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The Relations of Early Television Viewing to School Readiness and Vocabulary of Children from Low-Income Families: The Early Window Project

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For two cohorts of children from low- to moderate-income families, time-use diaries of television viewing were collected over 3 years (from ages 2–5 and 4–7 years, respectively), and tests of reading, math, receptive vocabulary, and school readiness were administered annually. Relations between viewing and performance were tested in path analyses with controls for home environment quality and primary language (English or Spanish). Viewing child-audience informative programs between ages 2 and 3 predicted high subsequent performance on all four measures of academic skills. For both cohorts, frequent viewers of general-audience programs performed more poorly on subsequent tests than did infrequent viewers of such programs. Children's skills also predicted later viewing, supporting a bidirectional model. Children with good skills at age 5 selected more child-audience informative programs and fewer cartoons in their early elementary years. Children with lower skills at age 3 shifted to viewing more general-audience programs by ages 4 and 5. The results affirm the conclusion that the relations of television viewed to early academic skills depend primarily on the content of the programs viewed.

INTRODUCTION

Television viewing is consistently blamed for a myriad of social and developmental problems, including poor school achievement. These sweeping condemnations ignore the obvious fact that television contains an enormous variety of forms and content; its impacts on children's development probably depend on the content and the degree to which programs are designed to convey that content effectively to developing audiences. Educational programming has become a regular, if small, part of broadcast offerings. It is widely assumed that children learn cognitive and social skills from such programs, but the evidence supporting these beliefs is somewhat scattered.

The purpose of the 3-year longitudinal study described in this article was to investigate the relations between young children's television viewing experiences and their performance on tests of school readiness and vocabulary. The sample consisted of children from families with low-to-moderate incomes because such families use television extensively (Huston & Wright, 1997) and because many educational programs (e.g., *Sesame Street*) are targeted at them. As a result, they may experience both the positive and negative effects of television more than do children from higher income families. We approached this topic with two core assumptions. First, different types of television programs can have correspondingly different relations to children's intellectual development. Second, such relations are probably reciprocal. Children's intellectual skills may be affected by viewing, and their acquired skills may affect subsequent viewing choices.

Relations of Television Viewing to Achievement

Most investigations of television and school achievement have been conducted with school-age children, and most have not distinguished among different types of program content. Correlational studies show a small but consistent negative relation between concurrent total television viewing and various indices of school achievement (e.g., language, cognitive skills), even with controls for confounding variables (Comstock, 1995). A meta-analysis of 23 studies found that the average correlation of total viewing with school achievement was −.05; the overall relationship was curvilinear, with students who watched about 10 hr a week performing best in school (Williams, Haertel, Walberg, & Haertel, 1982).

In two longitudinal investigations, by contrast, few relations between viewing and later achievement were found once appropriate confounding variables were controlled. Children in the National Health Examination were assessed twice (between ages 6 and 11 and again between ages 12 and 16 years). Although total time watching television in each age range was negatively associated with performance on achieve-

ment tests in adolescence, the relation dropped to zero when controls for grade-school test performance, region, and family characteristics were included (Gortmaker, Salter, Walker, & Dietz, 1990). A study following three panels of children over 3 years (grades 1–3, 3–5, and 6–8) showed temporal patterns that supported the hypothesis that total television viewing contributed to lowered reading skill over time among the oldest cohort of children studied (Ritchie, Price, & Roberts, 1987).

Some negative effects of total television viewing on reading acquisition in the early years were suggested in a natural experiment in British Columbia. A cross-sectional comparison of towns that did and did not receive television and an examination of changes after the introduction of television produced evidence of weak negative effects of television viewing on reading skills in Grades 2 and 3. No effects were observed for Grade 8 children (Corteen & Williams, 1986).

The relation between watching television and school achievement may vary for children living in different environments and from different cultural contexts. In one investigation, reading achievement was associated with low viewing for children from high SES families, but with high viewing for children from low SES families (Searls, Mead, & Ward, 1985). Among students with limited English proficiency, the amount of television viewed was positively associated with achievement in a large survey of California students (Comstock, 1991). Viewing may interfere with school achievement among more advantaged children, but it may contribute to knowledge or language ability for less advantaged children, possibly because of the differences in alternative opportunities for learning that are available in their homes and neighborhoods. The mixed results concerning the relations of television viewing and school performance may stem in part from the failure to consider the content of the programs viewed and from the wide range of ages included.

Relations of Television Content to Achievement

Educational programming for young children is based on a straightforward assumption that well-designed television can convey academic and social skills to viewers. Most of the research evaluating the impact of educational programming on language and school-related skills has been conducted with *Sesame Street*. It is a very popular program, and it emphasizes linguistic and academic skills more than do most other educational programs (Neapolitan & Huston, 1994). During the first 2 years after its inception, multisite field experiments were conducted to determine its effects on preacademic skills. Children whose parents were encouraged by researchers to have them watch *Sesame Street* improved more than a nonencouraged control group on such academic and cognitive skills as letter recognition, numerical skills, and classification (Ball & Bogatz, 1970; Bogatz & Ball, 1971). Similarly, a summative evaluation of *The Electric Company* showed that viewing the program at home fostered improved reading performance among children in Grades 1 through 4 (Ball & Bogatz, 1973). Survey information collected in the 1990s indicated that *Sesame Street* viewers had better school-related skills in kindergarten than did nonviewers, but the data were based on parent reports (Zill, Davies, & Daly, 1994).

Longitudinal methods have also been used to examine the relations between viewing and language development and school achievement. In one investigation, viewing *Sesame Street* between ages 3 and 5 predicted improvements in receptive vocabulary at age 5 (Rice, Huston, Truglio, & Wright, 1990). There was also a tendency for children who watched informative programs designed for children and adults to perform better on letter recognition and reading skills (Truglio, Huston, & Wright, 1986). When these same children were studied as adolescents, preschool viewers of child-audience informative programs had higher grades in high school than did nonviewers, even with controls for family characteristics (Anderson, Huston, Schmitt, Linebarger, & Wright, 2001). Rosengren and Windahl (1989) found that Swedish preschoolers who watched programs specifically designed for them had higher school test performance in Grade 1, which in turn predicted higher marks in Grade 6, compared with preschoolers who viewed other programs.

By contrast, viewing general-entertainment content tends to be associated with lower achievement. Among Swedish preschoolers, watching fiction programs in preschool predicted poor school marks at Grades 1 and 6 (Rosengren & Windahl, 1989). These investigators proposed that early viewing of preschool educational programs starts a positive cycle predicting viewing of informational programs and higher grades, while early viewing of fiction starts a negative cycle predicting more fiction consumption and lower grades.

In a longitudinal study of preschool and early school-age children in the United States, exposure to adult entertainment television predicted poor letter recognition at age 5, but was unrelated to later reading comprehension (Truglio et al., 1986). There was no relation between viewing cartoons or adult entertainment programs and vocabulary (Rice et al., 1990), but one 3-year longitudinal study in the Netherlands showed that viewing entertainment programming was negatively related to subsequent reading com-

prehension. There was a positive, although nonsignificant, effect for watching informational programs (Koolstra, van der Voort, & van der Kamp, 1997). Cross-sectional studies have shown that viewing sports, cartoons, and music videos predicted low school performance (Neuman, 1988; Potter, 1987; Smyser, 1981), but students who watched news performed better in school than nonviewers (Potter, 1987).

Taken together, these studies paint a picture suggesting positive effects of informative programming and small, but consistent negative effects of viewing entertainment programs on reading and academic achievement. Nonetheless, there are gaps in our knowledge. Few investigations included careful separation of television content or intended audiences. The early experimental studies of *Sesame Street* were criticized because the treatment included parental encouragement; hence, it was not clear that positive results would have ensued from viewing without adult intervention. In particular, the critics raised questions about the value of the program for children from economically disadvantaged families (Cook et al., 1975). Few investigations of entertainment programs include preschool children, even though it could be argued that television may be a more critical influence in the early years when children are not receiving much formal school instruction than it is after they enter formal schooling.

Finally, if television does affect children's intellectual development, little is known about the processes involved. Observational learning is one likely mechanism by which children learn the planned messages in educational programs as well as the unplanned messages in many other types of programming. Programs such as *Sesame Street* and *Mister Rogers' Neighborhood* have planned, age-specific curricula, and they contain linguistic and production techniques designed to enhance learning (Huston & Wright, 1994; Rice, 1984). Learning from television may also contribute to a reciprocal process through which children select their television and play environments to further the interests and motives acquired from television (Bandura, 1978). Long-term effects may come about as a result of entering school with readiness skills that facilitate success and teachers' perceptions of good school ability (Entwisle, Alexander, & Olson, 1997; MacBeth, 1996).

Cartoons, by contrast, contain language and humor that are beyond the comprehension abilities of preschool children (Rice, 1984), as well as high levels of violence. According to one theory, the resulting aggression leads to low levels of academic performance because it interferes with the ability to sit still and attend to academic content (Huesmann & Miller, 1994). Cartoons also have high rates of action, pacing, and visual and auditory effects, all of which may lead to arousal and activity, which are incompatible with acquisition of language and academic skills (Singer, 1980). There is some evidence that viewing violence in the early years predicts lowered academic performance in high school (Anderson et al., 2001).

Although the content of general-audience programming is highly variable, much of it is light entertainment that is not designed to convey educational messages. The level of vocabulary and required background knowledge is, for the most part, not geared toward young children. Two processes have been proposed to account for predicted negative influences of entertainment television, including cartoons, on intellectual development: television displaces other, more valuable ways to spend time and general-audience television does not engage the child's intellectual effort.

According to the displacement hypothesis, television viewing displaces more intellectually valuable activity, resulting in lowered levels of language and intellectual functioning. In another analysis of the data reported in this article, we examined displacement processes by analyzing differences among individuals in time allocation as well as individual changes over time in relation to changes in the time spent in other activities. Both analyses provided support for the hypothesis that general-audience programming displaces educational activities (including reading), social interaction, and video game play (Huston, Wright, Marquis, & Green, 1999; Wright & Huston, 1995).

For young children, in particular, general-audience programming may displace or interfere with the child's opportunity to interact with adults. Children usually view general-audience programs in the company of parents or other adults (St. Peters, Fitch, Huston, Wright, & Eakins, 1991). Adults watching television may be unresponsive and inattentive to the child. As a result, children may have fewer social and linguistic interactions with adults while deriving little from the television content that is occupying the adults' attention.

The second hypothesis is that entertainment television does not engage the child's mental effort. The most common version of this hypothesis is that entertainment television makes few intellectual demands and, as a result, creates habits of intellectual laziness and disinterest in school (Koolstra & van der Voort, 1996; Salomon, 1984). Some support for this hypothesis appeared in a longitudinal study of second- through eighth-grade Dutch children, which found that television viewing was associated with a subsequent decrease in positive attitudes toward reading. Attitudes toward reading, in turn, predicted reading achievement and time spent reading (Koolstra & van der Voort, 1996).

But, for very young children, much of general-audience television may be difficult rather than easy to comprehend. Children are most likely to become actively engaged with television content that is neither too easy nor too difficult to comprehend, that is, content that provides some challenge, but also allows an attentive child to gain a sense of mastery (Rice, Huston, & Wright, 1982; Wright & Vlietstra, 1975). A child who spends a lot of time in the presence of television that is not comprehensible may miss such opportunities.

Methodological Issues

For the most part, correlational methods, both cross-sectional and longitudinal, are the only viable designs for studying the relations of television viewing to academic and intellectual development, because true experiments are virtually impossible to mount. Although longitudinal methods provide some basis for inferring causal direction, two issues of interpretation are important. First, it is likely that correlations of viewing with child outcomes may result from bidirectional or reciprocal effects; viewing may influence academic performance, and academic skills may influence choices about television viewing. Analyses of longitudinal data rarely have been designed to detect these bidirectional patterns. Second, correlations of viewing and achievement may be a function of other factors. The most well-established influences on both viewing and achievement include a host of demographic and family characteristics (e.g., education, income, and ethnic group), all of which probably represent variations in children's home environments (Clarke & Kurtz-Costes, 1997; Huston & Wright, 1997; Truglio, Murphy, Oppenheimer, Huston, & Wright, 1996). Such characteristics can be statistically controlled, but it is always possible that unmeasured variables account for all or part of the associations observed.

Many studies are fraught with problems of measuring television viewing accurately. Viewing measures sometimes consist of one or a few questions with dubious validity asking individuals how much time they spend watching television. Written or oral viewing diaries are far more accurate (Anderson, Field, Collins, Lorch, & Nathan, 1985), but few studies have used them.

Purposes of the Present Study

The major purpose of the present study was to investigate the relations of television viewing to school-related skills and receptive language development during the preschool and early school years. We chose to study an ethnically diverse sample representing families with low to moderate incomes because these groups have been underrepresented in much developmental research and because television may play an especially important role in their lives. The study represents an advance over earlier longitudinal investigations because it began at age 2 to capture very early viewing experience and because the home environment was measured directly rather than relying solely on demographic indicators of family characteristics. Television viewing was assessed as it occurred naturally, thereby avoiding the problems created by "encouragement to view." Finally, multiple 24-hour diaries of children's time use in all activities (not just television) were used to obtain viewing information across time and to provide specific information about programs watched, and other categories of time use.

METHOD

Design

The design of the study is shown in Figure 1. There were four annual occasions of measurement, or "waves," consisting of a visit in the project office and a home visit. The year elapsing between waves was called a "period"; that is, Period 1 was between Waves 1 and 2, and so on. Thus, in this study, there were three periods and four waves.

Sample

The volunteer sample comprised two hundred and thirty-six 2- and 4-year-old children and their parents, whose family incomes were low to moderate. Families were recruited from census tracts in Kansas City, MO, and Kansas City, KS, with poverty rates higher than 10% and from populations receiving some form of means-tested government assistance (such as public housing). An additional group lived in neighborhoods in Lawrence, KS, where the median incomes were among the lowest in the city. Families were recruited to participate in a study of television and young children's development through community agencies, Special Supplemental Food Program for Women, Infants, and Children (WIC), Parents as Teachers, preschools and child care centers, posters in supermarkets and laundromats, radio announcements, local-access cable television channels, and word of mouth from other participants.

The path analyses presented in this article are based on 182 children who had complete data or who

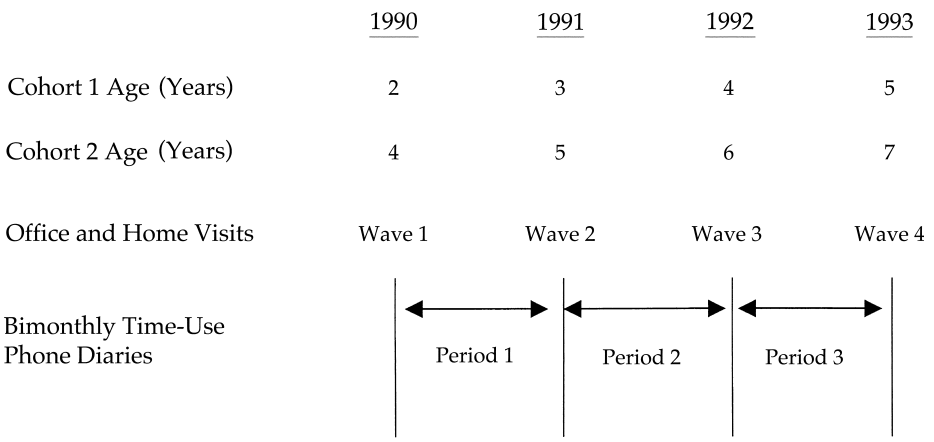

Figure 1 Design of the study.

were missing only one test score, one assessment period, or one viewing period over the 3-year time span. These missing data were imputed by regressing scores for a particular wave or period on scores for the same measure in the other waves or periods, using the sample for the cohort in which the child belonged. Overall, 2.1% of the scores for the younger cohort and 1.5% of the scores for the older cohort were imputed values.

The demographic characteristics of the initial and path analysis samples are shown in Table 1. Parents in the analysis sample were less likely to receive public assistance, more likely to be married, better educated, less likely to be African American, and had higher incomes and higher scores on the Home Observational Measure of the Environment (HOME; Caldwell & Bradley, 1984) than those without complete data (all $ps < .01$). Nevertheless, the analysis sample was ethnically diverse and represented families with low to moderate incomes.

Time-Use Diary

In some earlier studies of home viewing, parents kept written diaries of all television viewing over periods of 7 to 10 days (Anderson et al., 1985; Huston, Wright, Rice, Kerkman, & St. Peters, 1990). Videotapes of a sample of families during the diary period demonstrated high validity; the correlation, for preschoolers, between total viewing time scores from the two methods was .84 (Anderson et al., 1985). Written diaries are, however, tedious to maintain, and we were advised that asking low-income families to complete repeated diaries would risk highly selective attrition and missing data. Therefore, we elected to collect oral time-use diaries, using a method that has been employed extensively by time-use researchers (see Juster & Stafford, 1985).

Throughout the 3 years, families completed periodic telephone interviews. The calls served to track any changes in family composition, residence, living arrangements, or child care, and to collect a time-use diary. In these telephone interviews and at each office and home visit after the initial contact, the parent (typically the mother) was asked about the child's activities on the previous day. The parent described the child's activities sequentially from midnight to midnight. For each activity, they reported the amount of time spent and who else was present. If the child was watching television or the television was on in the same room, the name and type of program being viewed was recorded. The validity of this type of time-use diary has been established through multiple

Table 1 Characteristics of the Total Sample and the Path Analysis Sample

	Whole Sample ($N = 236$)		Path Analysis Sample ($n = 182$)	
Characteristic	*M*	*SD*	*M*	*SD*
Maternal education (y)	13.12	2.36	13.37	2.59
Income-to-needs ratio	1.54	1.12	1.72	1.15
Married (%)	72.0	—	77.0	—
HOME standard score	.00	1.00	.14	.88
African American (%)	41.0	—	32.0	—
Hispanic American (%)	17.0	—	19.0	—
European American (%)	41.0	—	47.0	—
Native American (%)	1.0	—	1.0	—

Note: HOME = Home Observational Measure of the Environment.

informants (e.g., husband and wife) and multiple methods (e.g., written and phone) (Juster & Stafford, 1985). This method has an added advantage over most measures of television use; the person is reporting on all activities rather than focusing solely on television. In addition, the report is recent and quite specific in time. Our goal was to obtain six diaries per year—one about every 2 months. In the early stages of the study, however, we had more difficulty reaching people and completing calls than expected, so staff time devoted to calling was increased in the later stages of the study, resulting in a higher rate of completed calls. The average number of 24-hr diaries per child was 3.3 in Period 1, 4.4 in Period 2, and 5.1 in Period 3.

The first activity named in a time interval was considered the primary activity. If the child was simultaneously doing something else, that activity was designated "secondary." For example, if the parent said the child was playing and also watching television, then play was recorded as primary, and television viewing as secondary. If the child was "watching television while she ate lunch," then eating was the secondary activity. If children spent part or all of the day away from the parent (e.g., in child care), the adult in charge was also called to get time-use information for that portion of the day.

Classification of Programs Viewed

All programs viewed were first classified by the intended audience (made for children or for general-adult audiences); child programs were further grouped by content type using a system developed from earlier studies (Center for Research on the Influences of Television on Children, 1983). Four categories of programs resulted: (1) child-audience, informative or educational programs (regardless of animation); (2) child-audience, fully animated cartoons with no informative purpose; (3) child-audience, other programs (neither fully animated nor informative purpose); and (4) general-audience programs. Reliability averaged 92% agreement, calculated by comparing codes assigned by two or more independent raters who were familiar with the program.

The average number of minutes of viewing was calculated for each of the four categories of programs: child-audience informative, child-audience cartoons, child-audience other, and general audience. Viewing on weekdays and weekends was calculated separately, because the kinds of programs offered are different. For each category of child-audience programs, totals included primary and secondary viewing of live broadcasts and videotapes. For general-audience programs, primary and secondary viewing were separated for descriptive purposes, but combined in the path analysis. The number of minutes spent viewing each type of program was calculated for each 24-hour diary. The score for a 1-year period was the average of all weekday or weekend diaries collected during that year up to and including the office visit for the next wave.

Home and Family Characteristics

The demographic characteristics of the families (parent education, occupation, family structure, primary language) were ascertained during the parent interviews at each annual wave. At each home visit, the HOME (Caldwell & Bradley, 1984) was collected. Using observation and unstructured questions, the interviewer awarded points for a list of observed conditions, facilities, responses to questions, and social and emotional features of the mother–child interaction. A large number of studies show that this instrument predicts IQ and school performance of children from a wide range of socioeconomic backgrounds, income levels, and ethnic groups (Bradley et al., 1989). The version for infants (ages 0–3) was used for the 2-year-olds; the preschool version was used for children who were 3 through 5 years of age; and the elementary school version was used for children 6 and over. The Wave 1 HOME score for each child was entered as a control in the analyses reported here. Because the infant and preschool versions have different numbers of items, standard scores for each version were calculated for the sample and used in the analyses.

All home visitors during Wave 1 were trained by an expert from the University of Arkansas at Little Rock, where the instrument was devised. Interobserver reliabilities were checked periodically by having two interviewers attend the same visit. One interviewer conducted the visit, and both scored it independently. A minimum criterion of 80% agreement was maintained.

Academic Skills and School Readiness

Reading and number skills. Basic academic skills are at the center of the concept of school readiness. These were measured by standardized tests administered individually during the office visit at Waves 2, 3, and 4. Two subtests from the Woodcock-Johnson Tests of Achievement were selected. This battery was standardized on a large, nationally representative sample from age 2 through 79 (Woodcock & Mather, 1989). Both subtests have internal consistencies greater than .90 for children in the age range of 3 through 7. Reading and prereading skills were assessed by the letter-

word recognition subtest measuring recognition of icons, letters, and words. Math skills were assessed by the applied problems subtest, which involves counting, inequalities, and simple arithmetic.

Vocabulary. The Peabody Picture Vocabulary Test–Revised (PPVT-R) measures receptive English vocabulary. It requires the child to point to one of four pictures on a page that illustrates or exemplifies a spoken word. The words range from simple objects to complex concepts. The test was standardized on an ethnically diverse sample ranging from age 2½ to 70, but one in which families with low occupational status were somewhat underrepresented. For children ages 3 through 7, internal consistencies range from .70 to .83 (Dunn & Dunn, 1981).

School readiness. General school readiness was assessed by the School Readiness Scale of the Bracken Basic Concepts Scales (Bracken, 1984). The test includes knowledge of colors, shapes, letters, numbers, and spatial and size relations. The standardization sample for the test included children from multiple ethnic groups. The internal consistency of the School Readiness Scale is at least .90 for children in the age range of 3 through 5, and test–retest reliability is .98 (Bracken, 1984). It was administered only to the younger cohort, because pilot testing indicated that many of the older cohort were likely to reach its ceiling by the third or fourth wave of data collection.

Standard scores based on the published test norms for the child's chronological age were used for all four tests. The Woodcock-Johnson and Peabody Picture Vocabulary tests have standard scores based on a mean of 100 and a standard deviation of 15. The School Readiness Scale scores were transformed to a distribution with a mean of 100 and a standard deviation of 15 in order to achieve comparability with the other tests.

Examiners

Because the sample included children from different ethnic groups, it was important to have diversity among the examiners. The examiners represented various ethnic groups and nationalities, including African American, European American, Filipino American, Mexican, Spanish, Mexican American, Israeli, Iranian, and Singapore Chinese. All spoke fluent English. For children from families in which the primary language was English, there was no effort to match the ethnicity of the examiner with that of parents and children, so many combinations occurred.

For children from Spanish-speaking families, a fully bilingual graduate student whose first language was Spanish administered all tests. Tests that involved written or spoken English (i.e., reading and vocabulary) were presented in English. Written translations of the instructions for the applied problems subtest and some portions of the Bracken School Readiness Scale were prepared by a Mexican graduate student (whose first language was Spanish). If the child appeared more fluent in Spanish than in English, or if the child stated a preference for speaking Spanish when asked, the tester was allowed to use these translated instructions. Although this procedure ran the risk of undermining the standardization of the tests, it seemed the best option to maximize children's comprehension of the tasks. Norms and procedures standardized on English speakers cannot be assumed to apply to children from other language groups in any case, so it seemed most reasonable to attempt to obtain optimal levels of performance for these multilingual children. By age 4, virtually all of the children chose to speak English during the tests.

Analysis Plan

Path analyses were used to determine the relations of viewing at Periods 1, 2, and 3 to test scores at Waves 2, 3, and 4. The ideal approach would have been a latent-variable, structural equation modeling analysis, but the small sample size rendered this technique inappropriate. The two cohorts were analyzed separately. Path analysis permitted consolidation of all time periods in a single analysis for each combination of a viewing category with a dependent variable, and it permitted tests of paths in two directions—from earlier viewing to later test scores, and from earlier test scores to subsequent viewing. For the younger cohort, there were 12 analyses (four test scores $\times$ three viewing categories), and for the older cohort, who did not receive the Bracken School Readiness Scale, there were 9 (three test scores $\times$ three viewing categories). Because viewing frequencies were skewed, each viewing score was transformed to the square root of (number of minutes + 1) to normalize the distributions and eliminate zeroes and values less than one. EQS was used for all analyses (Bentler, 1995).

Because of the sample sizes, it was important to limit the number of variables in the path analysis. Two control variables were included: the HOME score from Wave 1 and the primary language spoken in the home (1 = English, 2 = Spanish). These were selected on the basis of initial analyses designed to determine which of approximately 20 demographic

variables, child characteristics, family attributes, preschool experiences, and television technologies in the home accounted for independent portions of the variance in both the viewing patterns and the test scores. Parent education, income-to-needs ratio, and HOME scores accounted for overlapping variance. The HOME score was selected because it is a measure of the proximal quality of the child's environment and because it accounted for slightly more variance in test scores than did either of the other indicators. The primary language spoken in the home was related to educational viewing and somewhat less to viewing other types of television (children in Spanish-speaking families watched more educational television than did children in English-speaking families) and to some test scores. Primary language was statistically independent of HOME scores. In an earlier, unpublished report, ordinary least squares, calculated by regressing each test score in each wave of prior viewing in each television category, were presented (Wright & Huston, 1995). These analyses included multiple controls for demographic variables, child characteristics, child's initial language, family attributes, preschool experiences, and television technologies in the home. The regression approach involved a large number of equations, and accordingly path analysis was chosen as a more parsimonious approach for the present report. It is noteworthy, however, that the results obtained by the two methods were quite similar.

RESULTS

Description of Viewing

The number of hours children spent viewing informative and animated children's programs are shown in Figure 2. Available data for all 236 sample members are included. Children watched child-audience informative programs for about 2 hr per week at ages 2 through 4 years, with declines to about 1 hr per week at ages 5 through 7 years. Although *Sesame Street* was by far the most frequently viewed child-audience informative program at all ages (about 80% of all such viewing in 1990–1993), the proportion of viewing devoted to other child-audience informative programs increased as children got older. After *Sesame Street*, the programs watched most often in Period 3 were *Mister Rogers' Neighborhood*, *Reading Rainbow*, *Captain Kangaroo*, *Mr. Wizard's World*, and *3-2-1 Contact*. Children watched cartoons about 7.5 hr per week until about age 5, with a decline by age 7 to about 5 hr per week. The remaining category of child-audience programs, "child-audience other" (not shown in Figure 2), was viewed slightly over 1 hr per week by children at all ages assessed, and there were no significant age differences or age changes.

The average hours of viewing for general-audience programs are shown in Figure 3. Children spent an average of approximately 16 hr per week watching general-audience programs at ages 2 and 3, declining

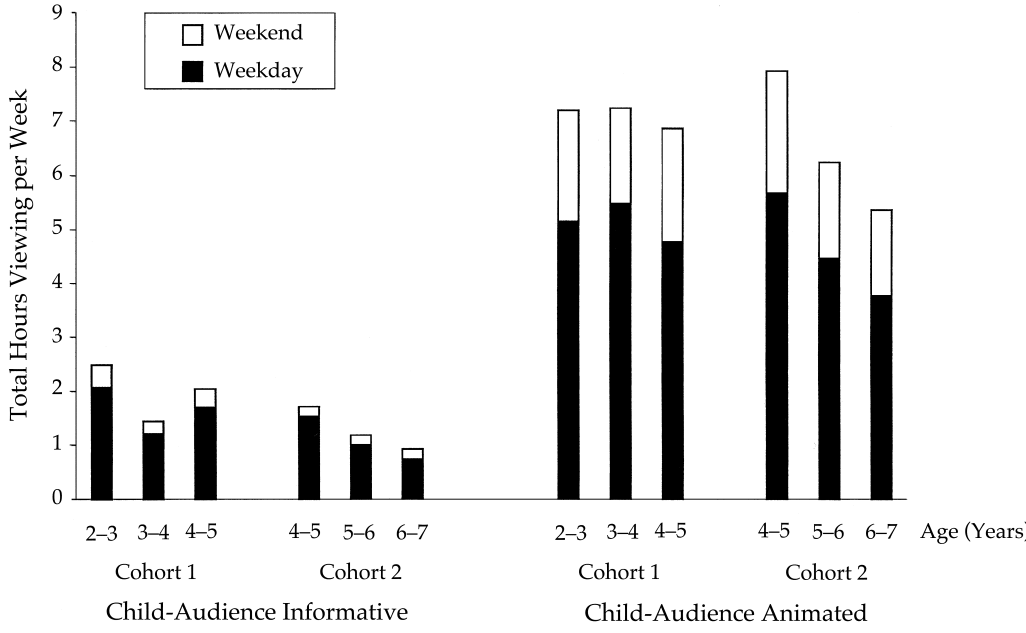

Figure 2 Average weekly viewing of informative and animated children's programs.

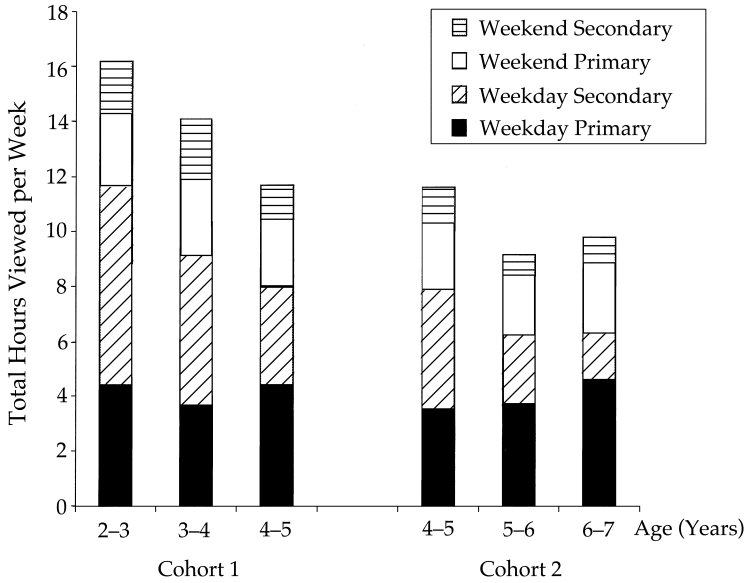

Figure 3 Average weekly viewing of general-audience programs.

to around 10 hr per week by ages 6 and 7. Most of this decline was accounted for by secondary viewing (see Huston et al., 1999, for analyses of age changes); the amount of primary viewing was fairly stable across the age ranges sampled.

Relations of Viewing to School Readiness and Achievement

The relations between viewing and test performance were analyzed using a path model. Child-audience informative, child-audience animated, and general-audience television were each tested separately. The means and standard deviations for HOME scores, television viewing (square root transformation), and test scores for children included in the path analyses are presented in Table 2, and the correlations among variables appear in Table 3. Frequency of viewing child-audience informative programs was negatively related to frequencies of child-audience animated and general-audience viewing in most comparisons, but the correlations were generally quite low. Frequencies of child-audience animated and general-audience viewing were somewhat positively related for the younger cohort, but not for the older cohort. These low intercorrelations suggest that it is appropriate to consider these viewing categories independently of one another. Other children's programming was not tested because it was viewed in-

Table 2 Means and Standard Deviations of Scores Used in Path Analysis

	Younger Cohort (N = 90)		Older Cohort (N = 92)	
Characteristic	*M*	*SD*	*M*	*SD*
HOME standard score	.12	.91	.15	.87
Primary language (% English)	77	—	88	—
CI 1	4.25	3.10	3.15	2.62
CI 3	4.09	2.59	2.37	1.92
CA 1	6.75	3.76	7.32	3.58
CA 3	7.07	3.17	6.30	2.84
GA 1	10.31	4.76	8.72	7.88
GA 3	9.23	4.18	7.96	2.87
LW 2	101.86	15.59	99.33	12.12
LW 4	95.01	16.39	106.29	19.44
AP 2	99.49	17.44	104.00	14.71
AP 4	99.56	17.20	111.68	17.67
PPVT-R 2	87.12	21.63	97.55	21.40
PPVT-R 4	96.27	17.37	100.83	17.69
SR 2	8.74	4.20	—	—
SR 4	8.06	3.11	—	—

Note: All viewing scores were square root of (average weekday min/day + 1). HOME = Home Observational Measure of the Environment; CI = child-audience informative television; CA = child-audience animated television; GA = general-audience television; LW = Woodcock-Johnson letter word subtest; AP = Woodcock-Johnson applied problems subtest; PPVT-R = Peabody Picture Vocabulary Test–Revised; SR = Bracken School Readiness Scale. The number following each measure indicates the period or wave of data collection.

Table 3 Correlation Matrix for Variables in the Path Models

	PL	HOME	CI 1	CA 1	GA 1	LW 2	AP 2	PPV-R 2	SR 2	CI 3	CA 3	GA 3	LW 4	AP 4	PPVT-R 4
PL		−.18	.20	.14	.03	−.33	−.28	−.58	N.A.	−.05	.12	−.13	−.22	−.15	−.36
HOME	.13		.19	−.11	−.17	.18	.27	.46	N.A.	−.11	−.34	−.06	.19	.14	.39
CI 1	.49	.33		.01	−.11	0	.01	0	N.A.	.44	−.14	−.06	−.09	.03	.11
CA 1	.23	−.30	−.18		−.01	−.11	−.02	−.14	N.A.	−.07	.39	.08	−.05	.03	.03
GA 1	.02	−.47	−.22	.46		−.25	−.37	−.18	N.A.	.06	−.02	.29	−.24	−.28	−.23
LW 2	.07	.31	.26	−.25	−.23		.57	.51	N.A.	.18	−.10	−.19	.64	.46	.49
AP 2	.06	.36	.34	−.17	−.39	.57		.56	N.A.	.11	−.14	−.10	.50	.70	.51
PPVT-R 2	−.31	.28	.08	−.22	−.37	.40	.55		N.A.	.07	−.27	−.03	.45	.50	.73
SR 2	−.21	.25	.18	−.14	−.19	.49	.58	.57		N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CI 3	.13	.24	.33	−.18	−.04	.20	.07	−.08	.16		−.15	.04	.16	.03	.13
CA 3	.07	−.17	−.12	.41	.29	−.15	−.11	−.17	−.12	−.08		.04	−.14	−.13	−.26
GA 3	.09	−.33	−.25	.32	.53	−.32	−.34	−.37	−.29	−.05	.25		−.21	−.07	−.11
LW 4	−.22	.18	0	−.10	−.12	.49	.37	.47	.61	0	−.12	−.16		.49	.45
AP 4	−.12	.15	.16	−.18	−.14	.50	.52	.62	.66	.03	−.10	−.21	.60		.47
PPVT-R 4	−.30	.32	.15	−.20	−.35	.44	.54	.79	.61	−.04	−.15	−.39	.58	.62	
SR 4	−.29	.11	.07	−.27	−.17	.49	.48	.57	.64	.03	−.19	−.26	.71	.71	.74

Note: Cohort 1 data are below the diagonal, Cohort 2 data are above the diagonal. PL = primary language; HOME = Home Observational Measure of the Environment; CI = child-audience informative television; CA = child-audience animated television; GA = general-audience television; LW = Woodcock-Johnson letter word subtest–Revised; AP = Woodcock-Johnson applied problems subtest; PPVT-R = Peabody Picture Vocabulary Test–Revised; SR = Bracken School Readiness Scale; N.A. = not applicable. The number following each measure indicates the period or wave of data collection.

frequently and because its content appeared to be highly variable over time.

For these analyses, weekend diaries were excluded because viewing on Saturday, Sunday, and weekdays followed different patterns, and there were insufficient numbers of Saturday and Sunday diaries to generate reliable estimates of viewing for each weekend day. A sizeable number of children had missing data for weekends during at least 1 of the 3 years. Adding weekend data to weekdays for some children and not others could distort the ordering of individuals; therefore, we elected to use the weekday diaries that sampled comparable time periods for all children.

The path model contains viewing in Periods 1 and 3 and test scores in Waves 2 and 4; Period 2 and Wave 3 were excluded. Models that included all three viewing periods (1–3) and three annually collected sets of test scores (Waves 2–4) were also tested, but the fit statistics were less than satisfactory. Accordingly, simpler models were used for the main analysis. Because relations among variables in path analysis are computed in temporal sequence, the models including all three periods and waves produced identical results for the initial parts of the model (paths from HOME and primary language to viewing and test scores, and the path from Period 1 viewing to Wave 2 test). There were no substantial differences between the results of the remaining portions of the two analyses.

A lagged path from Period 1 viewing to Wave 4 test score was included to test for delayed effects of viewing. The fit statistics presented include chi square, the comparative fit index (CFI), Bollen's incremental fit index (IFI), and the standardized root mean square residual (RMR). A good fit is indicated by a nonsignificant chi square; CFI and IFI .90 or above, with .95 and above being a very good fit; and RMR .08 or below. These are shown in Table 4. The models all reached criterion on the CFI, IFI, and RMR criteria, but chi square reached $p < .05$ on 5 of the 21 tests. Accordingly, these models should be interpreted with some caution.

The results of the path analyses are summarized in Figures 4 through 6. Each diagram contains the path coefficients for one of the three categories of television programs in relation to all test scores. There are separate diagrams for Cohorts 1 (ages 2–5) and 2 (ages 4–7). In all models, viewing was moderately stable, and test scores were very stable over time.

Viewing as a Predictor of Test Scores

Child-audience informative programs. The paths from child-audience informative viewing to test scores, shown in Figure 4, indicate that children who watched educational television frequently when they were 2 and 3 years old (Period 1) performed better on all four tests at age 3 (Wave 2) than did those who were infrequent viewers. Period 1 viewing was a significant positive predictor of letter-word, applied problems, PPVT-R, and Bracken School Readiness scores in

Table 4 Fit Statistics for Path Analyses

Viewing Category	Test	χ^{2a}	CFI[b]	Bollen IFI[c]	Standard RMR[d]
Cohort 1					
CI	LW	9.41^{+}	.94	.95	.06
CI	AP	7.80	.97	.97	.06
CI	PPVT-R	12.41*	.95	.95	.06
CI	SR	7.41	.98	.98	.05
CA	LW	11.51*	.90	.91	.06
CA	AP	4.00	1.00	1.01	.04
CA	PPVT-R	6.26	.99	.99	.04
CA	SR	5.33	1.00	1.00	.05
GA	LW	11.43*	.93	.94	.06
GA	AP	5.77	.99	.99	.05
GA	PPVT-R	5.45	1.00	1.00	.04
GA	SR	6.71	.98	.99	.05
Cohort 2					
CI	LW	5.63	.99	.99	.06
CI	AP	5.43	1.00	1.00	.05
CI	PPVT-R	5.80	1.00	1.00	.06
CA	LW	12.90*	.90	.91	.08
CA	AP	12.36*	.92	.93	.07
CA	PPVT-R	10.69^{+}	.97	.97	.08
GA	LW	7.53	.97	.97	.06
GA	AP	6.04	.99	.99	.05
GA	PPVT-R	6.72	.99	.99	.06

Note: CI = child-audience informative television; CA = child-audience animated television; GA = general-audience television; LW = Woodcock-Johnson letter word subtest; AP = Woodcock-Johnson applied problems subtest; PPVT-R = Peabody Picture Vocabulary Test–Revised; SR = Bracken School Readiness Scale.

[a] χ^2 is the significance of the difference between the proposed and observed models.

[b] CFI is the comparative fit index.

[c] IFI is the incremental fit index from Bollen (1989).

[d] RMR is the standardized root mean square of the typical residual correlation.

$^{*}p < .05$; $^{+}p < .10$.

Wave 2 for the younger cohort. Once these initial relations were taken into account, there were no significant relations of viewing to test scores in Wave 4. That is, viewing in later periods did not contribute to subsequent test performance beyond the effects of viewing in the initial period. The fact that test scores were highly stable over time indicates, however, that the advantage associated with early viewing was still present at Wave 4. For the older cohort there were no significant relations between viewing child-audience informative programs and test performance at any time period (Figure 4).

Child-audience animated programs. The relations of cartoon viewing to test performance are shown in Figure 5. For the younger cohort, children who were frequent viewers of noneducational cartoons at ages 2 and 3 (Period 1) had lower scores than did infrequent viewers on the letter-word subtest at Wave 2 and on the PPVT-R at Wave 4. Although most of the remaining coefficients were negative, they were not significant. For the older cohort, there was no evidence for a relation of viewing cartoons to later test performance.

General-audience programs. The path analyses for general-audience programs appear in Figure 6. For both cohorts, children who watched a lot of general-audience programming in Period 1 tended to perform more poorly than did less-frequent viewers. Among the younger cohort, heavy viewers of general-audience programs in Period 1 (ages 2–3) performed significantly less well than did infrequent viewers on applied problems and the PPVT-R at Wave 2 (age 3); the coefficients for letter-word and the Bracken School Readiness Scale were also negative but nonsignificant.

For the older cohort, children who watched a lot of general-audience programming when they were 4 to 5 years old (Period 1) performed significantly less well in tests of letter and number skills at age 5 (Wave 2) than did infrequent viewers, and also tended to do

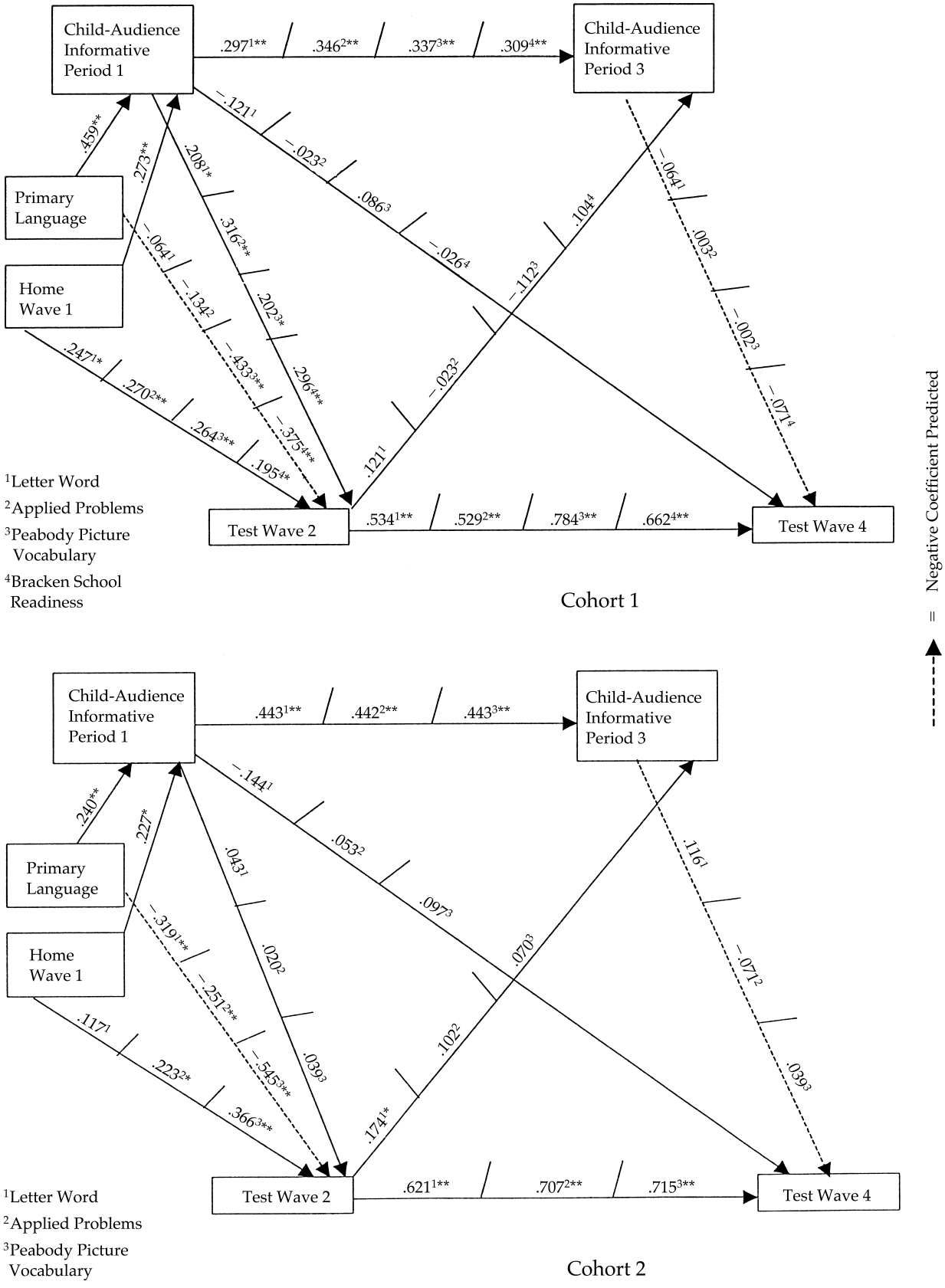

Figure 4 Path analyses: Child-audience informative television viewing and test scores for Cohort 1 and Cohort 2. * $p < .05$; ** $p < .01$.

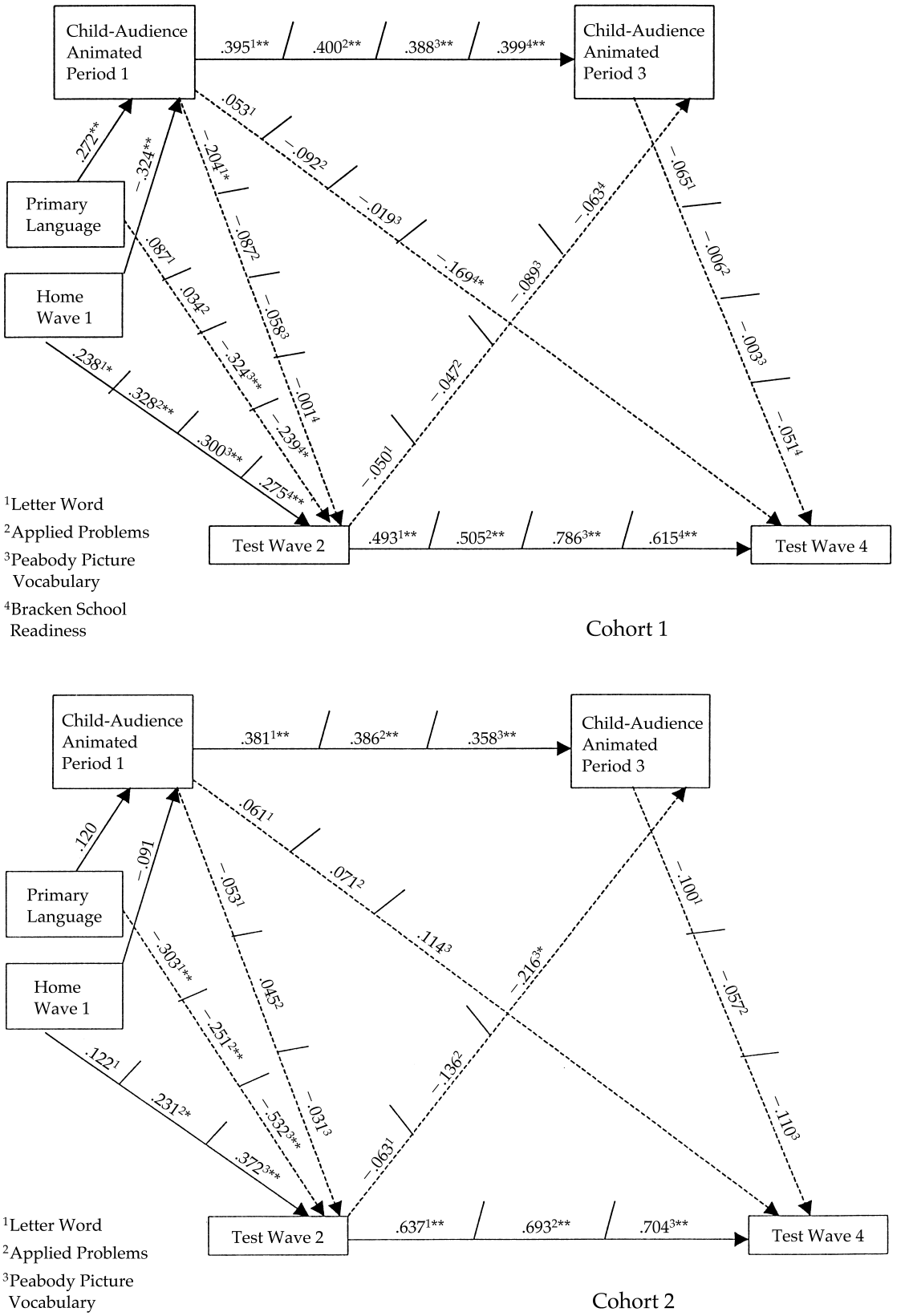

Figure 5 Path analyses: Child-audience animated television viewing and test scores for Cohort 1 and Cohort 2. * $p < .05$; ** $p < .01$.

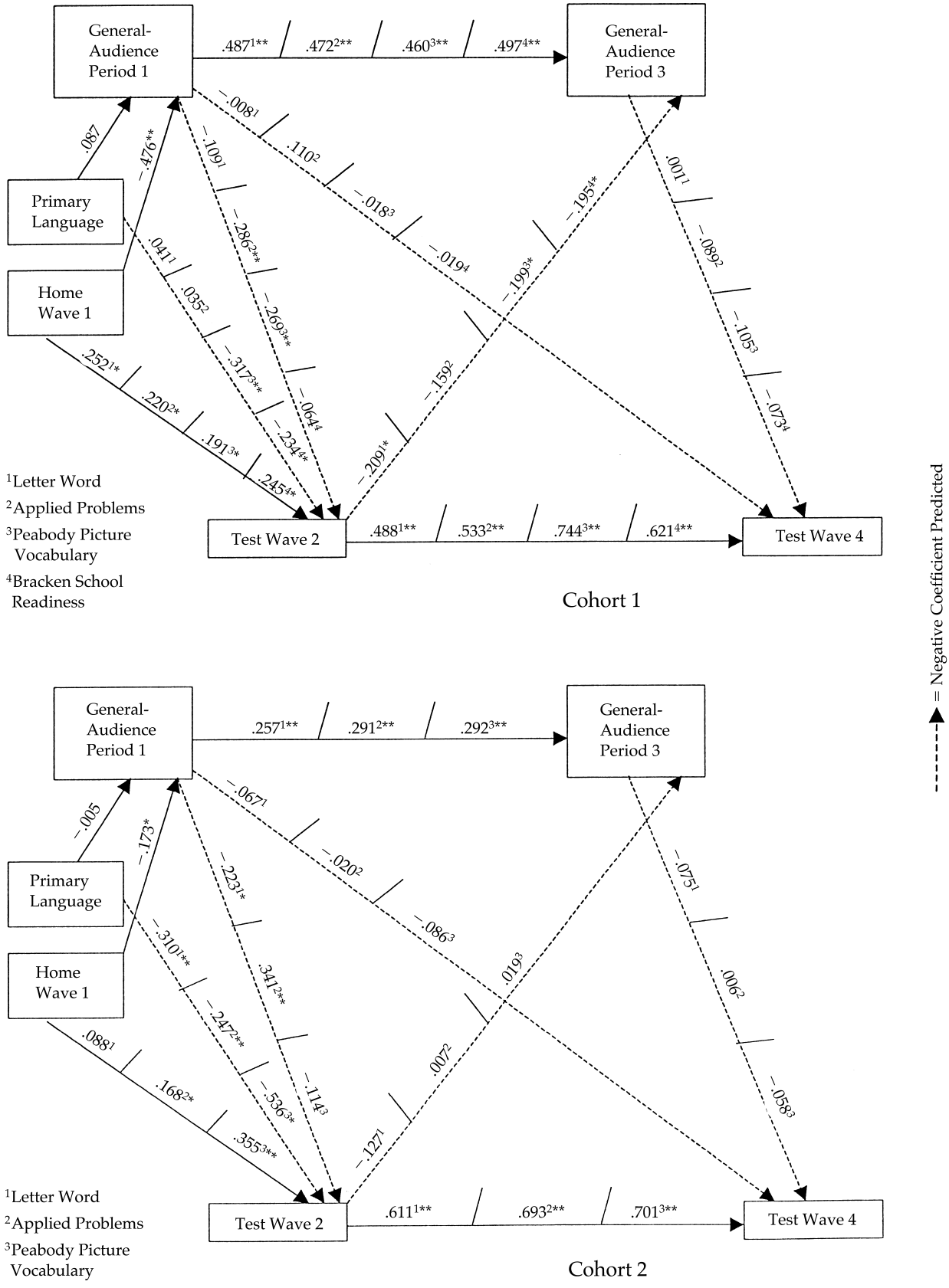

Figure 6 Path analyses: General-audience television viewing and test scores for Cohort 1 and Cohort 2.

less well on a test of receptive vocabulary skills. Viewing in later periods did not contribute to subsequent test performance beyond the effects of viewing in the initial period.

Test Scores as Predictors of Viewing

The path analyses were also designed to test relations between earlier test scores and later viewing. The path from Wave 2 tests to Period 3 viewing represents a test of the hypothesis that children's academic and language skills (as indicated in their early test scores) affects their later viewing patterns. The reader is reminded that an entire calendar year elapsed between Wave 2 and the onset of Period 3, which lasted for another year. The coefficients for paths predicting viewing from prior test scores are shown in Figures 4 through 6.

Child-audience informative programs. Among the younger cohort, test scores did not predict subsequent viewing of child-audience informative programs. For the older cohort, children who did well on the letter-word subtest at age 5 (Wave 2) watched significantly more child-audience informative programming at ages 6 and 7 (Period 3) than did those whose letter-word skills were low, and there was a tendency for high math skills and vocabulary to predict later informative viewing as well (see Figure 4).

Child-audience animated programs. Test scores at age 3 were not related to viewing cartoons at ages 4 and 5 for the younger cohort. Among the older cohort, however, children with low PPVT-R scores at Wave 2 (age 5) watched significantly more cartoons in Period 3 (ages 6 through 7) than did those with high vocabulary scores (see Figure 5). The relations of reading and math scores to later cartoon viewing were also negative, but nonsignificant.

General-audience programs. For the younger cohort, there was a strong pattern showing that children who performed well on the academic skill and language tests at Wave 2 (age 3) spent less time watching general-audience programs during Period 3 (ages 4 and 5) than did those who did not perform well. Three of the four coefficients were significant, and the fourth was consistent in direction (see Figure 6). For the older cohort, test scores were not consistently related to subsequent viewing of general-audience programs (Figure 6).

DISCUSSION

Child-Audience Informative Programs

The findings of this study provide strong support for the notion that the effects of television viewing depend on program content and genre. For very young children, viewing informative programming designed for children was associated with subsequent letter-word skills, number skills, receptive vocabulary, and school readiness. Individual differences in these skills were fairly stable through the preschool years, suggesting that early effects of viewing can be lasting. These patterns occurred in a multiethnic and multilingual sample of children from low- to moderate-income families—groups that may be especially likely to benefit from educational television. It is noteworthy that children in families whose first language was Spanish watched a great deal of educational television. There were too few of them to analyze as a separate group, but parents often commented that the whole family viewed *Sesame Street* and other programs to improve their English.

If television plays a causal role in these associations of viewing and school readiness, what processes might be involved? One explanation for positive effects of educational programs is relatively straightforward—children learn educational content from viewing. Such programs present information with techniques designed to be comprehensible and appealing to young children. Many of them are based on careful curriculum development and formative research, and, unlike most entertainment programs, they are targeted toward a specific age group.

Viewing educational programs may also influence children's motivation and interests in ways that lead them to engage their home and school environments differently. Children who watched a lot of educational television also devoted more time to reading and educational activities away from television than did infrequent viewers (Wright & Huston, 1995). When children enter school, those with good school-readiness skills are likely to have more experiences of success and to be perceived by teachers as more able, perhaps starting a trajectory of better performance and higher levels of academic motivation than children who enter with poor skills. This snowball effect seems the most likely explanation for the finding in another longitudinal sample that preschool educational viewing was positively associated with official high school transcript grades, with similar controls for third variables (Anderson et al., 2001).

The relations of educational viewing to school readiness were strongest for viewing at ages 2 and 3. It is possible that the earliest years are especially important because very young children are less likely than older children to be in preschool, child care, or other structured settings that provide planned stimulation and instruction in a preacademic curriculum. It is also possible that interest in informative programs

declines during the preschool and early school years. Certainly, viewing time devoted to informative programs drops with age. Both the drop in viewing and the absence of effects for school-age children, however, may be due to the lack of age-appropriate educational programs, particularly in the early 1990s when these data were collected, rather than to developmental change in interest in informative television per se. Moreover, we measured only one category of outcomes—academic skills. Children of different ages may learn a wide range of information about science, society, and the social world from educational programs.

Early viewing may also have lasting effects, in part, because it influences subsequent viewing choices indirectly. Children's test scores did not predict changes in viewing child-audience informative programs in the preschool years, but children with good skills at age 5 tended to view more child-audience informative programs and fewer cartoons in their early elementary years than did those with poorer skills.

General-Audience Programs

This study's findings also support hypotheses drawn from several theories predicting that extensive viewing of entertainment programming may be a negative contributor to intellectual development. Although cartoon viewing at age 2 and 3 was associated with lower scores on some measures, the patterns were much stronger for general-audience programs. For both cohorts, those who were frequent viewers of general-audience programs performed less well on tests of school-related skills and/or receptive language than did less frequent viewers. Again, the high individual consistency of test performance over time means that initial effects of viewing tended to be lasting. Once these initial effects were controlled, there were relatively few additional effects. One exception was cartoon viewing for the younger cohort; viewing at age 2 and 3 was associated with lowered school readiness at age 5, even though it did not predict school readiness at age 3.

Two processes have been proposed by which general-entertainment programming might lead to lowered intellectual development. The first is displacement. Our other analyses of these data provided some support for the notion that viewing general-audience entertainment programs displaces time in educational activities and social interaction. Children who watched a lot of general-audience entertainment programs spent less time using print media than did less-frequent viewers (Wright & Huston, 1995). Moreover, individual patterns of change in viewing over the 3 years were associated with changes in time spent in reading, other educational activities, and social interaction. When general-audience viewing increased, the time spent in educational activities and social interaction decreased, and, conversely, when general-audience viewing declined, children increased the time they spent in educational activities and social interaction (Huston et al., 1999).

The related hypothesis—that for very young children, general-audience programming interferes with opportunities for verbal and social interactions with parents, child-care providers, and other adults because the adults are watching the television—also found some support in these data. Among the 2- to 4-year-olds in this study, a great deal of general-audience program viewing was "secondary." In many instances, it is likely that the child was playing, eating, or doing something else while the television was on in the room. Although parents are usually present when young children watch general-audience programs (St. Peters, Oppenheimer, Eakins, Wright, & Huston, 1991), they may be attending to the program and be unavailable for conversation or interaction with the young child.

The second hypothesis—that entertainment television may not engage children in effortful mental activity—may also account for the findings. It seems unlikely that general-audience content was easily understood by such young children. In fact, both cartoons and general-audience programs may pose challenges to comprehension for them, and much of this programming may be beyond their level of understanding. When children perceive programs as incomprehensible, their attention drops and they are likely to pursue other activities (Anderson & Burns, 1991). Moreover, a child with prolonged exposure to such content may have few experiences of engaging successfully with the material, solving a problem, and getting a sense of mastery. Once children comprehend some of the general-audience programming available, they tend to watch situation comedies and other light entertainment that may indeed foster a preference for material that makes few intellectual demands.

Early viewing may also have indirect effects on later viewing patterns. Early exposure predicted lower skills at age 3; children with low skills at age 3 increased their viewing by ages 4 and 5; and, in the older cohort, viewing at ages 4 and 5 predicted lower performance at age 5. These patterns could reflect the continuing role of home environment as an influence on both viewing and intellectual development, but it may also indicate that more advanced preschool children

seek out activities other than television. This pattern did not appear to continue when children entered school.

Selection Issues

The fact that most of the significant relations occurred for the first viewing period may mean that early patterns of viewing are established in a stable way that has early effects, but it could also indicate that selection variables affected the initial relations of viewing to test scores. Controlling for the quality of home environment by using the HOME Scale assured that there was not a large confound with cognitive stimulation and support in the home environment. Controlling for primary language assured that the results were not an artifact of English fluency. Analyses not shown here also excluded a number of other variables including parent education, occupational status, family structure (single or two parents), child-care experience, birth order, parent regulation and encouragement of television viewing, and the child's initial language ability as explanations of the relations between viewing and children's performance. It is not logically possible to exclude all possible unmeasured variables that might account for the relations between viewing and children's performance, but these results are quite robust in the face of controls for many likely explanatory variables (see Wright & Huston, 1995).

Although establishing the independent contribution of television to the outcomes is important, it is not theoretically reasonable to assume that any aspect of a child's experience operates independently of the overall context in which it occurs. It may be that exposure to different types of television occurs in different home and child-care contexts. If that is the case, we would not conclude that television has no independent effects, but that the television content forms a significant part of those varied contexts.

Integrated Model

We stress the importance of content over total amount of viewing because child-audience informative viewing and other types of viewing are associated with opposite patterns of language and school-related skills. Content and hours in front of the television, however, are confounded in the world. In this sample, the average child watched between 1 and 3 hr a week of educational programming; in an earlier study, the averages ranged from 3 to 5 hr a week. Our sample watched 10 to 16 hr a week of general-audience programs plus another 5 to 8 hr of cartoons. The issue of content versus total time can be addressed in two ways. Would there be negative effects if children spent 15 to 25 hours a week watching only child-audience informative programs? The data did not permit an answer because almost no child did so, and we cannot infer a linear increase in benefits with extremely high amounts of exposure. The cumulative benefits or hazards of viewing would probably depend on many factors, including the richness and variety of educational content viewed, its appropriateness for the child's age and interests, and whether the activities displaced by viewing were more or less valuable for intellectual development than the content of the television programs.

If total viewing time rather than content were critical, then might one expect positive effects from 3 hr a week of watching entertainment programs? Is there some benefit to small amounts of television, regardless of content? No theory or data suggest that sitting in front of the television per se promotes intellectual development. Positive outcomes might occur, however, if the time spent watching television provided opportunities to learn language or social information (for example, immigrants sometimes use television to learn a new language) or if it displaced time in harmful activities.

Similarly, most theories that predict negative effects of viewing general entertainment suggest that harm is a function of the amount of time devoted to it. One exception may be the "mental effort" hypothesis. If the critical variable is the lack of intellectual demands in the content of entertainment programs, then even small amounts of exposure might create a taste for such content, which would, in turn, be carried over to other parts of the child's life.

Real children watch both child-audience informative and entertainment programs. How might exposure to the two types of programming combine to influence school readiness? We propose that each effect operates relatively independently, and that they are additive. That is, learning content and interests from child-audience informative programs is a function of viewing those programs, relatively independently of the time spent viewing other types of programs. Time with general-audience programs interferes with practicing and acquiring school-related skills through several mechanisms that may be relatively independent of child-audience informative viewing. In an earlier longitudinal study, we performed "viewing diet" analyses, in which child-audience informative and general-entertainment viewing were considered jointly as predictors. The associations of each viewing category with high school grades in these diet analyses were similar to those found using single viewing categories as predictors (Anderson et al., 2001). In the present study, the number of cases did not permit

considering viewing diet in the path analysis, but the low correlations among the different types of viewing suggest that the results would be quite similar to those reported for single viewing categories.

These results support the conclusion that, contrary to Marshall McLuhan's (1964) famous dictum, it is the message, not the medium, that matters. Watching educational programming, at least in small amounts, is associated with high levels of school-related and language skills, and watching a lot of general-audience programming is associated with low levels of the same skills. These results occurred for children as young as age 2 in low-income families from a range of ethnic identities.

As a society, we are making choices about the programming offered to children that have consequences for what they derive from it. Public policy in recent years has been designed to require broadcasters to serve the educational and informational needs of children (Kunkel, 1998). Good educational programs can provide lasting benefits to children at many ages, but it may be especially important to provide such fare for very young children because they are less likely than older children to be exposed to formal preschool instruction, and because stable habits of viewing may be formed in the first few years of life. At the same time, there is a continuing need for age-specific programming that will interest and teach children beyond the preschool years.

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