein, O’Hara & Madden, 1983; Madden, Levenstein & Levenstein, 1976; Royce, Darlington & Murray, 1983). These findings are particularly the case for children deemed at risk for intellectual development and subsequent school functioning. In addition to these intervention successes, we have demonstrated that the program is exportable, since similar findings have occurred in four replication sites (Levenstein, 1975).

A larger question for this intervention program, as well as for early childhood intervention programs in general, is whether the effects found in the early years set a pattern of change that influences later behavior. Unfortunately we have only limited data (Levenstein & O’Hara, 1983) to evaluate this hypothesis. The present study offered an opportunity to review a high school population from one of our first replication sites. We were able to identify a group of children who had been in the program’s earlier cohorts and now had entered or graduated from high school. We decided to undertake an exploratory study to determine whether differences in high school attendance and graduation could be found between child participants in the program and those who did not have access to it. If in fact differences were found between program and control dyads, then it could be of value to undertake a longer-term examination of dyadic behavior to seek to identify what changes in the mother within her interaction with the child had occurred to enable consistent support for the child to continue long after the MCHP intervention ceased. One intention of the intervention’s creators was to generate a new developmental trajectory for some of the mothers so that they would continue to work along the guidelines and philosophy of the program on their own because of having internalized its approach. This type of possibility can usefully be addressed in further research, if positive long-term effects on its child participants are found for the MCHP.

The Parent-Child Home Program

One of the MCHP’s earliest replications conducted with low-income, low-educated parents and their small children at high risk for educational disadvantage was the Parent-Child Home Program (PCHP) in Pittsfield, Massachusetts Chapter One schools (funded under Title One of the 1965 federal Elementary and Secondary Education Act). Given the PCHP’s 1972 certification by the Verbal Interaction Project as an authentic replication of the Mother-Child Home Program after two years of operation; yearly administrator reports of program operation; periodic site visits by staff members of the National Center for Mother-Child Home Program; and a 1996 site visit to the PCHP by outside consultants (Sullivan Educational Associates, 1996) supported by a private founda-
tation, it can be assumed that the PCHP is an authentic replication of the Mother-Child Home Program. The PCHP's only modifications of the original MCHP were two nomenclature changes: (calling the program the Parent-Child rather than the Mother-Child Home Program, and its home visitors "Teaching Demonstrators" rather than "Toy Demonstrators") and a slight modification of the criteria for program eligibility (described below) from the four risk factors required by the original MCHP: parents' low education; low income; low occupational status; and home rental.

Pittsfield's PCHP replicated the method, curricula, and delivery of the original MCHP:

- 46 biweekly, half hour Home Sessions spread over seven months in each of two years;
- A cognitive curriculum summarized in a “Guide Sheet,” a one-page list of concepts (e.g., color, shape, size, number, relationships, categories) to be fostered by verbal interaction using developmentally appropriate labels for words or actions applied to a book or toy brought weekly for the toddler as materials to illustrate the MCHP curriculum;
- A curriculum of social-emotional behavior related to cognitive aims, embodied in a 20 item VIP-created instrument called “Child’s Behavior Traits, which is both a guide and a measure of a child’s achievement of social-emotional goals in his/her interaction with the TD;
- A “parenting” curriculum in a 20 item VIP-created instrument, “Parent and Child Together,” a guide and measure of positive parental behavior as modeled by home visitors and achieved by parents.
- MCHP criteria for attractive curriculum materials, the Verbal Interaction Stimulus Materials (VISM): 12 illustrated books and 11 toys permanently assigned during each of the two program years, chosen yearly by the Coordinator (director) to suit local interests while following stable MCHP criteria. The toys were meant to provide the child with a connection between actions and words, extending to direct preparation for literacy through the parent’s pleasurable reading of the books. A different set of toys and books was used with each age group, one for two-year-olds and one for three-year-olds, so that a total of 46 books and toys, or VISM, were brought, signed for by the parent, and left with the family, a book one week and a toy the next, over two years;
- Paraprofessional or volunteer home visitors (TDs) trained to model positive verbal interaction curricula around books and toys, write Home Session reports, meet with the Coordinator for weekly group guidance and occasional individual sessions, and empathize with parents without instructing, counseling, or becoming a close friend;
- Home Sessions arranged at the parent’s convenience and with the parent always present;
- A report written by the TD on each Home Session, to be reviewed by the TD’s Coordinator and sometimes used in weekly TD group discussions;
- Motivation for parental cooperation through the TD’s non-didactic modeling, respect for family privacy and life styles, abstention from direct teaching or counseling, and permanent assignment (gifts) of attractive books and toys;
• Involvement of parents in the child's play by inviting the parent to participate in the verbal interaction techniques modeled by the TD;
• Further parent education by TDS' modeling of positive behavior, without direct teaching, e.g., positive responsiveness to the toddler, and encouraging parent's pleasurable reading to the child, with the aim of promoting the parent's literacy as well as the toddler's;
• Program Coordinators are college graduates who are sensitive to nuances of family relationships and able to use TDS' Home Session reports in helping with problems at weekly TD group meetings. The Coordinators must also serve as models for TDs; demonstrate the verbal interaction curriculum to be used with each book or toy; maintain collegial contacts with her sponsoring organization; order and inventory books and toys; and create verbal interaction activities around the books and toys to illustrate the stable cognitive curriculum contained in "Guide Sheets" for each VISM.

The PCHP was assessed by independent evaluators in 1984 for its effects on children's academic achievement through eighth grade. Program participants' eighth grade test scores in reading, language and math significantly surpassed those of Chapter One (now "Title One") students who had not participated in the PCHP, and their math scores were on a par with those of non-PCHP, non-Chapter One students in the same school system. The evaluators commented on page 24 of their report to the Pittsfield Public Schools (DeVito & Karon, 1984): "Overall, it appears that program intervention [PCHP] for these students as two- and three-year-olds had lasting effects since as a group throughout school they met or exceeded national achievement norms and generally outperformed the groups to which they were compared."

INTRODUCTION TO THE PRESENT STUDY

A major aim of home-based cognitive intervention programs is to improve at-risk children's chances of graduating from high school. This was of central importance to the Pittsfield school district because its dropout rate was viewed as too high by the assistant superintendent who brought the PCHP to Pittsfield in 1970, an impression supported by later documentation of the 1991-94 cumulative dropout rate, for all students including the non-disadvantaged, of 25.9%, with dropouts defined as "students who leave school prior to graduation for reasons other than transfer to another school" (Massachusetts Commonwealth Department of Education, 1995).

In 1996, when the Parent-Child Home Program was in its twenty-sixth year, an opportunity arose to perform a retrospective study of its toddler participants' high school outcomes, taking advantage of records kept by the school system and the PCHP, and of the availability of a randomized control group selected years earlier for a never-completed study (see "Subjects," below). The cognitive and academic achievements previously cited for Pittsfield program and non-program students in Chapter One-supported schools had been interpreted as being predictive of later success in high school (Levenstein, 1988). A follow-up study would make it possible to explore whether these outcomes were valid predictors of high school graduation. This report describes PCHP participants' academic performance as reflected in high school graduation by June 1996, examining the high
school dropout and high school graduation rates of five yearly cohorts of PCHP toddlers
who completed their careers in the Pittsfield school system. Subjects included students
who had completed the full two-year PCHP; others who had enrolled but who participated
for less than two years; and a group of students who had been screened as toddlers for the
PCHP and had demonstrated the same five risk factors required for program eligibility but
who had been randomly assigned to nonprogram status.

METHOD

Participants

The participants of the present study are 123 students who at approximately age two,
in 1976-1980, had been recruited for the Parent-Child Home Program; the 1976 toddlers
were the first group for whom reliable and complete high school graduation records were
available. The five study cohorts had by 1996 become young men and women aged
between 17 and 22 years, comparable with the participants on a study of national high
school data reported by the U.S. Education Department’s Center for Education Statistics
(Sanderson, Dugoni, Rasinski, Taylor, & Carroll, 1996; McMillen & Kaufman, 1996).

Parents of the original two year olds had been recruited for the PCHP by invitations
sent to parents of all students attending the city’s designated Chapter One (now called Title
One) elementary schools. Responders were considered eligible for Pittsfield’s PCHP if
they qualified as having at-risk status by meeting five of the following eight criteria:

1. Child’s IQ score under 100 on the Peabody Picture Vocabulary Test (PPVT);
2. Single parent family;
3. Unemployment of mother;
4. Unemployment of father;
5. Family receives AFDC payments;
6. Parents’ education under 12th grade;
7. Family income qualifies for poverty status; and
8. Older sibling in a Chapter One remedial program.

All dyads who had five or more of these risk factors in 1976, 1977 and 1978 were
offered the PCHP. Because a subject-randomized experimental study of the PCHP was
being considered at the state education level, the 1979 and 1980 cohorts of eligible dyads
were randomly divided into PCHP and control groups, with an explanation to families that
limited funds would make a lottery necessary. Only 10 dyads were randomized as controls
in 1979, and eleven in 1980 (an associate “blindly” picked names out of a hat) so as to give
a maximum number of families the presumed benefit of the program.

All parents who were offered the PCHP accepted enrollment, as did those in the con-
trol group. Their degree of program participation was measured by the number of toys and
books—Verbal Interaction Stimulus Materials (VISM)—received by each dyad, out of a
possible total of 23 in each of two years or 46 in all (one for each two Home Sessions).
Toddlers were considered to have completed the full two-year program if they received at
least 35 VISM out of the possible 46 (75%); the actual mean number for the original 113
dyads in this group was 44.8 VISM (97% of the possible 46), S.D. = 1.45. The original 44
dyads who received 16-34 VISM, 35% to 74% of the planned number, were classed as having had the equivalent of one year of the program; their actual mean +/- S.D. number of VISM was 23.6 +/- 4.22. Thirty-one dyads in the 1976 to 1979 cohorts withdrew from the program before arriving at 16 VISM; they actually received an average of 7.9 VISM or 17% of the possible 46 (+/- 4.14). No 1980 dyads fell into this group.

Twenty-one control dyads in the 1979 and 1980 cohorts, who received no part of the PCHP but met criteria for PCHP eligibility, brought the total of original program and non-program dyads to 209.

Data Collection and Analysis

The data for the present analyses were collected retrospectively from subject records of the Parent-Child Home Program, and from records on file in the offices of the Pittsfield school system, up to date as of June 1996. The study’s school data were checked for accuracy by school district personnel who had no knowledge of subjects’ program status. Though most demographic baseline data and scholastic data had unfortunately been discarded by the school over the years to conserve space, the PCHP had preserved names, birthdates, gender and cognitive test scores at entry on every child who had ever entered the PCIIP or had been in the control group.

Group differences were compared using chi-square tests for categorical variables and the student t test for continuous variables, using Statview statistical software for Apple Macintosh. Multivariate analyses (multiple logistic regression) were performed using SPSS for Windows. All p values are two-tailed.

RESULTS

Outcomes

Subjects. Of the 209 at-risk toddlers in the original parent-child dyads, 123 students (58.9%) had completed or were completing their school careers within the Pittsfield school system and could therefore be included in the 1996 follow-up study. Six of the 123 were not yet in their last year of high school by June 1996, leaving 117 who had reached the end of their secondary school career. The chief analyses, of high school graduation, were performed on these 117, whereas examination of dropout rates was performed on the entire group of 123.

The major reason for students’ non-inclusion as 1996 subjects was moving out of town and thus out of the school district, mainly because of parents seeking work elsewhere due to the gradual reduction of the primary industry’s work force through downsizing. In this geographically mobile population, six of the children who withdrew from participation in the PCHP because of moving away from Pittsfield later transferred back into the Pittsfield schools and were therefore available for follow-up. Some attrition due to geographic mobility took place during or shortly after families’ first year of participation in the PCHP, but most occurred during the 16 to 20 years of the follow-up period. Three children died while enrolled in school. Given the high rate of loss to follow-up (41.1%), it was particularly important to see whether the groups were comparable at baseline. As can be seen in
Table 1, there was no significant or substantial difference in age, sex or baseline Peabody Picture Vocabulary Test (PPVT) IQ scores between subjects with or without follow-up.

Similarly, there were no significant baseline differences between the total pooled program subject group and the randomized controls, though there was a non-significant trend for controls to have lower PPVT scores than program children. Children who received the full program did enter the program at a significantly younger age than early program dropouts and had significantly higher pretest PPVT scores than either program dropouts or controls. Thirty of the 123 participants (24.4%) had dropped out of school by June 1996. Excluding the six who were still in school, 87 of the remaining 117 had graduated from high school (74.3%).

As shown in Table 2, there were significantly higher rates of high school graduation (84.1%) and lower rates of dropping out of high school (15.7%) among students who had

**Table 1. Baseline Characteristics of Toddlers Eligible for the Pittsfield Parent-Child Home Program (PCHP) in 1976-1980**

<table>
<thead>
<tr>
<th>Age in days</th>
<th>PPVT score</th>
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<tbody>
<tr>
<td>N</td>
<td>Mean ± SD</td>
</tr>
</tbody>
</table>

| Toddlers on whom follow-up data are available: Exposed to the PCHP | | Toddlers who attended | |
|---|---|---|---|---|---|
| For the full two years | 70 | 54.3% | 804 ± 112 | 68 | 89.7 ± 11.9 |
| For one year | 28 | 64.3% | 851 ± 174 | 24 | 81.3* ± 16.0 |
| For less than one year | 10 | 60.0% | 989* | — | — |
| Total PCHP participants | 108 | 57.9% | 835 ± 148 | 92 | 87.5 ± 13.5 |
| Randomized controls | 15 | 53.3% | 845 ± 95 | 13 | 82.7* ± 8.9 |
| Total in follow-up study | 123 | 56.9% | 835 ± 142 | 105 | 87.1 ± 13.2 |
| Toddlers lost to follow-up | 86 | 45.3% | 846 ± 169 | 56 | 86.8 ± 11.1 |
| All eligible toddlers, total | 209 | 52.2% | 840 ± 153 | 161 | 86.9 ± 12.4 |

**Note:** *p < 0.05 vs. full two-year PCHP group

**Table 2. Academic Outcomes as of June 1996, According to Degree of Exposure to the Pittsfield Parent-Child Home Program in 1976-1980**

<table>
<thead>
<tr>
<th>Program exposure</th>
<th>% Dropped out of High School</th>
<th>As compared with full program:</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>χ²</td>
</tr>
<tr>
<td>Full (2 years)</td>
<td>70</td>
<td>—</td>
</tr>
<tr>
<td>One year</td>
<td>28</td>
<td>28.6%</td>
</tr>
<tr>
<td>Less than one year</td>
<td>10</td>
<td>50.0%</td>
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<tr>
<td>All PCHP participants</td>
<td>108</td>
<td>22.2%</td>
</tr>
<tr>
<td>Randomized controls</td>
<td>15</td>
<td>40.0%</td>
</tr>
</tbody>
</table>

**Graduation from high school, of 117 students eligible to graduate from high school**

<table>
<thead>
<tr>
<th>Program exposure</th>
<th>N</th>
<th>% Graduated from High School</th>
<th>As compared with full program:</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>—</td>
<td>χ²</td>
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<tr>
<td>Full (2 years)</td>
<td>69</td>
<td>84.1%</td>
<td>—</td>
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<tr>
<td>One year</td>
<td>25</td>
<td>68.0%</td>
<td>2.93</td>
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<tr>
<td>Less than one year</td>
<td>10</td>
<td>50.0%</td>
<td>6.27</td>
</tr>
<tr>
<td>All PCHP participants</td>
<td>104</td>
<td>76.9%</td>
<td>—</td>
</tr>
<tr>
<td>Randomized controls</td>
<td>13</td>
<td>53.9%</td>
<td>6.08</td>
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<table>
<thead>
<tr>
<th></th>
<th>Unadjusted</th>
<th>Adjusted for baseline IQ</th>
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<tr>
<td>N M O. R. C I.</td>
<td>p</td>
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<tr>
<td>All subjects enrolled in the PCHP vs. controls</td>
<td>117 2.86 0.88-9.32 0.08</td>
<td>99 2.12 0.54-8.32 0.28</td>
</tr>
<tr>
<td>Subjects enrolled in 1979-80 vs. controls</td>
<td>45 3.06 0.77-12.1 0.11</td>
<td>39 2.03 0.40-10.34 0.39</td>
</tr>
<tr>
<td>Subjects with IQ ≤ 90 vs. controls with IQ ≤ 90</td>
<td>65 2.40 0.56-10.20 0.24</td>
<td>65 2.40 0.56-10.26 0.24</td>
</tr>
<tr>
<td>Subjects with IQ ≤ 100 vs. controls with IQ ≤ 100</td>
<td>90 2.47 0.63-9.76 0.20</td>
<td>90 2.23 0.56-8.93 0.26</td>
</tr>
<tr>
<td>Subjects completing full PCHP program vs. controls</td>
<td>82 4.51 1.27-16.04 0.02</td>
<td>78 2.11 0.49-9.10 0.32</td>
</tr>
</tbody>
</table>

Notes: *O.R. = Odds Ratio by multiple logistic regression  
**C.I. = 95% Confidence Interval  
Subjects still in high school omitted from all analyses
completed two full years of the Parent-Child Home Program as toddlers than among randomized controls (53.9% graduated, 40.0% dropped out). Academic performance in students who had been exposed to less of the PCHP was intermediate.

One limit to the interpretation of these results is that the absence from the full program group of dyads who began the PCHP but did not complete it could have introduced a bias in favor of positive findings. We therefore performed additional analyses classifying subjects according to program enrollment rather than by program completion, thus including as program subjects all dyads who were offered the PCHP whether or not they completed the prescribed two years of the program. This intention-to-treat approach, regularly used in controlled tests of new therapeutic agents, analyzes all subjects assigned to treatment or control groups, whether or not the subjects actually completed the treatment to which they had been assigned. Intention-to-treat analyses of the present data showed that among the 117 participants who were no longer in high school, 76.9% of all subjects in the experimental group and 53.8% of controls had graduated from high school ($\chi^2 = 3.228, p = 0.07$); these outcomes correspond to a Relative Risk of 1.43, and to a crude Odds Ratio of 2.86. Among all 123 traced subjects, 22.2% and 40.0% respectively had dropped out of school ($\chi^2 = 2.26, p = 0.13$). Thus, children who were offered the program did better than randomized controls on both measures even if all program enrollees are included, an advantage which in the case of high school graduation approaches statistical significance despite the tiny number of controls.

A second problem is that, as was seen in Table 1, the randomization process had yielded a control group with slightly lower baseline IQs (mean 82.7 +/- Standard Deviation 8.9) than either the 1979-80 program enrollees they were directly randomized against (88.8 +/- 11.7, $p = 0.10$) or the program group as a whole (87.5 +/- 13.5, $p = 0.20$). Not unexpectedly, baseline IQ was predictive of academic performance; mean IQ was 89.2 +/- 13.6, 80.7 +/- 10.2, and 82.5 +/- 8.8 among high school graduates, dropouts, and current students respectively ($p = 0.02$ by ANOVA). Although the difference in baseline IQ between the entire group of program enrollees and the randomized controls was not statistically significant, it could have had an impact on the results of intention-to-treat analyses.

We dealt with these differences in preprogram IQ using two approaches. One was to adjust for IQ using multivariate analyses (multiple logistic regression), and the other was to reanalyze the data among only low-IQ subjects. The results of these techniques are summarized in Table 3. It can be seen that the Odds Ratios in the "Adjusted for baseline IQ" column are all greater than 2.0. This suggests that whichever technique is used, PCHP enrollees or completers are more likely to graduate from high school 16 to 20 years later, after taking baseline IQ into account. It might be noted that the greatest educational advantage (the highest adjusted O.R.) was found for the lowest-IQ toddlers, those with baseline IQs < 90.

Since there was no significant difference in graduation rates between students randomized to the program in 1979-1980 (69%) and those enrolled in the PCHP in 1976-78 (76%), all five program cohorts were combined for purposes of most analyses. When the validity of this approach was tested by repeating the principal analyses within the directly randomized 1979-80 cohorts, the results were essentially unchanged (Table 3).

Given the limitations of this case-control study, it was felt appropriate to cross-check the suggestion of program efficacy by comparing the performance of PCHP students with that of several historical comparison groups. The dropout rate among all youngsters who
entered the PCHP (22.2%), and especially among those who completed the full program (15.7%), was lower than the later cumulative Pittsfield city dropout rate of 25.9%. The program statistics also compare favorably with the national dropout rate of 27.4% for U.S. students of low socioeconomic status, defined as the lowest quartile of all family income levels, as presented in a 1994 study of a national cohort of 1988 eighth-graders (Sanderson et al., 1996, based on McMillen & Kaufman, 1996), even though only 54.8% of the national cohort had two or more risk factors (Sanderson et al., 1996) vs. 100% for all PCHP screenees. The full program group's graduation rate of 84.1% approximates the 83.7% graduation rate of middle-socioeconomic-status students in the same 1994 follow-up study.

**DISCUSSION**

The chief focus of this study is on the long-term follow-up of a replication of the Mother-Child Home Program, a ludic and relatively simple verbal interaction intervention designed to promote the conceptual/cognitive growth of at-risk toddlers and thus improve their readiness for literacy (Bronfenbrenner, 1974; Hunt, 1975; Levenstein, 1988; Wargo, Campeau & Tallmadge, 1971). The analyses showed that 17- to 22-year-old young adults who had completed the Pittsfield Parent-Child Home program as toddlers were less than half as likely than randomized controls to have dropped out of school. Their high school graduation rate was comparable to that of middle class students, and exceeded those of local and national disadvantaged comparison groups.

In order to evaluate the possibility that the results might have been influenced by parents' self-selection—since less promising children may have been more likely to drop out of the PCHP before completing it—results were also analyzed on an "intention to treat" basis. In this approach all subjects who were offered the program were included in the program group whether or not they had completed the full program. Using these rigorous criteria, the advantage of the program group over randomized controls approached but did not meet statistical significance. This possible superiority of program children could be accounted for only in part by differences in baseline characteristics.

Although it must be emphasized that interpretation of these results is limited by the small number of controls, by the failure of many differences to reach statistical significance, and by the dearth of demographic and pre-graduation scholastic data on the study subjects, the findings would appear to suggest that socioeconomically disadvantaged toddlers who complete an authentic two-year Mother-Child Home Program replication have bettered their chances of achieving high school graduation, that even incomplete PCHP participation may improve students' chances of graduation, and that those toddlers who start the PCHP with the lowest IQs may reap the most benefit.

It should be noted that enrolling parents in voluntary interventions or research with their young children inevitably entails some degree of self-selection which may result in bias in favor of the intervention when non-randomized comparison groups are used. In other recently published childhood intervention studies, for example, participants volunteered from among a much larger pool of potential subjects approached through schools, local newspapers, bulletin boards in public libraries, etc. (Bomstein, Haynes, O'Reilly, & Painter, 1996; Creasey, & Reese, 1996; Feeny, Eder, & Recorla, 1996; Krevans & Gibbs,
The high attrition rate of the subjects in this study (41% at 16 to 20 years after participation in the program) is another weakness that is shared by many other studies that involve parents with their children. For example, at 12 years after children ended participation in preschool programs examined in the Consortium for Longitudinal Studies (Lazar & Darlington, 1982) an average of 55.8% of subjects in the 11 programs under scrutiny had been lost to follow-up. In six recent follow-up studies involving children, published in juried journals in 1996 and 1997, attrition rates were 18-19% after 3-4 years (Harrist, Zaia, Bates, Dodge, & Pettit, 1997; Kochanska, Murray, & Coy, 1997); 17-32% after 10-11 years (Rose & Feldman, 1996; Ensminger, Lankin, & Jacobson, 1996; DeBerry, Scarr, & Weinberg, 1996); and 48% after 18 years (Pakiz, Reinherz, & Giaconia, 1997).

The question might be raised whether other intervening learning experiences available in Pittsfield (e.g., a center-based preschool for four year olds conducted by the school district and Chapter One remedial services in elementary school) could have contributed to the apparent effects. No data are available for directly examining this possibility. Although there seems to be no reason that the full-program PCHP completers should have been preferentially offered such remedial services, it cannot be excluded that PCHP graduates might have taken greater advantage of such opportunities, possibly in relation to greater parental motivation.

The possibility that the MCHP might have long-lasting positive effects, a result not unheard of for interventions very early in life (Olds, Eckenrode, Henderson, Kitzman, Powers, Cole, Sidora, Morris, Pettit, & Luckey, 1997) seems to be made plausible by several elements of its approach. One is reflected in Bronfenbrenner’s speculation (1974) that “the momentum of the system” could insure enough continuity of maternal verbal interaction into the child’s future to support the child’s academic progress long after the mother had terminated her connection with the MCHP. To test this hypothesis, one method could be to gather verbal interaction data on former program dyads periodically for correlation with children’s academic performance throughout their school careers, perhaps using a procedure similar to that described by Levenstein and O’Hara in their 1983 report to the National Institute of Education.

Another key element could be the choice of the VIP to intervene using the MCHP during a period of early childhood that may be critical for the emergence of the child from the stages of enactive and iconic representation of the world into the verbally symbolic mode necessary for growth of conceptualization and thus of intellectual development (Bruner et al., 1966; Vygotsky, 1962).

Yet another factor in any positive long-term positive outcomes may be the role of parental motivation in entering and completing a program (White, 1959 and 1963). Initial parental enrollment rates in MCHP replications of close to 100% are abetted by the offer of tangible gifts of toys and books, and most families (54.1% in the present study) stay for the full two years of the program. Also, the program was specifically designed to be non-didactic and permeated with a ludic spirit intended to make learning and the road to literacy intrinsically motivating and fun for both child and parent. The 1994 National Assessment of Educational Progress study of national reading achievement found that the contextual element of fun characterizes the experience of expert readers at every grade level tested (Campbell, Donahue, Reese & Phillips, 1996).
The importance of any benefits the MCHP may have for disadvantaged children is enhanced by several side benefits. The program provides entry level employment and closely supervised training in basic entry-level work skills for home visitors who often have little education and may never before have held paid jobs. It appears to foster the readiness of participant mothers and home visitors for school completion as well as for employment (Levenstein, 1988).

It should be recalled that the present report does not come from the setting in which the original model was developed but from an authentic replication conducted by a school district. Veterans in the field of innovative social/educational intervention programs are familiar with examples of methods that work fairly well in the relatively protected environment of their original sites but whose benefits and even methods dissipate when the program is adopted in "real world" locations. The strong hint of favorable high school outcomes described in this report suggests that the method can be exported with its essentials intact, at a relatively low cost (under $2,000 per family in 1996), to other sites than the laboratory of its creation. These practical program considerations, coupled with the encouraging findings of the present exploratory study, tentatively suggest that society's attempts to avoid the human and fiscal costs of the continuing family cycle of poverty might be aided through wider utilization of the Mother-Child Home Program.

REFERENCES


