



## Continuing effects of early enrichment in adult life: The Turkish Early Enrichment Project 22 years later<sup>☆</sup>

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### ARTICLE INFO

#### Article history:

Received 9 November 2006

Received in revised form 12 May 2009

Accepted 17 May 2009

Available online 1 July 2009

#### Keywords:

Early enrichment

Preschool education

Mother training

Long-term effects

Early childhood intervention

### ABSTRACT

Long-term studies of early intervention, spanning over decades, are scarce in the United States and nonexistent in the rest of the world. The Turkish Early Enrichment Project (TEEP) is the only non-U.S. example to date. This paper reports a new follow-up assessment of the long-term outcomes of TEEP, an intervention carried out in 1983–1985 with 4–6 year old children from deprived backgrounds (previous evaluations were carried out at the completion of the intervention and seven years later). Findings from 131 of the original 255 participants indicate more favorable outcomes for children who received either mother training or educational preschool, or both, compared to those who had neither, in terms of educational attainment, occupational status, age of beginning gainful employment, and some indicators of integration into modern urban life, such as owning a computer. Further analyses of the intervention effects on the complete post-intervention developmental trajectories indicated that children whose cognitive deficits prior to the intervention were mild to moderate but not severe benefited from early enrichment. Thus, a majority of the children who received early enrichment had more favorable trajectories of development into young adulthood in the cognitive/achievement and social developmental domains than comparable children who did not receive enrichment.

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### 1. Introduction

The significance of early childhood intervention derives from two concurrent realities – the critical importance of the early years for human development and gross inequalities in opportunities available to young children. Intervening to foster optimal development raises issues that are multifaceted and complex. These issues have concerned not only psychologists and developmental scientists, but also economists, educators, neuroscientists, and policy makers, because as noted by Nobel laureate economists Fogel (1997) and Heckman (2000, 2006), the quality of early childhood development has a significant effect on the quality of populations. Despite its importance, research on the long-term effects of early intervention, especially into adulthood, is only recently emerging, despite the notable history of early intervention in both Europe and North America. Research on early intervention in the Majority World<sup>1</sup> is less common, though increasing in recent years (Evans, 2002; Kirpal, 2002; Myers, 1992; Young, 2002).

The present study presents the long-term outcomes of an early childhood intervention in the Majority World, the Turkish Early Enrichment Project (TEEP). As such, it contributes to the body of early childhood intervention research in three ways. First, it

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<sup>1</sup> A term adopted by Kagitcibasi (1996) that we prefer to use instead of “developing countries” or “the Third World”, referring to the majority of the world’s population outside of the high income countries.

presents the effects of an early childhood intervention immediately after the intervention, in early adolescence, and in young adulthood, providing a rare opportunity to detect the emergence and disappearance of intervention effects at different developmental stages. Second, it allows the exploration of early intervention effects in socio-cultural environments where few preschools are available and families have few resources to stimulate the development of intellectual capacity of children. Third, it investigates both the effects of supporting mothers to administer a home-based intervention and the effects of preschool attendance. In societies where preschools are not available and are not considered important, home based interventions may be the only viable option.

### 1.1. An overview of early interventions

Over the years, varied outcomes have emerged from intervention programs, with corresponding variations in the interpretations and the policy-relevant conclusions derived from them. In the American example, the first wave of early intervention programs was conducted within the context of Lyndon Johnson's war on poverty, particularly under Project Head Start. Initial expectations of these programs, ranging from increasing intelligence to providing better employment opportunities to the poor, proved unrealistic, leading to disappointment as the early post-intervention cognitive gains were found to dissipate in a few years (e.g. Cicirelli, Evans, & Schiller, 1969). Based on limited short-term evidence, policy recommendations were made, rather prematurely, against investment in early education (Smilansky, 1979).

The second wave of evaluations was more positive, with findings of delayed gains and long-term positive effects such as less grade repetition, fewer referrals to special education, and lower dropout rates (Berrueta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984; Lazar & Darlington, 1982). A general consensus on the long-term benefits of early intervention emerged in the following decade, particularly for better school performance and social adjustment of at-risk children (Barnett & Boocock, 1998; Campbell & Ramey, 1994; Guralnick, 1997; Ramey & Ramey, 1998; Reynolds, Chang, & Temple, 1998; Schweinhart, Barnes, Weikart, Barnett, & Epstein, 1994; Zigler & Styfco, 1994). Enthusiastic reviews pointed to the long-term risk prevention effects of early intervention (Yoshikawa, 1994; Zigler, Taussig, & Black, 1992).

More recently what may be termed a third wave of evaluations of early intervention appears to be in progress. This wave attempts to articulate a generalized summary of intervention effects. To arrive at generalizable conclusions, investigators examine commonalities and differences among many programs, using meta-analysis (Blok, Fukkink, Gebhardt, & Leseman, 2005; Layzer, Goodson, Bernstein, & Price, 2001) or comparisons of many (generally American) programs and outcome studies (Love, Schochet, & Meckstroth, 2002). A number of recent reports of long-term effects of the well-known American intervention projects such as High/Scope (Schweinhart, Montie, Xiang, Barnett, Belfield, & Nores, 2005), Chicago longitudinal study (Reynolds & Ou, 2004), and the Abecedarian project (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002) reiterate the school-related benefits, such as low rates of grade repetition and referral to special classes, high levels of school attainment, and better overall adjustment extending into adulthood. Others (Blok, Fukkink, Gebhardt & Leseman, 2005) while corroborating the cognitive gains of early intervention, find low levels of effectiveness in the socio-emotional domain. Some reviews reflect upon what went wrong in terms of early unrealistic expectations from early intervention, such as unwarranted assumptions of life-long gains from limited and one-shot investments (Brooks-Gunn, 2003; Zigler, 2003). Yet other evaluations attempt to reveal important factors such as the quality of intervention, which may influence outcomes (Ramey & Ramey, 1998).

Outside of the U.S., European research with ethnic minority mothers and children has produced variable outcomes (van Tuijl & Leseman, 2004; van Tuijl, Leseman, & Rispen, 2001). There are also recent attempts to examine quality and standards of care in early intervention in the Majority World leading to policy relevant recommendations (Evans, 2002; Kirpal, 2002; Willms, 2002).

### 1.2. Previous long-term evaluations of early interventions

Of special relevance to the present study are those long term longitudinal studies of early childhood interventions that had the goals of improved cognitive functioning and long term achievement, such as the original High/Scope Perry Preschool study, the Abecedarian study, and the Chicago longitudinal study. These studies longitudinally evaluated potential program effects into adulthood on a wide range of outcomes. These studies had distinct modes of intervention. All three shared the goal of supporting long-term cognitive and educational benefits in children from disadvantaged backgrounds, but they differed in their methods of intervention and assessment.

The High/Scope Perry Preschool project compared children who received an enriched preschool intervention to similar children who were not offered this opportunity. The Abecedarian study (Campbell et al., 2002; Ramey & Campbell, 1991) consisted of long term delivery of intensive multimodal intervention as well as a more complex design including interventions at different developmental periods – infancy through early childhood only, school age only, and both infancy/early childhood and school age periods, and a no-intervention group. The Abecedarian study was followed by the Project CARE that was very similar to the Abecedarian intervention, but had an additional study group of home-based intervention (Burchinal, Campbell, Bryant, Wasik, & Ramey, 1997; Wasik, Ramey, Bryant, & Sparling, 1990). Project care also included home visits for the center-based intervention. The control group received no educational intervention. The Chicago longitudinal study (Reynolds & Ou, 2004) also combined parent involvement with a child-focused preschool program. Family services were provided together with post-program school support. Among the three programs, the design of the Abecedarian study was most similar to the design of the present study, in that some children received two modes of intervention, some received only one, and some received none. All have carried out evaluations of adult effects when the participants were in their early to mid-twenties, and the current evaluation of TEEP follows the same pattern.

The main differences between TEEP and the studies mentioned above revolve around the nature of the intervention and the nature of the sample. In TEEP, two interventions were compared: A mother training program emphasizing educational activities with the child plus support for the mother through group meetings and guided discussions, and an educational preschool environment. Compared to the other intervention studies, the mother training in TEEP was both more intensive and much more heavily oriented to activities designed to promote the child's cognitive growth. The educational preschool environment aspect of TEEP was most similar to that studied in the Perry Preschool project, as the preschool enrichment program of the Abecedarian study covered the whole first five years of life, not just the two or three years immediately preceding school entrance.

All of the American studies cited above aimed to intervene in groups that were at risk not only for low educational achievement and failure to develop their cognitive, personal and social potential, but also for the need for social services, delinquency and drug use in adolescence and young adulthood because of factors such as minority status, discrimination, poverty, low educational level of parents, and family instability. In contrast, the children included in TEEP were mainly at risk for low educational achievement and failure to develop to their full potential because of poverty and their families' low educational level. They did not represent a population suffering from discrimination or family instability, and they were not expected to be at risk for delinquency or other social problems. In Turkey, as in most of the Majority World, poverty and low levels of education characterize a large proportion of the population (World Bank & State Institute of Statistics, 2005) but this is mostly due to lack of economic development with a correspondingly small middle class rather than to problems such as minority status and discrimination.

The findings of the three programs were largely convergent in demonstrating some educational and related economic benefits and spotty social developmental benefits. In early adulthood, the High/Scope Perry program participants had better educational attainment and economic status than the control group. In addition, they had less involvement in crime, and a higher percentage of women achieving a stable family structure. Further findings through age 40 (Schweinhart et al., 2005) reconfirmed sustained benefits in educational attainment employment and income, stable living arrangements, and less involvement in crime. The evaluation of the Abecedarian program demonstrated the benefits of early intervention in cognitive functioning, school achievement and occupational status, but benefits in social development were limited, showing themselves mainly in less teenage pregnancy and less use of tobacco and marijuana. Delinquency did not appear to be affected. In a number of outcomes the benefits of the combination of preschool and school age intervention exceeded the benefits of preschool intervention alone, but school age intervention alone did not appear to have any effects (Campbell et al., 2002). The evaluation of the Chicago longitudinal study in early adulthood demonstrated gains in high school completion, low rates of special education, low rates of grade repetition, and additional beneficial effects in less involvement in crime. Nevertheless, the analyses of outcomes at various developmental stages in the original High Scope Perry Study suggested that some of the beneficial effects decreased somewhat through middle childhood but re-emerged in adolescence and early adulthood (Schweinhart & Weikart, 1997). None of the long term evaluations focused on *trajectories of gains* throughout the developmental span, except for an examination of growth curves in the cognitive domain in the Abecedarian project (Campbell, Ramey, Pungello, Sparling, Miller-Johnson, Burchinal, & Ramey, 2001).

Taken together, these studies suggest some long term benefits of exposure to early childhood educational experiences which may be detected in young adulthood, even if they appear to diminish in middle childhood. It is also suggested that size of the effect may be more influenced by the duration of intervention than by the specific content of the intervention, and that the benefits may be greater in the area of achievement than in social development. How and under what conditions such benefits emerge may require further study.

Another conclusion emerging from the few long term follow-up studies to date pertains to the difficulties of conducting long-term longitudinal research for purposes of evaluation. Two sources of difficulty are particularly noteworthy: Problems of sample attrition, and problems of comparable assessments at different developmental stages.

To varying degrees, all of these long term evaluation studies – and perhaps especially the present study – faced the problem of attrition from the samples. With small initial samples in relatively small communities, both the Perry project and the Abecedarian project were able to follow well over 90% of their original participants into early adulthood. With a much larger sample in a larger urban setting, the Chicago longitudinal study had higher attrition but nevertheless was able to follow over 80% of the original sample to age 20. The present study suffers from much higher attrition than the others (39%), probably due to the rapid changes taking place in Istanbul as a target of rural-to-urban migration over the interim. Families included in the study mostly lived in squatter settlements that have since been incorporated into the municipality, with the destruction of many of the original homes and their replacement with large apartment buildings and changes in (or new assignment of) street names, numbers, and telephone numbers, and resultant frequent moves by residents. Furthermore, the lack of accessibility of financial databases or comparable tracking information makes it difficult to update contact information in Turkey.

The validity of long term evaluations is threatened to the extent that attrition is selective. Often in longitudinal research, members of disadvantaged groups are lost at higher rates than those from relatively advantaged groups. In evaluation studies, this may imply higher rates of attrition from the control groups. Differential attrition rates, thus, may be a source of bias in the estimation of intervention effects.

The second important difficulty of conducting long term evaluations is the lack of comparable assessments throughout the developmental span ranging from early childhood to young adulthood. In the absence of identical assessments, some studies investigated intervention effects separately at each time point of assessment. Although this approach provides a snapshot of the effects of intervention at different developmental stages, it does not allow the investigation of the intervention effects on individual developmental trajectories. Investigation of these trajectories, on the other hand, requires comparable assessments at different developmental stages. Few studies have accomplished this goal, although the Abecedarian project (Campbell et al., 2001) used standardized IQ tests and age-appropriate versions of a series of standardized achievement tests over four testing points,

allowing the calculation of growth curves in the cognitive domain. However, even if identical measures (e.g., standardized IQ tests) are used across different developmental stages, the content of these tests as well as their meaning as indicators of “life success” necessarily differs across developmental periods.

### 1.3. The issue of mode of delivery in early intervention

Long-term effects of early intervention appear to be influenced by the mode of delivery. Long-standing issues such as the relative effectiveness of child-centered versus parent-centered or center-based versus home-based intervention are being actively debated again, with equivocal results. A recent meta-analysis of 19 studies of the effectiveness of early intervention programs (Blok et al., 2005) found that delivery mode made the strongest contribution to effectiveness in the cognitive domain, with center-based delivery modes being superior to home-based delivery mode. Additionally, enhancing parental skills was found to relate positively to cognitive outcomes. The results of this meta-analysis concur with an earlier review of home-visiting programs reporting meager outcomes (Home visiting, 1999). However, the relatively weak effectiveness of the home-based delivery of early childhood interventions may be due to the widely varying content of the “home-based” interventions. Specifically, not all home-based interventions have a clear focus on supporting early childhood cognitive development. In contrast to Blok et al. (2005), several reviews and evaluations point to significant positive effects of home-based intervention programs on child outcomes (Bekman, 1998a, 2003; Behrman, 1999; Elderling & Leseman, 1999; Kagitcibasi, 1996, 1997a,b; Kagitcibasi, Sunar, & Bekman, 2001; Layzer et al., 2001; NICHD, 1999; Reynolds, Wang, & Walberg, 2003; Young, 1996).

A conceptual problem in this debate is that programs categorized as parent-focused or home-based tend to be those that provide parent support without directly providing enrichment to children, with the result that they compare unfavorably with child-focused programs (e.g. Farran, 1990; Ramey & Ramey, 1998; Wasik, Bryant, & Lyons, 1990). However, parent-focused intervention need not be the exclusive aim of home visiting, and a child focus can be integrated with a parent-focused approach. In fact, a combination of parental support/education and child enrichment is found to be beneficial, particularly in counteracting the negative effects of poverty (Behrman, 1999; Eccles & Harold, 1993; Korenman, Miller, & Sjaastad, 1995; Lee & Croninger, 1994; Masten & Coatsworth, 1998; McLoyd, 1998; Yoshikawa, 1994; Zigler et al., 1992).

Hadeed (2005) categorizes community programs in terms of the various services they provide and concludes from research evidence that the intervention programs that work best combine a child education program with parent education, involving explicit instructions on maternal teaching strategies. Indeed, as Hadeed notes, some studies have shown that children's cognitive improvement doubled when intervention programs involved education for both mothers and children (Layzer et al., 2001; McCartney & Dearing, 2002).

What is possibly of key importance for the effectiveness of combined parent- and child-focused approaches is the intensity, duration and quality of early enrichment provided to children while parents are supported. Although the child focus in parent support programs is usually rather marginal, this need not be the case. Thus, in addition to the combined home and center based intervention mode examined by Blok et al. (2005), there can be another model of intervention with home- and community-based parent-focused approach that also emphasizes the provision of learning experiences to children. This model involves a combination of an intensive parent education program and an intensive early childhood education program. This was the model used in the study presented here, the Turkish Early Enrichment Project (TEEP).

### 1.4. The Turkish Early Enrichment Project (TEEP)

The TEEP was designed to investigate the separate and combined effects of two types of enrichment of early childhood environments: A center-based education and a home-based educational intervention for children at preschool ages. It was considered important to evaluate the efficacy of a home-based intervention because of the overall low level of school achievement in the population (World Bank & State Institute of Statistics, 2005) and the scarcity of educational preschool centers (Kapci & Duygu, 1999). The expectation was that both types of enrichment would have beneficial effects, and that their combination would provide the greatest gains. The TEEP was a four-year study comparing pre- and post-intervention developmental indicators and measures of family environments. Children experienced one of three alternative care environments: An educational day care center (educational group), a custodial day care center (custodial group), or home (home group). Mothers of approximately half of the children in each care environment were randomly assigned to receive mother training and the other half did not receive any mother training. The mothers were trained to carry out cognitively stimulating structured activities with their children. Additionally, mothers who received training also received parent support.

The children of TEEP were assessed at four different time points – pre-program, immediately post-program, 7 years after the program and 19 years after the program. The results pertaining to immediate post-program and the seven year follow-up evaluations have been presented elsewhere (Bekman, 1998b, 2003, 2004; Kagitcibasi, 1996, 1997a,b; Kagitcibasi, Sunar, & Bekman, 2001; Kocak & Bekman 2004) and are briefly summarized here. The present paper focuses on the results of the 19-year follow-up.

#### 1.4.1. Results of the immediate post-program evaluation

Positive and non-interacting effects of both preschool care environment and mother training were observed on IQ scores, school grades, achievement test scores, and general cognitive ability scores immediately post intervention. In addition, children with trained mothers had higher school adjustment ratings, more positive self-concept, and lower aggression than other children.

Mothers' orientation to the child was significantly affected by mother training. Compared to non-trained mothers, mothers who received training reported significantly greater attentiveness to and direct interaction with the child, and more involvement with their children in cognitively oriented activities and school responsibilities. They also had higher educational aspirations and expectations for their children, used more positive disciplinary strategies, and more praise than the non-trained mothers. Thus the immediate post-program results supported the expectation of positive gains from home-based and center-based early enrichment, with the home-based intervention (i.e., mother training) resulting in additional improvements in the children's home environments.

#### 1.4.2. Results of the 7-year follow-up evaluation

Based on the long standing claim regarding the importance of parent involvement even in a center-based intervention, our general expectation was that benefits of mother training for the children, now adolescents, would persist in the long run, because changes in mothers had already been shown to change the children's home environments. Indeed, at the 7-year follow-up mother training predicted school attainment, independent of both baseline IQ and early care environment. Mother training (but none of the care environments) positively affected school grades throughout the five years of compulsory education. Both mother training and educational care predicted higher scores on a standardized vocabulary test.

Adolescents in the custodial care group were less satisfied with their school success and had lower academic self perception than the adolescents in other care environments. Attitudes of adolescents and their parents toward education were positively influenced by mother training. Both mothers and fathers in the mother training group had higher expectations for their children's further education than the parents in the non-mother training group. They also reported fewer problem behaviors of the child, and more positive parent-child relationships than non-trained mothers did. In sum, both types of enrichment, but particularly mother training, were associated with positive outcomes in early adolescence. Between the immediate post intervention and the 7-year follow-up, there was a shift from greater effects of educational day care to greater effects of mother training on cognitive abilities, which suggested that the effects of early experience could change over time.

#### 1.4.3. The current study: 19 year follow-up

The results of the 7-year follow-up suggested that some of the gains from the two types of enrichment were evident seven years after the intervention. In particular, mother training appeared to influence the achievement domain. Thus, at the 19-year follow-up, outcomes measuring progress in education and educational achievement were expected to indicate sustained benefits of mother training. This expectation was based on the assumption that mother training had beneficial effects in promoting a positive attitude towards learning in early childhood, and a sense of competence in the mothers for being involved in learning activities of their children. These effects were expected to be particularly marked in the present study because of the extremely low level of education of the participating mothers and the low likelihood that they would have engaged in any effort to promote learning in their children unless they received training and were encouraged to do so.

Immediate post intervention and 7-year follow-up data indicated that both educational care and mother training were associated with enhanced cognitive functioning. This effect – that is, the effect of any type of enrichment intervention – was expected to persist into young adulthood. Again, this effect should be particularly clear in the current study because children's environments in non-educational childcare or their homes were far from optimal in terms of stimulating cognitive growth. Previous studies of early childhood interventions, as reviewed above, support this hypothesis. Whether home based or center based, efforts to enrich the environments of deprived children have resulted in cognitive gains. The differences between particular ways of enriching those environments have mattered much less than the differences between enriched and non-enriched environments in terms of children's outcomes.

It is likely that improved cognitive functioning and a higher level of educational attainment will lead to a higher level of socioeconomic success. However, it is unclear whether differences in socioeconomic success will be evident in early adulthood. Indeed, if better educated young adults have fewer years of job experience than those who joined the labor force earlier due to discontinued education, the beneficial secondary effects of continued education may not yet be evident at the 19-year follow-up.

There were no clear expectations regarding the effects of mother training or the three care environments on social adjustment. If such effects did operate, the causal processes were likely to be distinct for the two types of enrichment. Adult children of trained mothers may have better social adjustment because they experienced more positive mother-child relationships than the children of non-trained mothers (Kagitcibasi et al., 2001), thus developing more adaptive mental models of interpersonal relationships (Johnson, Dweck, & Chen, 2007). Children in the educational care environments, on the other hand, may have developed a sense of competence acquired through their higher levels of achievement, leading to reduced stress in young adulthood while transitioning into adult roles of employment and family building. This improved sense of self and lower levels of stress may lead to improved social adjustment in young adulthood for the children who experienced educational care compared to the children from other care environments.

The 19-year follow-up aimed to explore the continuing effects of early intervention on the participants' educational attainment, socioeconomic success, family relationships, life satisfaction, and social participation and adjustment. In accordance with our hypotheses, separate effects of early care environments and mother training were investigated, as well as the effects of having experienced any form of enrichment (i.e., mother training and/or educational care).

## 2. Method

### 2.1. Design of the study and the intervention

The original TEEP was conducted in low income areas of Istanbul (Turkey) with 255 mothers and their young children. Most of the mothers had only an elementary education (mean 5.36 years). About two-thirds were working as unskilled factory workers. During the first year, baseline data were collected through observations and testing of two cohorts of participating children (ages 3 and 5) and in-depth interviews with the mothers. The educational and custodial day care centers catered to the children of the working mothers, and were mainly provided by the work places of the mothers. The children attended the facility provided by the factory where the mother worked or, for those whose workplaces did not provide daycare, the nearest state-supported facility. Thus, the type of center was not chosen in accordance with the parents' preferences as in the U.S., but on the basis of convenience or necessity. The educational centers provided a program that met stringent criteria for providing a high-quality educational environment as determined by objective assessments of child/caretaker ratios, daily program of activities, equipment available, and attitudes of the staff, using rating scales by trained observers and interviews with the staff (Kagitcibasi et al., 2001). The custodial centers merely provided care. The equivalent of the custodial model of daycare may be difficult to find in societies where preschool education is widely available and regulated by legislation. The custodial centers in this study neither provided nor encouraged play or any creative activities, and did not offer materials or activities that could promote learning. These centers merely kept the children quiet and obedient during the day. The children whose mothers were not employed were at home during the day (the home group).

In the second and third years of the study mother training was provided to a randomly selected group of the mothers of children who were in each of the three care environments. Reassessments and additional measures of overall development of children, including the extraction of school records, were conducted in the fourth year of the study when the children had finished one or three years of primary school. More detailed information on the study design, subjects, and the implementation of the intervention are available in Kagitcibasi et al. (2001).

In summary, the introduction of mother training followed an experimental design, as the training recipients were selected randomly. Evaluation of the effects of educational, custodial, or home care environments involved a non-experimental design, as assignment to these conditions could not be made randomly.

Mother training consisted of a cognitive component that taught mothers to encourage their child's cognitive activities, and a parenting support component. The cognitive component was a Turkish adaptation of the HIPPIY Program (Lombard, 1981). It comprised 60 sets of structured cognitive activities, each set designed to be carried out over a week, mainly building pre-literacy and pre-numeracy skills using work sheets and story books. These materials were provided to a randomly selected group of mothers across care settings by specially trained and supervised paraprofessionals who instructed the mothers in the use of the materials using role-playing techniques. The mothers then worked with their own children on a daily basis to complete the week's cognitive tasks. In alternating weeks the materials and training were provided in home visits, and in the other weeks they were provided at group meetings, where the mother support or parenting component of mother training was also provided. This component consisted of 30 biweekly guided group discussions, designed to sensitize the mothers to the needs of their children as well as to their own needs. It was designed to build better communication skills, better parenting skills, and empowerment of the mothers, and it covered such topics as health and nutrition, children's developmental needs, play activities for young children, child discipline, and parent-child interaction. The mother training program was implemented over a two-year period.

At the 7-year follow-up, the children who had been 3 and 5 years old at the baseline were 13–15 years old. Of the 255 families in the original study, 225 were located and 217 consented to further participation. Table 1 presents the distribution of the participants by care environment and mother training status for immediate post intervention, 7-year follow-up, and 19-year follow-up assessments.

### 2.2. Participants in the 19-year follow-up

The initial contact for the second follow-up was made by telephone with the mothers, who were asked for their adult children's contact information. The participants were interviewed individually using a structured protocol. Interviewers met with the participants in their home or work, except for 25% of the respondents with whom telephone interviews were conducted.

Of the 217 participants in the first follow-up study, 131 were located and interviewed, for a response rate of 61%, 12 years after the 7-year follow-up study. As a check on the comparability of participants of the follow-up study and those who could not be

**Table 1**  
The design and the samples of TEEP study.

	Immediate post intervention				7-Year follow-up				19-Year follow-up			
	Educational care	Custodial care	Home	Total	Educational care	Custodial care	Home	Total	Educational care	Custodial care	Home	Total
Mother training	27	40	23	90	24	37	22	83	13	21	13	47
No mother training	37	65	63	165	31	50	53	134	21	28	35	84
Total	64	105	86	255	55	87	75	217	34	49	48	131

reached or declined to participate, *t*-tests were conducted to compare the two groups for sex composition, baseline IQ scores, baseline SES levels and whether or not they were still in school at the time of the 7-year follow-up. The comparisons did not indicate any significant differences between the two groups. These attrition analyses were also repeated for the participants in each study condition (mother training, non-mother training, educational care, custodial care, and home groups). The only significant difference between the participants and non-participants was found in the home group, where significantly more male than female participants were lost from observation by the 19-year follow-up (16 of 36 versus 10 of 39, respectively,  $p < .05$ ).

Despite the lack of differences between groups, as in any long term follow-up study, one must consider that the participants may have differed from non-participants due to differential experiences during the 12 year period between the 7-year follow-up and the 19-year follow-up. Such differences often arise due to the attrition of relatively disadvantaged participants. This selection process could lead to the under-representation of the negative outcomes and over-representation of the positive outcomes at the 19-year follow-up. Similarly, it would be an issue of concern if the rates of attrition were higher among the participants in the educational care and mother training groups – the two groups that are expected to display positive outcomes. However, the attrition rates are remarkably similar across the study groups. The educational care group had an attrition rate of 47% between the immediate post and 19-year follow-up studies, compared to 48% for the custodial and home care groups. Likewise, the mother training group had an attrition rate of 47% compared to 48% for the non-mother training group. In conclusion, neither differential attrition by known participant characteristics, nor differential attrition across mother training or care environment groups was observed. The only concern in this study regarding attrition could be the magnitude of attrition over the 19 years of follow-up – which is not excessive considering the upheavals involved in rapid urbanization as discussed above.

Mean age for the participants was 25.7 (see Table 2). The sex composition of the study condition groups differed significantly ( $\chi^2(5) = 12.0, p < .05$ ). Almost one third of the participants (38% of females and 27% of males) were married at the time of the 19-year follow-up. Mean age at marriage was 21.9 for women and 23.6 for men. Among those who were married, 21 had one child and four had two children. On average, participants had almost 11 years of education, equivalent to high school completion at that time. Females had almost two years more schooling than males (11.8 years and 9.8 years, respectively;  $F(1, 131) = 14.50, p < .001$ ).

### 2.3. Measures

In the original TEEP study, extensive assessments were carried out with both mothers and children at the baseline and during the year following the intervention. Children's cognitive development was assessed, and mothers reported on children's socio-emotional development, their child rearing practices, intra-family status, family relations, and satisfaction with self and life in general. The 7-year follow-up interviews were carried out with the children (at that time young adolescents), their mothers and also fathers. In addition, the adolescents took vocabulary and cognitive assessments. Their school grades were also recorded, from the first grade through the last grade attended. The interview topics included educational experiences, attitudes, aspirations and expectations, as well as family relations and social adjustment of the adolescent. The mother interviews further included child-rearing attitudes and practices and questions related to the mother's role in the family, status, and self-concept. The measures used in the immediate post intervention and 7-year follow-up assessments have been described elsewhere (Kagitcibasi et al., 2001). This section presents the 19-year follow-up measures and the composite measures created for the analyses of developmental trajectories. Means and standard deviations for each variable by study group, and the correlation matrices are available at (<http://portal.ku.edu.tr/~ckagitcibasi/TEEP>).

Topics of the 19-year follow-up protocol included demographic information, educational history, occupational status, attitudes toward school and education, income and expenditures, attitudes toward child rearing and family life, and social participation or integration into urban life. Outcomes in the achievement/cognitive domain that were used in the present study were educational attainment, vocabulary test scores and college attendance. A 24-item short form of the multiple-choice format vocabulary test developed by Gulgoz (2004) was used to measure knowledge of Turkish vocabulary. Scores ranged between 0 and 24, and Cronbach's alpha was 0.77.

Outcomes in the socioeconomic domain were the following: Age at first gainful employment, occupational status, monthly expenditures, whether the participant owns a computer and whether the participant owns a credit card. The age at which participants first started working to earn an income was examined, because an early start to workforce participation is widely accepted as an indicator of less qualified jobs and low lifetime earnings (Kaytaz, 2005). Occupational status was measured using Kagitcibasi's (1973) Occupational Status Index. The classification was based on income level and prestige, with the scale ranging

**Table 2**

Characteristics of the 19-year follow-up participants by condition: Means (*SD* in parentheses) and percentages.

	Mother training			No mother training			Total
	Educational care	Custodial care	Home	Educational care	Custodial care	Home	
Mean age	25.7 (0.9)	25.8 (1.0)	25.1 (1.0)	25.8 (1.2)	26.0 (1.0)	25.6 (1.2)	25.7 (1.1)
% Male	30.8	57.1	15.4	61.9	64.3	51.4	51.1
% Married	23.1	38.1	46.2	28.6	35.7	28.6	32.8
Mean completed years of education	10.8 (3.1)	11.8 (2.5)	11.1 (4.0)	11.5 (3.0)	10.0 (3.2)	10.2 (3.1)	10.8 (3.1)
<i>n</i>	13	21	13	21	28	35	131

from 1 (unemployed, housewife), to 2 (least prestigious – unskilled workers) through 7 (most prestigious – professionals, large business owners, etc.). Because only 48% of the respondents reported their monthly income, monthly household expenditure, which has been shown to be a reliable indicator of income in Turkey, was used in the analyses (Kaytaz, 2005).

Outcomes in the social/family adjustment domain were life satisfaction, child rearing attitudes, and the quality of the respondents' family relationships. Life satisfaction was measured with seven items, all rated on 5-point scales, about satisfaction with family, friends, work and spouse. These items were used to construct an additive scale (0–100,  $\alpha = 0.75$ ). Child rearing attitudes were measured by eight items that measured whether the respondent supported an authoritarian approach to child rearing. The items were about whether children should be included in family decision making, whether children should be given explanations when they are asked to do things, whether it is important to understand a child's point of view, whether it is appropriate for a child to express negative feelings, and whether children need to be scolded or punished. An additive scale score of authoritarian orientation towards childrearing was constructed (0–100,  $\alpha = 0.70$ ). The quality of family relationships was measured by a single item eliciting the degree of closeness of the family relationships of the respondent, reported on a 5-point scale.

The analyses of the complete 19-year post-intervention developmental trajectories of the participating children were based on composite scores in two domains of development: Cognitive/ achievement domain and the social development domain (see Heckman, 2008 for a discussion of a similar procedure). In the absence of identical measures across time, one must rely on conceptually similar measures that can be statistically standardized. This approach was adopted here. At each time point of assessment, measures assessing a given domain of development were used to obtain a composite score that was standardized for that assessment point and for this particular sample of participants. All of the measures included in the composites were expected to change as a function of learning, experience, and age. Hence, a composite score quantified the relative performance or the relative level of development of a participant compared to his or her peers at that particular time. A rising trajectory indicated that a participant's performance was increasingly improving in comparison to his/her peers. A declining trajectory indicated that a participant's level of development was increasingly deteriorating in comparison to his/her peers.

*Baseline cognitive composite:* This measure was needed to statistically control the post intervention developmental trajectories for pre-existing differences in the groups of children who experienced different intervention conditions. This composite measure was the factor score that consisted of children's embedded figures test scores and Stanford-Binet IQ scores. In some analyses, a hypothesis was tested regarding the variability of the TEEP program effects due to cognitive differences prior to the intervention. For this purpose, the PRE cognitive composite was categorized as low and high cognitive ability, where low was defined as scores more than  $3/4$  SD below the mean of the sample prior to the intervention. Usually, a low level of performance is defined as at least 1 SD below the sample mean. The choice for a cutoff that was closer to the mean was made on the basis of the absolute scores of this sample of participants. Because the average level of pre-intervention cognitive development in this sample was rather low (the mean baseline IQ score was 84) a composite score of  $3/4$  SD below the mean corresponded to a low functioning group with a mean baseline IQ score of 70.

*Immediate post intervention cognitive/achievement composite:* This measure was used as the first time point of the trajectory of post-intervention development. This composite measure was the factor score that included the following measures: Stanford Binet IQ score, children's embedded figures test score, Wechsler analytical triad test score, Turkish language test score, math test score, the last available Turkish grade from school (1st–3rd grades) and the last available math grade from school (1st–3rd grades), all evaluated as a part of the immediate post intervention assessment. The dominant factor accounted for 47% of the joint variance in these measures and the Cronbach reliability coefficient of the composite was 0.81.

*7-Year follow-up achievement composite:* This measure was used as the second time point of the trajectory of post-intervention development. This composite measure was the factor score that included the following measures: Vocabulary test score; whether the child had dropped out of school, was behind grade level, or was at grade level; 5th grade Turkish grade; and 5th grade mathematics grade, all evaluated as a part of the 7-year follow-up. The dominant factor accounted for 59% of the joint variance in these measures and the reliability of the composite was 0.76.

*19-Year follow-up achievement composite:* This composite measure was the factor score that included only three measures: Vocabulary test scores; last grade completed; and the self assessment of grades in last year of school, all evaluated at the 19-year follow-up. The dominant factor accounted for 50% of the joint variance in these measures. Because there are only three measures available, and each assessed somewhat different aspects of the cognitive/achievement domain, their internal consistency is not high ( $\alpha = 0.50$ ). Nevertheless, it was important to include a composite that assessed all available relevant dimensions of this domain. Alternative approaches to using multiple assessment data that modeled measurement errors were also estimated (see Section 2.4) but none of the alternative approaches yielded any results about the developmental trajectories that differed from those presented here.

*Immediate post intervention measure of social development:* There were no assessments of social development at baseline. Four items were asked of the mothers at immediate post assessments, measuring school adjustment of the children who were, at that time, attending grade school. These items were about whether the child looked for excuses not to go to school, whether the child liked his/her school and teacher, and whether the child got along with his/her classmates. These items were used to form a school adjustment scale ( $\alpha = 0.56$ ).

*7-Year follow-up measure of social development.* Twelve items were asked of the mothers that were typical of those commonly used to measure socio-emotional adjustment of children (Achenbach & Edelbrock, 1983) such as whether the child got along well with others, fought often, was obedient to parents, talked back, etc. The twelve items were used to form a social adjustment scale ( $\alpha=0.80$ ).

*19-Year follow-up measure of social development.* Because the participants of the TEEP study were young adults at the time of the 19-year assessment, typical social development measures did not apply. At these ages, assessments frequently target delinquency or psycho-social adjustment. Because of the very low prevalence of delinquency in this sample, delinquency measures were not meaningful. Instead, a measure was created that was based on four different indicators of social development: (1) a score that assessed the extent to which young adults were assimilated into modern urban society based on eight items indicating whether the participants had been at a bank alone, used the internet, traveled alone, or paid bills, and frequency of reading newspapers, seeing movies, and watching the news ( $\alpha = 0.59$ ); (2) the occupational prestige score; (3) the age at first gainful employment; (4) the respondent's estimate of household expenditures. These four indicators were combined in a factor score (the dominant factor accounted for 39% of the joint variance).

#### 2.4. Statistical methods

In this section, the statistical methods of analyses for the analyses of outcomes at each time point of assessment and the analyses of the complete developmental trajectories are presented, respectively. The analyses of the outcomes at the 19-year follow-up were simple comparisons of the groups using ANCOVA, a variant of general linear models (GLMs), with a statistical control for pre-intervention Stanford Binet IQ differences in groups. When percentages were compared, simple chi-square tests of group differences were conducted. Earlier analyses revealed no differences in intervention effects by cohort of the child (Kagitcibasi et al., 2001). Here, cohort differences are not investigated. In addition, interaction of the two types of enrichment, i.e., the child care environment and mother training, were tested. Sex interactions and the interactions of the two types of enrichment were reported only if these interactions were statistically significant. In some cases, pairwise comparisons of estimated marginal means were made. In these cases, Bonferroni corrections were used to determine statistical significance. The sample size permitted us to detect effect sizes of approximately 4, but not less. Only statistically significant findings are presented.

The analyses of group differences in developmental trajectories used within subjects ANCOVA analyses, another variant of GLMs. There are two key advantages to conducting analyses of trajectories beyond conducting separate analyses of outcomes at each time point. First, through the analyses of trajectories it is possible to ask questions about sustained or even accentuated effects of intervention over time. These questions are strongly relevant to policy formulation and the evaluation of the costs and benefits of an intervention. Second, the analyses of trajectories investigate the group differences in a combined time series of observations. Hence, the analyses of trajectories can leverage more statistical power to detect group differences than separate cross-sectional analyses of a time series of observations.

There are two other alternative methods of approaching the analyses of multiple outcome time-series data. Another variant of GLMs, namely MANOVA and a structural equation model with latent variables. Models using both of these alternative methods were estimated to validate the results and conclusions presented here. The estimates of the trajectories and the conclusions based on these estimates did not vary across the estimation approaches. The ANCOVA models that are presented here yielded the most parsimonious results that are easily interpreted.

The question about differences in trajectories is often analyzed in two components: (1) analysis of the differences in the overall level of development that are revealed by individual trajectories and that can be attributed to intervention effects; and, (2) analysis of the differences in the shape of the individual trajectories that can be attributed to intervention effects. If a within-subjects analysis of variance model is applied, the first component corresponds to the main effect of the intervention and the second component corresponds to the interaction effect of time with intervention. TEEP design implies that early childhood enrichment effect consists of the interaction of two different types of enrichment: The type of care environment and mother training. In addition, the effects on the developmental trajectories of exposure to any type of enrichment were investigated.

### 3. Results

Based on previous analyses of TEEP (Kagitcibasi et al., 2001), both mother training and educational care were expected to result in beneficial outcomes for the participants. Because of the emerging benefits of mother training at the 7-year follow-up, these effects were expected to be stronger than the care environment effects at young adulthood. The following section provides the results of the analyses of three domains of outcomes: Achievement/cognitive domain, socio-economic domain, and social/family adjustment domain.

#### 3.1. Results of the 19-year follow-up

Group differences in three different types of outcomes were investigated: (1) achievement and cognitive skills (school attainment, college attendance, vocabulary test scores); (2) socioeconomic success (age at beginning gainful employment, occupational status, monthly expenditures as an index of income, and indicators of integration into the modern urban world); and (3) life satisfaction, family relationships and childrearing values. The outcomes considered in different domains were interrelated. For example, achievement, cognitive performance, and socioeconomic status were moderately correlated.

The original TEEP design allowed for comparisons in a  $3 \times 2$  design of care environment (educational, custodial, and home) by mother training. However, analyses of the data through the first follow-up indicated no interaction effects of the care environment with mother training. Due to the smaller sample size of the second follow-up study, and our concern for a lack of power for multiple comparisons, only a limited set of comparisons were conducted instead of comparing all possible combinations of the two

**Table 3**

The estimated marginal means of the outcomes in the cognitive/achievement and social developmental domains for different enrichment groups at 19-year follow-up.

	Mother training		Preschool environment			Any enrichment	
	MT	NMT	ED	CUST	HOME	AE	NE
Completed education	11.2	10.5	10.7	11.1	10.4	11.2 <sup>†</sup>	10.3
Vocabulary test score	13.7	12.7	12.8	12.6	13.7	13.2	12.9
College attendance	44.7% <sup>†</sup>	29.8%	41.2%	34.7%	31.3%	44.1%*	26.6%
Age at gainful employment	17.6 <sup>†</sup>	16.5	17.8	16.9	16.1	17.5*	16.2
Occupational status	3.7	3.6	4.5*	3.6	3.1	4.0*	3.3
Monthly expenditures	\$540.0	\$560.0	\$633.3	\$526.7	\$520.0	\$573.3	\$526.7
Owns a computer	42.6%	30.1%	50.0% <sup>†</sup>	27.1%	31.3%	44.1%*	24.2%
Owns a credit card	70.2%*	53.0%	55.9%	60.4%	60.4%	61.8%	56.5%
Life satisfaction	72.2	76.6	75.2	72.8	77.1	74.4	75.6
Authoritarian childrearing attitudes	23.4	25.0	24.7	26.4	22.2	24.5	24.3
Family relationships	4.4	4.3	4.2	4.3	4.5	4.4	4.3

Note. MT = mother training, NMT = no mother training, ED = educational child care, CUST = custodial child care, HOME = no child care, AE = any enrichment, NE = no enrichment. These estimates are obtained after controlling for pre-intervention Stanford Binet IQ scores.

<sup>†</sup> $p < .10$ . \* $p < .05$ .

types of early intervention. The comparisons were selected on the grounds of theoretical or policy interest, and in accordance with the study hypotheses.

Three types of comparisons were conducted: Mother training vs. no mother training; educational care vs. custodial care vs. home comparisons; and, comparisons between the participants who had exposure to any enrichment vs. those who had no exposure to an enriched early childhood environment. For the latter purpose, we combined the respondents from the mother training group (from all three care environments) and the educational care group (regardless of whether they received mother training) to form the “any enrichment” group. This group was compared to the “no enrichment” group consisting of custodial care or home groups who did not receive mother training.

The comparisons of participants in characteristics that were hypothesized to be affected by early enrichment are shown in Table 3. The three types of comparisons are given in the three columns of this table, respectively. This table displays the estimated means after adjusting for the differences in baseline IQ levels of the respondents.

### 3.1.1. Effects of mother training and the care environment

*Achievement/cognitive domain.* Among the outcomes in this domain, none indicated a statistically significant advantage of the mother training group over the no mother training group although the differences were in the expected direction (see Table 3). There was a trend suggesting that the participants whose mothers were trained were more likely to attend college than the participants whose mothers were not trained. No significant advantage was detected for any of the three environments of early childhood in this domain.

*Socioeconomic domain.* The outcomes in this domain did not indicate a statistically significant advantage for mother training. There was a trend for later gainful employment for the participants whose mothers were trained than others. The care environment effects were limited. The occupational status of the participants of educational care was significantly higher than the other participants ( $F(2, 124) = 4.3, p = .02$ ). The differences in the timing of gainful employment and monthly expenditures by care environment were in the expected direction but not statistically significant.

*Social/family adjustment domain.* A significantly higher percentage of those in the mother training group had credit cards than those in the no mother training group ( $\chi^2(1) = 4.0, p = .05$ ).

There were no statistically significant differences between the care environment groups in the indicators of this domain. The differences in the rates of computer ownership displayed a trend in the expected direction, with the participants in the educational care environment having the highest rates of computer ownership.

### 3.1.2. Interaction effects of the two types of enrichment and the moderating effects of sex

The two types of enrichment, i.e., mother training and the care environment, had no significant interactive effects on any of the outcomes examined here. However, sex moderated the beneficial effects of early care environment on educational attainment, ( $F(2, 123) = 3.6, p = .04$ ). For young men, educational or custodial care environments appeared to be more beneficial than home environment, in terms of their educational attainment. For young women, the three types of care environment did not result in differential levels of educational attainment.

In sum, there are weak and spotty effects of early enrichment in terms of mother training or an enriched care environment on young adulthood outcomes. The dearth of statistically significant findings could partly be due to the relatively small size of the sample in comparison to the sizes of the differences between groups and the variability within each group. This latter factor is due to the design of the TEEP: A portion of the participants in every care environment experienced enrichment through mother training, and a portion of the participants in no mother training group experienced an educational care environment. The next set of analyses present comparisons of the participants who experienced any enrichment in early childhood to those who did not.

### 3.1.3. Effects of enrichment versus no enrichment

*Achievement/cognitive domain.* A significantly higher percentage of participants experiencing enrichment attended college (44.1%) than others (26.6%,  $\chi^2(1) = 5.0, p = .03$ ). There was a trend indicating that the participants who experienced enrichment had higher educational attainment than the participants who did not experience enrichment. A moderation of this effect by sex was detected. Any enrichment in early childhood was beneficial for the educational attainment of young men. There was a trend for women in any enrichment group to have higher educational attainment than women in the no enrichment group ( $F(1, 125) = 3.7, p = .06$ ).

*Socioeconomic domain.* Participants who experienced any enrichment entered the workforce later than those who experienced no enrichment (17.5 years and 16.2 years, respectively;  $F(1, 118) = 4.4, p = .04$ ), consistent with their relatively longer years in school. Indeed, when college attendance was controlled, early enrichment effects were nonsignificant, confirming this mediation (results not presented in Table 3). In addition, those who experienced any enrichment had jobs of significantly higher status than others ( $F(1, 125) = 3.8, p = .05$ ). There were no significant differences in the monthly expenditures of the participants in the two groups. A significantly higher percentage of the participants who experienced any enrichment reported owning a computer (44.1%), compared to 24.2% of the respondents who did not experience enrichment in early childhood ( $\chi^2(1) = 5.7, p = .02$ ).

*Social/family adjustment domain.* There were no effects of early enrichment on the outcomes in this domain.

## 3.2. Results of the analyses of developmental trajectories of the participants

The results of the analyses of the developmental trajectories of the participants of the TEEP are presented in three sections. The first section presents the effects of the two types of enrichment and their interaction. The second section presents the effects of having experienced any type of early childhood enrichment. The third section presents the findings pertaining to the variability in the effects of exposure to early childhood enrichment.

### 3.2.1. Effects of mother training and the care environment

*Cognitive/achievement domain.* The analyses of the composite cognitive developmental trajectories included the baseline cognitive developmental composite as a covariate. Overall and time-varying mother training effects were not significant (effect size about 0.2). The main effect of the care environment on cognitive composites was not significant but its interaction with time was significant ( $F(4, 254) = 2.5, p = .04$ ). The difference in the trajectories of cognitive composites indicated that children in the home group had gains in cognitive skills over time whereas children in the educational group had a loss of cognitive skills over time, relative to their peers.

The analyses investigating the overall and time varying effects of the interaction of mother training and the care environment yielded no support for this interaction. The post hoc tests revealed a significant effect of mother training for the custodial care group but not the remaining two groups of early care environment (pairwise comparison  $p = .03$ ).

*Social developmental domain.* These analyses indicated that mother training had no significant overall effects on the social developmental composites and no significant time varying beneficial effects. Post-hoc tests indicated that there was a significant advantage of the children whose mothers were trained in social development that emerged at the 7-year follow-up but this advantage was not sustained through the 19-year follow-up (pairwise comparison  $p = .02$ ).

The overall effect of early care environments on the social developmental domain was non-significant. However, there was a trend indicating a time-varying effect of early care environment ( $F(4, 254) = 2.2, p = .08$ ). The post hoc tests indicated a trend for the advantage of the educational care group in the social developmental composite at the 19-year follow-up over the custodial care and home groups (pairwise comparisons  $p = .10$  and  $p = .08$ , respectively).

The analyses investigating the overall and time varying effects of the interaction of mother training and the care environment yielded some support for this interaction ( $F(2, 124) = 2.8, p = .06$  overall, and  $F(4, 248) = 4.6, p = .001$ , time varying, respectively). The investigation of the pattern of these effects indicated an advantage for the participants whose mothers had received training who were in the custodial care or the home groups but not in the educational care group in terms of their social development. This finding was supportive of the hypothesis that exposure to any early enrichment, regardless of the type of that experience, is beneficial for children from disadvantaged backgrounds.

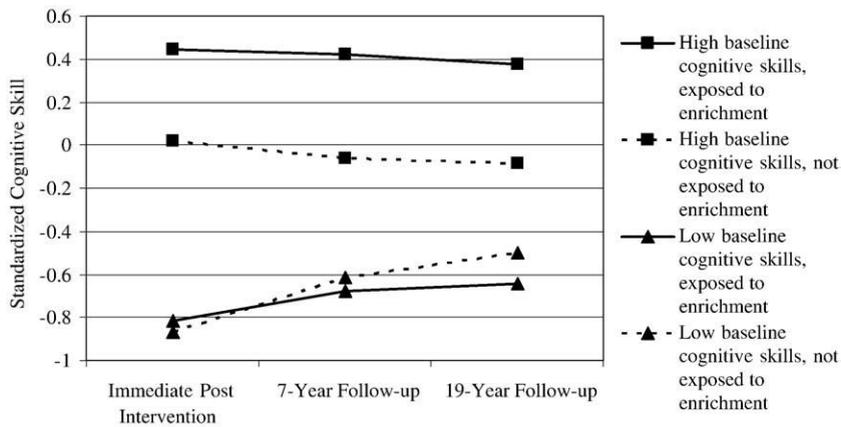
### 3.2.2. Effects of enrichment versus no enrichment

*Cognitive/achievement domain.* The overall or time varying effects of having experienced any enrichment on the cognitive/achievement composite scores were not statistically significant.

*Social developmental domain.* There was a significant overall effect of experiencing an enriched environment in early childhood on the trajectories of social development ( $F(1, 128) = 3.9, p = .05$ ), but its time varying effects were nonsignificant. At every observation point, the participants who experienced an enriched environment in early childhood had a significant advantage over the others in their social developmental composites.

### 3.2.3. Sources of variability in the effects of early enrichment

*Cognitive/achievement domain.* There was a time varying interaction effect of mother training with sex ( $F(2, 252) = 3.5, p = .03$ ) indicating an emerging advantage at the 7-year follow-up of male participants whose mothers received training over male participants whose mothers did not receive training. A comparable pattern emerged when the interaction of the effects of experiencing any enrichment with sex were investigated ( $F(2, 252) = 2.9, p = .06$ ), supporting an advantage of an exposure to



**Fig. 1.** The effects of exposure to any early childhood enrichment on the cognitive/achievement trajectories of children who had high vs. low baseline cognitive skills.

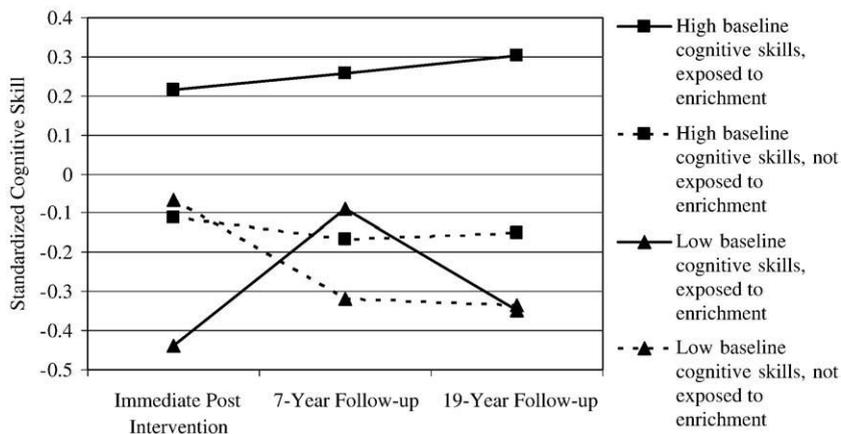
enrichment among the male participants at the 7-year follow-up. These advantages of the males detected at the 7-year follow-up were not maintained at the 19-year follow-up. There was also a significant time varying interaction effect of the care environment with sex ( $F(4, 248) = 2.5, p = .04$ ). Post hoc tests indicated an advantage of the home group over the educational care group for female participants at the 19-year follow-up (pairwise comparison  $p = .04$ ).

Exploratory analyses of the trajectories of development in the cognitive/achievement domain indicated that at every time point the participants who had experienced enrichment performed better than the participants who had not. The fact that these effects were not statistically significant was suggestive of two possibilities: (1) that the effects were too small to be detected with the relatively small sample size, and/or (2) the effects were variable, and therefore the standard error of the average effect was too high for it to be detected as statistically significant.

In order to investigate the variability of the effects of exposure to enrichment, the baseline cognitive skills composite was categorized as low and high. Then, the interactions of baseline cognition with enrichment effects were estimated, allowing for differential effects of exposure to enrichment across the participants who had low versus high initial levels of cognitive skills.

These analyses indicated a trend towards an interaction of the enrichment effects with pre-existing cognitive capacity ( $F(1, 127) = 3.1, p = .08$ ). The post hoc test of differences clearly supported the conclusion that participants who experienced enrichment in early childhood, and who had close to normative levels of baseline cognitive skills, had a significant advantage at every time point over the participants who did not experience enrichment (pairwise comparisons at immediate post, 7-year and 19-year follow-up:  $p = .01, p = .01, p = .02$ , respectively; see Fig. 1). In contrast, the participants who had very low initial level of cognitive skills did not differ by enrichment exposure at any of the time points. The effect size of exposure to enrichment for the participants who had baseline cognitive skills that were no lower than  $3/4$  SD below the mean of this sample (approximately 75% of all participants) was about 0.4.

*Social developmental domain.* There were no statistically significant moderator effects of sex on the overall or time varying effects of mother training, care environment or exposure to enrichment. Post hoc tests indicated an advantage for male participants who were exposed to enrichment that emerged at the 7-year follow-up, but was not sustained (pairwise comparison  $p = .03$ ).



**Fig. 2.** The effects of exposure to any early childhood enrichment on the social developmental trajectories of children who had high vs. low baseline cognitive skills.

Similar to the cognitive/achievement domain, the trajectories of development in the social developmental domain indicated that at every time point the participants who were exposed to enrichment had an advantage over other participants. The pre-existing differences in the level of abilities of children were examined as a possible source of variability of enrichment effects, but this hypothesis was not supported. The post hoc test of differences clearly supported that among the participants who had close to normative levels of baseline cognitive skills, those who were exposed to enrichment had a significant advantage over comparable participants who did not experience enrichment at the 7 and 19-year follow-up, but not at immediate post intervention (pairwise comparisons  $p = .04$ ,  $p = .02$ ,  $p = .09$ , respectively; see Fig. 2). In contrast, the participants who had low baseline cognitive skills did not differ by enrichment exposure at any time point throughout the trajectory. The effect size for the participants who had baseline cognitive skills that were no lower than  $3/4$  SD below the mean of this sample was about 0.4 for both the 7-year and the 19-year follow-up.

#### 4. Discussion

The main finding of the present study is that high-quality early childhood enrichment for children in deprived environments, whether provided through mother training, educational preschool education, or both, has positive effects on the overall development of the child that carry over into young adulthood. Despite variability of the effects of early intervention across cognitive/achievement, socioeconomic, social/family adjustment domains and participant characteristics, the 19-year post intervention evaluation indicated that both mother training and preschool day care had some benefits that were still apparent in young adulthood: Participants who had been exposed to either type of early enrichment, compared to those who had not, exhibited higher school attainment, began their working lives at a later age, and had higher occupational status. Also, those whose mothers had received training were more likely than others to own a credit card, and those who had attended an educational nursery school were more likely than others to own a computer, both signs of greater integration into modern urban life.

In addition, analyses of the long term effects of TEEP provide insight into the emergence and fading of early intervention effects throughout childhood, adolescence, and early adulthood. The present study improved upon previous evaluations of long term outcomes of early enrichment by investigating the differences of entire developmental trajectories, rather than single point-in-time outcomes. The analyses of the developmental trajectories in cognitive/achievement and social developmental domains indicated that any type of early enrichment benefited the developmental trajectories of children. However, these benefits varied to some extent by sex and age of the child and the type of intervention. For example, educational attainment of male, but not female participants was affected by early environment. Also, mother training showed a positive effect on social development, but only in early adolescence. And the effect of mother training on social development was stronger in participants who did not attend an educational preschool.

Perhaps more important than these sources of variation was the finding that the degree of cognitive impairment prior to intervention had consistent effects over the entire developmental trajectory. Children who were in the lower 25% of the distribution of cognitive skills prior to the intervention did not display any effects of exposure to enrichment. Thus, the findings of the 19-year follow-up identified a group of children who may be at high risk of developmental delays, and may need more intensive intervention than enrichment of the home and/or preschool environments in order to attain favorable developmental trajectories. This issue was not studied in previous research addressing long term benefits of early enrichment. In contrast, participants from the upper 75% of the distribution of cognitive skills at the outset showed all the effects listed above, indicating that early enrichment can have lasting effects on a large majority of children in deprived environments.

The findings reported here are in concordance with the findings of other studies of long term effects of early enrichment. Long term beneficial effects on achievement and cognitive developmental outcomes have been reported by the High Scope/Perry program (Schweinhart & Weikart, 1997), the Abecedarian study (but only for conditions that included the 5-year preschool intervention; Campbell et al., 2002), and the Chicago longitudinal study (Reynolds & Ou, 2004). Furthermore, the findings of the High/Scope Perry Curriculum Comparison study indicated that whether a child received some type of early enrichment mattered more than the particular content of that early enrichment (Schweinhart & Weikart, 1997), similar to the current finding that mother training and educational child care environment had comparable and non-interacting beneficial effects. Only a few social developmental benefits of early intervention have been detected by previous long term studies; thus there is a lack of strong evidence of substantial benefits in this domain. The Blok et al. (2005) meta-analysis of 19 studies published since 1985 which examined 85 different outcomes also pointed to weak effects in the socio-emotional domain compared with the cognitive domain. The current study indicates comparable benefits of early enrichment in cognitive/achievement and social developmental domains in terms of the effect sizes among the children who were in the upper 75% of the distribution of cognitive skills prior to the intervention.

Variability of the effects of early enrichment is of great policy interest, and thus merits further investigation. Adding to extant research, the current study investigated the variability of early enrichment effects by prior level of cognitive ability and by sex. A source of variability in enrichment effects that is often suspected is the pre-existing differences in the level of abilities of children who are exposed to enriched environments.

An important question in this regard is whether the variability of benefits is due to the differences in the cognitive skills of the children, their mothers, or both. It is possible that the mothers of children with extremely low levels of cognitive skills also had low levels of cognitive skills. Mothers with low levels of cognitive skills might not have understood or implemented the enrichment activities as effectively as the mothers who had higher levels of cognitive skills. All of the mothers in this sample had very low levels of education and they were not administered any cognitive tests prior to the mother training. In order to gain some insight into this

issue, one could focus on the effects of educational care among the children whose mothers did not receive training, eliminating potential mother effects in enrichment experiences. These analyses suggested that indeed the effects of educational care were positive and larger among the children in the upper cognitive skill group than the lower cognitive skill group, although these findings are based on small sample sizes. Taken together, these results would suggest that early enrichment experiences will benefit most children's cognitive and social developmental trajectories unless their initial levels of cognitive skill are extremely low.

Another source of variability of enrichment effects was sex. The impact of early enrichment was greater for male than for female respondents in the achievement/cognitive domain, which contrasts with the finding by [Campbell et al. \(2002\)](#) of greater impact on female participants. Within the present study, female participants, regardless of intervention status, had higher educational attainment than males. There is evidence that females are quicker than males to adopt "modern" or progressive ideologies (e.g., [Sidanius & Pratto, 1999](#); [Sunar, 1982, 1988](#)); the striving for education among girls in rural-to-urban migrant families, and less successful trajectory of boys who do not experience intervention, could be a reflection of the same tendency. Also, boys may be under greater pressure to contribute financially to the family, so that countervailing influences may be required to keep them on the educational track. It is possible that the difference in sex-related findings between the present study and those from the Abecedarian project may be attributed to cultural differences regarding gender roles in Turkish society versus that among African Americans, who constituted the great majority of participants in the Abecedarian project.

Identification of these two sources of variation in outcomes (initial level of cognitive skill and sex) underscores the fact that an intervention program does not have uniform effects throughout a target population. Rather, individual and group characteristics, as well as local social conditions and expectations, may make it easier or more difficult for a given child to benefit from an enrichment program. Nevertheless, the overall results suggest that a large majority of children are likely to benefit from high-quality enrichment.

Inspection of the developmental trajectories suggests that the developmental gains due to early enrichment are mainly due to developmental loss in those children who did not have early enrichment, particularly in early adolescence. This finding raises the question of whether intervention at that point could prevent some of the decline. The results of the Abecedarian project ([Campbell et al., 2002](#)) suggest additional benefits from school age intervention following preschool intervention, but the most effective type and timing of intervention after middle childhood remains unknown.

The policy implication of all of these findings is that high-quality early enrichment, whether home-based or center-based, is valuable. The delivery mode that is appropriate and feasible in a particular context should be selected taking into consideration constraints such as resources, costs, the acceptability of the mode of intervention, and the number of beneficiaries. Cost effectiveness is crucially important for policy and applications, particularly when programs are to "go to scale". Expensive programs, even if highly effective, have limited applicability for low income groups. In general, home-based programs are less expensive than center-based ones, especially as in the case of TEEP where institutional investments are not required and paraprofessionals are used. A recent cost-benefit analysis conducted in Turkey ([Kaytaz, 2005](#)) calculated and compared the cost-benefit ratios of different models, home-based and center-based, under different scenarios. The calculated benefit-cost ratios ranged from 4.35:1 to 6.31:1 for center-based education and from 5.91:1 to 8.14:1 for mother-child education. The implications of this simulation study parallel the findings from the current study: Both types of intervention can be expected to produce important social and economic returns.

Given that early intervention produces long-term positive results, does it also contribute to social justice by equalizing opportunity? In other words, does it counteract social class differentials in educational achievement and other outcomes? TEEP was conceived and implemented as a study of an intervention in the context of socio-economic disadvantage. Some commentaries on early intervention in the context of socio-economic deprivation point to the limitations of early intervention in bridging the gap between outcomes for children of the lower and the middle socio-economic levels. Early reviews (e.g., the [Coleman Report, 1966](#); [Bernstein, 1970](#)) had pessimistic conclusions regarding the compensatory effects of early childhood interventions. More recent studies (e.g., [Pigott & Israel, 2005](#)) indicate that SES differentials may narrow, but persist after early intervention. Similar results have been found in Turkey. A study of the effects of the Mother-Child Education Program (MOCEP), modeled on an abbreviated version of TEEP (developed and implemented in Turkey through the joint efforts of the Mother-Child Education Foundation and the Turkish Ministry of Education, with World Bank support), showed that the low SES children who received this program had better school readiness than those who did not receive the program, but they were still significantly worse off than the middle SES children who received no intervention ([Aksu-Koc, 2005](#)). Other evaluation studies on MOCEP in Turkey ([Ayciceği, 1993](#); [Bekman, 1998a](#); [Ercan, 1993](#)) and in Bahrain ([Hadeed, 2005](#)) have also found improvements in school readiness following the program, but they have not examined long-term effects.

It is clear that by itself, early intervention, especially if limited in scope, cannot remedy socio-economic inequalities ([Brooks-Gunn, 2003](#); [Zigler, 2003](#)). The participants of the current study are mostly the children or grandchildren of rural-to-urban migrants, constituting a group of socioeconomic disadvantage. As a result of this migration and overall economic development, the participants fared better, in terms of their educational attainment, than their parents. Although the mothers' mean educational attainment was only 5.4 years, the overall mean for the study participants was 10.8 years. Within this low-SES group, which benefited from the "rising tide" of economic development and concurrent expansion of educational opportunities, there remained important differences between those who received early enrichment and those who did not. In the long term, early home-based and center-based enrichment had benefits for most young adults compared with those who did not have access to it. It must be further emphasized that it is the no-intervention group, initially similar in all important aspects to the intervention group, which is the meaningful comparison group, rather than a middle class group.

Although the findings from this long-term follow-up are highly encouraging, some notes of caution must be sounded. Foremost among the limitations of the study is the fact that random assignment to the preschool environments was impossible. The choice of

an educational over custodial center was determined by availability at the workplace and thus could have been a selection factor regarding workplace resources. Also, although the children in educational care had quite similar experiences in terms of enrichment, the custodial care environments were less uniform, having in common mainly a lack of educational orientation, and the home group was potentially even more variable than the other two environments.

An additional limitation of this long-term follow-up study was attrition. An attrition problem is certainly expected over a 20-year period in a geographically mobile society undergoing rapid urbanization. Nevertheless, it reduced the sample size by nearly half, in turn reducing the statistical power of the analyses, as well as raising the question of the unobserved characteristics of the attrited sample that may threaten the validity of the findings. Even though there was no indication that the remaining sample is biased due to known characteristics or differential attrition across study conditions, the small sample size means that even fairly large differences are not statistically significant. On the other hand, the consistency of the results, even with the small sample size, raises our confidence in the meaningfulness of the findings.

Another problem in the current study is the quality of the composite measures used in the trajectory analyses. The original measures that made up the composites were quite heterogeneous, ranging from standardized IQ tests to single questions from interviews. Greater coherence of the composites would undoubtedly have facilitated more certain conclusions.

The analysis of developmental trajectories in itself (especially long-term trajectories spanning early childhood through young adulthood) poses another problem, which is the impossibility of repeating the same set of assessments at different developmental periods. This is an obstacle inherent in applied developmental research that strives to adopt a longitudinal perspective. Nevertheless, in the absence of identical measures across time, one must rely on conceptually similar measures that can be statistically standardized.

The long term findings of TEEP are of great significance for policy and applications in the Majority World where most children lack opportunities for early childhood education. The global average of preschool education is 40%. Whereas the figure is as high as 90% of the children in high income countries, in low income countries it is as low as 24% (UNESCO, 2005). In Turkey it is a low of 24% (MEB, 2007). In most cases the children who have the greatest need for early enrichment experiences are those who live in poverty and have the least access to it. The present study underscores once more that concerted efforts are called for toward providing all children with enriched environments in early childhood.

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