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ABSTRACT

Students from seven schools, some from English-speaking (N=226) and some from non-English speaking (N=60) families, were tested for reading achievement in grades 1, 2, 3 and 6, and for mathematics achievement in grade 6. Students from non-English speaking families achieved significantly poorer reading results than those from English speaking families, and these differences were consistent and stable across grades 1-6. Longitudinal analyses suggested that the effect occurred primarily in grade 1 and that the lower reading achievement scores obtained by students from non-English speaking families in subsequent school years could be explained by the poor reading performance in grade 1 without taking into account the home language. The group differences were quite specific to language and reading skills and did not generalize to performance in mathematics. In year 6 the two groups did not differ in mathematics measures and students from non-English speaking families scored significantly better after controlling for language skills. Students in the two groups differed on many variables (for example, socio-economic status and home environment) so that causal conclusions are not justified. However, the specificity of the group achievement differences to language and reading skills suggests that home language may be an important determinant of early reading, and that early reading is in turn the primary determinant of subsequent reading performance. (Author)

Reading and Arithmetic Achievement in Primary Grades For Students From Non-English Speaking Families A Seven-Year Longitudinal Comparison

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Running Head: A Longitudinal Comparison

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ABSTRACT

Students from seven schools, some from English-speaking (N=276) and some from non-English speaking (N=60) families, were tested for reading achievement in grades 1,2,3 and 6, and for mathematics achievement in Grade 6. Students from non-English speaking families achieved significantly poorer reading results than those from English speaking families, and these differences were consistent and stable across grades 1-6. Longitudinal analyses suggested that the effect occurred primarily in grade 1 and that the lower reading achievement scores obtained by students from non-English speaking families in subsequent school years could be explained by the poor reading performance in grade 1 without taking into account the home language. The group differences were quite specific to language and reading skills and did not generalise to performance in mathematics. In year 6 the two groups did not differ in mathematics measures and students from non-English speaking families scored significantly better after controlling for language skills. Students in the two groups differed on many variables (for example, socio-economic status and home environment) so that causal conclusions are not justified. However, the specificity of the group achievement differences to language and reading skills suggests that home language may be an important determinant of early reading, and that early reading is in turn the primary determinant of subsequent reading performance.

Reading and Arithmetic Achievement in Primary Grades For Students From Non-English Speaking Families A Seven-Year Longitudinal Comparison

Language and Mathematics Performance of Non-Native Speakers

One of the most important problems facing educators today is how to measure and reduce inequalities in opportunity and performance for children from different ethnic and migrant groups. Traditional definitions of equality have emphasized input variables such as 'per pupil' expenditure, but more recently the focus has shifted to output variables such as academic achievement and the impact which input variables have on these products (Marjoribanks, 1978, 1980). In multi-cultural countries like Australia, where there are many nationalities within each school group, each with its own set of unique characteristics, and where the language of school instruction is entirely English, the problem is particularly complex. Marjoribanks (1980), for example, emphasized that the relationship between family background variables, other input variables, and academic attainment may differ for various ethnic migrant groups. Nevertheless a critical variable appears to be whether or not English is spoken in the home. In the report on Literacy and Numeracy in Australian Schools (Volume 1), Hewitt concluded that "if no English was spoken in the home, the chance of reading mastery was considerably reduced...Whilst the amount of English spoken in the home again appeared to influence numerical mastery, the effect was not as great as for reading". (Hewitt, 1976, p.191-192). Marjoribanks (1978, 1980) also found that word knowledge and word comprehension scores were lower for three non-Anglo groups (Greeks, Southern Italians and Yugoslavians) than for three Anglo-groups (middle class Anglo-Australians, lower-class Anglo-Australians and English). There was a similar pattern of differences between the language groups for scores in mathematics and general intelligence, but in each case the magnitudes of the differences were smaller.

Many studies from different countries have examined language and mathematics performance of non-native speakers, though the focus of much of this research, unlike that of the present investigation, is on bilingual instruction. However, generalisation of findings can be questioned because factors such as attitudes, motivation, language experience and aptitudes may not be comparable.

In Sweden, Lofgren and Ouvinen-Birgerstam (1982) compared

performances of a project group of non-native speakers (Finnish children in Sweden) being taught in the two languages with groups of their own age in Sweden and Finland. The project children's language proficiency in Swedish was found to be roughly one S.D. below the Normative average of the same age Swedish children but the mathematics achievement was only slightly below the Swedish norm groups. The project children and the children attending Finnish classes had comparable command of Finnish vocabulary, reading and writing but children not receiving any instruction in their first language performed more poorly in these language skills.

In Canada, Lambert (1972) also studied the second language problem. He studied a sample of children whose dedicated parents arranged schooling in French for their English-speaking children in kindergarten and primary school. After five years of the study, he reported no retardation in English and the development of a competence in French that surpassed that of children who studied French as a Second language.

Also in Canada, Cummins (1981) emphasized the importance of age-on-arrival of second language learning. He stresses the mismatch of government provision of two years of special training for these learners after arrival when it has been established that it takes an average of at least five years for the immigrant arriving after the age of six to approach grade norms in the second language. Cummins and Swain (1983) suggested that "current school programs and personnel are actively creating educational deficits in minority students" (p.24). This point is also made by Edelsky et al. (1983) who stressed the need for overall change in school interactions and teaching. Edelsky (1982) stressed a further factor to consider - the nature of the two writing systems. Engle (1975) also stressed the importance of the linguistic relationship between the two languages and their function in the community and school.

In Australia Hewitt (1976) also found a discrepancy between reading and mathematics results of 10 and 14 year old migrants. Fifty eight per cent of the 10 year old (N = 829) and forty three per cent of the 14 year old migrant students failed to reach the eighty per cent mastery criterion on the Reading Tests while thirty two per cent of the 10 year old and thirty four per cent of the 14 year old migrant students failed to reach the eighty per cent mastery criterion on the Numeration Test. The latter figures are much closer to the figures for overall Australia than the performance in reading.

In summary, a wide variety of studies have found that non-native speaking children lag behind native speaking children in their mastery of reading and language skills. Although performance by non-native speakers in other subjects such as mathematics also suffer, the defects are typically smaller than in reading and language. While many of these studies are also concerned with the effects of home environment variables and different instructional techniques, the overwhelming conclusion is that non-native speaking students are handicapped in their mastery of reading skills and this is the focus of the present investigation.

The present Investigation

Students, some from English-speaking and some from non-English speaking families were tested for reading achievement in grades 1,2,3 and 6, and for mathematics achievement in grade 6. The study is longitudinal, spanning all the primary school years. Parents' language was determined in the kindergarten year, along with a number of other measures and demographic data, and reading and/or mathematics measures were collected from this same sample of students in grades 1,2,3 and 6. The design of the study provides a strong basis for studying the impact of home language, how this impact varies at different points of time during the primary grades and how this impact differs for achievement in reading and mathematics.

Method

Sample

The initial sample consisted of all kindergarten pupils in seven public schools in one geographic location, the St. George region of metropolitan Sydney. This region was selected because it reflects the socioeconomic and multi-cultural backgrounds found in metropolitan Sydney and other large Australian cities. In the state of New South Wales, where the study was carried out, Kindergarten is the first year of formal schooling, followed by years 1-6 in the primary school.

At the commencement of the study in 1974, tests were administered to a total of 392 children (52 per cent males) who ranged in age from 5.0 to 7.1 years (mean age = 5.6) and 286 of these children could still be traced for retesting in 1980. As is frequently a problem in longitudinal studies, many children from the original sample changed schools within the city or moved to another city within the state over the course of the study. Whenever these children could be located at a time when testing was to be carried out, materials were sent to the child's teacher with a request for cooperation and a tester visited

the classroom to collect data from the child. Only in cases where the child moved out of the state (or out of the country) or where no forwarding address was available, was the child dropped from the sample. Supplementary analyses were performed to determine if the final sample differed significantly from the original one.

A total of 22 per cent of the original sample (21 per cent of the 286 children considered in this paper) came from a family classified by the school as having no English speaking parent. This percentage is reasonably representative of metropolitan schools, being similar to that found in a 1980 survey conducted in government schools in New South Wales (Johnston, 1982). The family language information was obtained during the first year of schooling. Although there is no facility for making home visits, the class teacher and/or the Infants' Mistress or Principal meet with the parents and request information concerning the amount of English spoken in the home. Very precise records are maintained as this vital information determines the number of 'English as a Second Language' assistants the Principal can request. For the purpose of this study, children who came from families where no parent spoke English were classified into one group, while those coming from families where at least one parent spoke English were classified into a second group along with those where English was spoken by both parents. A check was mad on parents' language was checked again in grade 1 by referring to the grade 1 records and consulting with teachers and the Principal; virtually no changes were reported.

The largest non-English speaking subgroup were Greek speakers but there were also migrants from Asia, Africa, other European countries and from North and South America. However, neither parents' native language nor their proficiency in it was taken into account in this study. The English and non-English speaking subgroups did not differ significantly ($p < 0.05$) in terms of the sex, age, size of family or ordinal position of the child within the family. Children in the non-English speaking group were more likely to be born outside Australia (66 per cent as opposed to 16 per cent in the rest of the sample) and came from families where the heads of the households held occupations with a lower status (mean of 8.3 compared with 11.5 for the rest of the sample ($t(273) = 6.00$, $p < 0.01$) on a 1-17 scale adapted from Congalton (1969).

Materials and Administration

The materials considered in this study are part of a larger, on-

going longitudinal study described in more detail by Butler, Marsh, Sheppard and Sheppard, (1982, 1983). An extensive battery of tests was administered in Kindergarten in 1974, and various reading achievement tests were administered near the end of the academic year in 1975, 1976, 1977 and 1980. The relationship between kindergarten measures and subsequent reading performance is described elsewhere (Butler, et al., 1982, 1983) and will not be considered in the present investigation. At the end of year 6 (1980), teachers were asked to judge students in terms of ability in mathematics and language. Also "end of year 6" assessments, which summarize student performance in mathematics and language, were made available to the researchers. The specific tests and occasion of administration for those materials administered in kindergarten, and in years 1,2,3 and 6 and considered in the present investigation are as follows:

NOVEMBER/DECEMBER 1975 (YEAR 1):

1. ACER Lower Grades Reading Test (ACER, 1973). The test is designed for children with about 6 months of reading instruction and requires such activities as matching words and pictures, reading simple instructions, and demonstrating comprehension by following written instructions. This test results in a single score.

2. The Standard Test of Reading Skill. This is Test 1 of the Standard Reading Tests (Daniels & Diack, 1958). The test requires that children read aloud questions of increasing difficulty and provide answers to questions which assess comprehension. The test results in a single score.

3. Test Ri, Graded Word reading Test (Schonell, 1955; also see Buros, 1959, p. 746). This test requires children to read aloud words of increasing difficulty which are presented in written form and result in a single score.

OCTOBER/DECEMBER 1976 (YEAR 2):

1. Doren Diagnostic Reading Test of Word Recognition (Doren, 1973, adapted for Australian use, see Butler, 1979). The test has separate scores for letter recognition, beginning sounds, whole word recognition, speech consonants, ending sounds, blending, rhyming, vowels, discriminant guessing, spelling, and sight words.

2. Test Ri, Graded Word reading Test (see above).

OCTOBER/DECEMBER 1977 (YEAR 3):

1. Stanford Diagnostic Reading Test Level 1 (Karlsen, B., Madden R and Gardner E.F., 1966; Also see Buros, 1972, p.1127). This is a multiscale test with separate measures for reading comprehension, vocabulary, auditory discrimination, syllabification, beginning and ending sounds, blending, and sound discrimination.

2. Test Ri, Graded Word reading Test (see above).

OCTOBER/DECEMBER 1980 (YEAR 6):

1. Stanford Diagnostic Test Level I (Karlsen, Madden and Gardner, 1966; Also see Buros, 1972, p.1127). This is a multiscale with measures for reading comprehension (literal, inferential and total), vocabulary, syllabification, sound discrimination, blending and rate.

2. Test Ri, Graded Word reading Test (see above).

3. Teacher Ratings for Student Ability in Language Subject Area and

Mathematics Skills. Teachers evaluated the students using a seven point response scale which varied from "1 - very inadequate" to "7 - superior".

4. End of Year 6 Assessment. All public schools provide a summative scores for each student in language and mathematics achievement at the end of Grade 6 when students transfer from Primary to High School. These scores are used for selection for specific High Schools as well as streaming within High Schools. The score is a composite mark out of a possible 300 points and is based on standardized examinations and class teachers' assessments. The scores are designed to be comparable across different schools, though the precise manner in which they are determined may vary somewhat from school to school.

Preliminary Data Reduction

Preliminary analyses and primary factor analyses were conducted to see what variables could be meaningfully combined to produce total scores. This analysis is described in more detail by Butler, et al.(1982, 1983). Factor analyses of the various reading measures collected in each year demonstrated each time that different reading scores could be combined to provide a total score. In each of the four factor analyses, between 56% and 68% of the variance could be explained by a single factor and there was only one eigenvalue greater than 1.0. Even when the reading scores from all four years were combined into a single analysis (a total of 28 variables including the different subscales for the Stanford and Doren tests) the data could be adequately explained by a single "general reading ability" factor (see Butler, et al, 1982, 1983 for more detail).

In order to obtain comparability across the different scores, the following variables were each standardized to a mean of 0.0 and a standard deviation of 1.0: total reading scores for each of the years 1975, 1976, 1977 and 1978; teacher ratings of student ability in mathematics and language collected in 1980; and end of year six assessments in language and mathematics. Since the variables for each year were based upon different tests, no information was lost by standardizing the scores. Only the Schonell test was administered in each of the four years, and a separate analysis of these results was conducted on the raw (unstandardized) scores from this test.

Missing Data

An important problem in any large-scale survey study, particularly a longitudinal study that spans all the primary school years, is the handling of missing data. The decision was made to base the major analyses on data from those pupils who completed the standardized reading tests during the 1980 (N = 286). For this group there was little missing data for any of the variables assessed earlier: combined reading in 1975 (7 missing cases), 1976 (1 missing case), year 1977 (no missing cases), 1980 (no missing cases); teacher

ratings in 1980 (10 missing cases),; end of year six assessments (14 missing cases). For these missing cases, the mean of the entire group was substituted for any missing values.

A more serious problem was the question of whether any bias had been introduced due to attrition from the sample tested at the start of the study. A total of 106 students (27%) from the original population were not available for testing in year six in spite of concerted efforts to trace their location. However, the major emphasis of this study is the comparison of students who came from English speaking and non-English speaking families, and the level of attrition was nearly identical for these two groups. Scores on the Slosson Intelligence Test (Slosson, 1963) and the Peabody Picture Vocabulary Test (Dunn, 1965) were available for all children from the testing conducted in kindergarten in 1974, and the students from the original sample who were not tested in 1980 did not differ significantly from those who were, on either of these tests or on their sum. Varying numbers of those students who were not tested in 1980 had been available for testing in 1975, 1976 or 1977. A second check established that the total reading scores in each of the three earlier testings for students who were not tested in 1980 did not differ significantly from those who were. Finally, based upon the total reading score in 1976 (N = 320 children), a two-way ANOVA was conducted to determine if the apparent difference between students from English and non-English speaking families was related to whether or not a child was in the group which was available to be tested in 1980. There were substantial differences for children from English And non-English speaking families which will be discussed later, but these differences did not significantly relate to whether the child was tested in 1980. Thus, while the problem of attrition does dictate caution in the interpretation of the results, it seems unlikely that this problem will have any substantial influence on the conclusions of the study.

Statistical Analyses

All of the statistical analyses described in this study were conducted with the commercially available SPSS Program (Hull & Nie, 1981; Nie et al., 1975). The first analysis consisted of a three-way ANOVA where one factor was a repeated measure variable (the year in which the reading test was administered) and two factors were between-group variables (language group and student sex). The purpose of this analysis was to compare the two groups (students from English and non-

English speaking families) on the combined reading scores, to determine if the group differences varied over time, and to determine if group differences depended upon student sex. A similar analysis was conducted for scores from the Schonell reading test, the only test to be administered in all four years. Next, teacher ratings of ability in language and mathematics, and end-of-year-six assessments in these two subjects were examined in a three-way ANOVA where subject (language or mathematics) and source (teacher ratings or end-of-year-six assessments) were repeated measure variables, and language group (students from English and non-English families) was a between-group variable. Each of these ANOVA's was conducted with the SPSS MANOVA procedure, and results are reported in terms of univariate ANOVA's though conclusions based upon multivariate ANOVA's were similar.

Finally, language group, student sex, reading scores from each year, teacher ratings and end-of-year-six assessments were included in a single path analysis. For the purposes of this analysis, teacher ratings of language ability were combined with end-of-year six assessments in language, as were the corresponding measures of mathematics. The path coefficients derived from the path model described in the results section are based upon standardized beta weights resulting from a series of multiple regression analyses (see Wolfle, 1980; Kerlinger & Pedhazur, 1973).

Results

Comparison of reading Scores Over Time

The total reading scores for 1975, 1976, 1977 and 1980 are presented separately for students who come from English and non-English speaking families (see Figure 1A). The two language groups consistently differ by about two-thirds of a standard deviation in each of the four years which span the primary school grades. Statistical analyses support these observations in that the differences between the groups is significant ($F(1,282) = 27.31$, $p < 0.001$), but does not vary over time ($F(3,846) = .52$, $p > 0.5$). The effect of sex is also significant ($F(1,282) = 29.67$, $p < 0.001$), with girls scoring somewhat higher, but this effect does not interact significantly with any of the other effects. For this analysis, there is no information on change in reading scores over time, since the scores were standardized (across both groups) separately for each year.

Insert Figure 1 About Here

The interpretation of Figure 1A is complicated by the fact that

the particular set of reading scores administered each year varied, hence it is not meaningful to compare the raw (unstandardized) scores over time. However, one reading test, the Schonell test, was administered each year of the study and the raw scores for this test are shown in Figure 1b. This figure shows that students from non-English speaking families scored about 6.5 points below other children on the Schonell test in each of the four years, while both groups improved about 10 points per year during the primary school years. Statistical analyses showed that the difference between language groups is significant ($F(1,282) = 13.41$, $p < 0.001$) and that the size of the difference does not vary over time ($F(3,846) = 0.51$, $p > 0.5$). Again the effect of sex is statistically significant ($F(1,282) = 5.90$, $p < 0.01$) but does not interact significantly with any of the other variables. For this analysis there is a substantial increase in the reading scores over time ($F(3,846 = 1296.77$, $p < 0.001$) (recall that these scores were not standardized separately for each year).

Comparisons in Language and Mathematics at the End of Primary School

Results described above are based upon standardized reading tests which were administered by researchers as part of this study. At the end of year six, students are formally assessed by their school in language and mathematics, and these assessments were made available to the researchers. In addition, as part of this study, teachers were asked to rate each child's ability in language and mathematics. Standardized scores for these four variables are presented separately for students from English and non-English speaking families (see Figure 2). The two groups differ substantially in measures of language achievement, but not in measures of mathematical achievement. As might be expected, the pattern of results is consistent for both teacher ratings and end-of-year-six assessments. Statistical analyses of the results substantiate these observations in that the language group-by-subject interaction is statistically significant ($F(1,284) = 24.6$, $p < 0.001$). The effect of source (i.e. teacher ratings vs end-of-year-six assessments) could not differ significantly since both scores were standardized, but more importantly it did not interact with any other effect. Simple t-tests were used to compare the language groups on each of the four measures separately. Students from English speaking families scored significantly higher than those from non-English speaking families on both measures of language achievement (teacher ratings -- $t(284) = 4.2$, $p < 0.001$, end-of-year-six assessments -- $t(284) = 3.5$, $p < 0.001$), but the two groups did

not differ significantly on either measure of mathematics achievement (teacher ratings-- $t(284) = 0.6$, $p > 0.5$; end-of-year-six assessments -- $t(284) = 0.8$, $p > 0.4$). The consistency of these findings across two different sources substantially strengthens the conclusions. The effects of the language measures are consistent with results presented in Figure 1. However, it is also an important finding that children from non-English speaking families, in spite of being more than half a standard deviation below other children in reading achievement during their six primary school years, do not differ significantly from them in terms of mathematical achievement.

Insert Figure 2 About Here

Stability of Reading Differences Over Primary School Grades

Figure 1 illustrates average reading scores over time, but it does not indicate the consistency of the relative rankings of students in reading achievement over the six years of primary school. Total reading scores for each year are highly correlated with those from other years (mean $r = 0.76$) despite the fact that different reading tests were used each year. If scores from first grade are excluded, then the mean correlation increases to 0.84. Thus, while the absolute level of reading achievement does improve over time, the relative ranking of students remains remarkably stable.

The stability of the reading scores and the relationship of reading scores with other variables is further examined with a path analysis. The description and analysis of the path model follow the strategies presented by Wolfle (1980). The variables included in this analysis are presented in Figure 3 and the ordering of these variables (from left to right) represents the hypothesized direction of the effects. Straight arrows represent direct effects that are statistically significant, and the arrows are excluded when the path coefficients are not statistically significant (all excluded paths have coefficients less than 0.08). The curved arrow connecting the measures of the end of year 6 assessments of language and mathematics achievement indicate that no causal ordering between these variables has been hypothesized, and that the correlation between them may be due to other variables not included in the model, for example, halo effects or a general ability factor.

Insert Figure 3 About Here

The results of the path analysis (see Figure 3) again demonstrate the stability of reading achievement scores over time. Reading scores

collected at any particular point during the primary school years are primarily determined by reading achievement from the testing conducted immediately prior to that point in time. Reading achievement in 1975 has a large direct effect on reading in 1976, 1976 reading level has a large direct effect on reading in 1977, and so forth. This suggests that the acquisition of reading skills for students in this study followed a smooth, stable developmental pattern where the acquisition of skills at any particular point in time is dependent upon the mastery of prior skills. Students who were poor at reading in the earl; years of primary school remained poor at reading during all six primary school years.

For purposes of this study, the effects of language group membership (belonging to English vs non-English speaking families) in Figure 3 is particularly interesting. Membership of a language group has a large direct effect on reading achievement in 1975 (first grade), but not on reading achievement in any subsequent year. It must be emphasized that these results do <u>not</u> imply that language group has no effect on subsequent reading performance in later school years. The results show that while these effects are substantial, they are <u>indirect</u> effects. Students from non-English speaking families perform more poorly on reading achievement tests all through primary school, but this poorer performance can be explained in terms of their poorer performance in first grade and thus it is an indirect effect. Hence language group seems to have little effect on reading achievement during the primary school years beyond the effect it has on first grade reading. This suggests that it is the poor initial reading skills, rather than an inability to handle new skills, which restricted reading improvement during these years for the migrant children, and that subsequent schooling does not appear to help overcome the initial problem.

The measures of language and mathematics shown in Figure 3 are based upon an average of teacher ratings and end-of-year-six assessments. Results for the combined language measure follow the pattern described earlier. Language achievement assessed in this manner is significantly related to the total reading score in 1980, which is in turn determined by reading achievement in earlier years. There is no direct effect of language group on the language achievement measure at the end of primary school but rather there is a long indirect chain of effects where language group impacts reading achievement in first grade which affects reading in second grade and

so forth. The relationship between language group and mathematics achievement is more complicated. The indirect effect of language group (i.e. its effect carried through earlier reading scores) is negative, but the direct effect is positive. Thus, students from non-English speaking families actually perform better at mathematics after controlling for the effects of their poorer reading achievements (i.e. the path coefficient (.13) in Figure 3 is positive). This positive direct effect on mathematics achievement and the negative indirect effects cancel each other out so that overall there is little or no difference between the two language groups in terms of mathematics achievement (see Figure 2).

Discussion

The results of this study provide several important conclusions. First of all, students from non-English speaking families are substantially disadvantaged in early reading achievement; these differences are stable and remain consistent during the first six years of schooling. Second, language group membership has no direct effect upon reading achievement scores beyond first grade; rather the initial disadvantage in reading skills observed in first grade accounts for poor reading achievement in subsequent grade levels. Third, the disadvantage observed in these children is quite specific to language/reading skills and does not generalize to their performance in mathematics. At the end of primary school, students from non-English speaking families do not differ from other children in mathematics achievement whether measured by the end-of-year-six assessments or by teacher ratings; the math scores are significantly higher than those of other children after controlling for reading ability. This set of conclusions is strengthened by the representativeness of the original sample of students, the consistency of the findings over a variety of indicators, the longitudinal design of the study, and the lack of relationship between attrition and the variables considered.

The conclusion that the language group differences are similar over time needs to be defended, particularly when the characteristic being assessed is known to be changing over time as is the case with reading achievement during the primary school years. Two strategies, each with its own problems, were used to arrive at this conclusion.

The first strategy was to form a total score based upon a variety of different reading tests selected to be most appropriate for each year of the study, standardizing the scores separately for each year,

and then making comparisons on the basis of standard deviation units. While this approach seems most defensible, it assumes that each of the different total scores is reliably measuring comparable components of reading. Substantial support for this assumption comes from the preliminary analysis which suggested that the various reading tests administered each year, and even the set of scores from all four years, reflect a single factor of reading achievement, and extremely high correlations between total reading scores for the different years provide further support for this approach.

The second strategy was to make comparisons on the basis of the same test (Schonell) administered in each of the different years of the study. This second approach seems less defensible in that it is unlikely that the same test could be appropriate across all the primary grades. Indeed, the Schonell test used measures only word recognition and is not a comprehensive measure of reading achievement. Consequently, both comparisons, those based upon the total reading scores (Figure 1A) and those on the Schonell test (Figure 1B) are subject to criticism, as is likely to be the case in any such comparison. However, confidence in the conclusions is strengthened considerably by the consistency of the two sets of findings.

Students from English and non-English speaking families represent two intact groups which differ to an unknown extent on many variables (e.g., family SES, home environments, cultural background, parents' education, literacy in the home, children's language skills in their native language etc.) in addition to home language. Consequently, since random assignment is not possible and never could be possible, it is impossible to determine that any one or any combination of these differences causes differences in language/reading skills. Even if some of the group differences in language skills could be explained in terms of other variables (e.g., SES), attributing the differences to the other variables instead of to home language could only be justified if the other variables were causally predominant over home language, and such an assumption would be nearly impossible to prove. However, the lack of group differences in mathematics achievement provides an additional clue to this problem. While it is still possible that some other variable such as SES produces a low level of language/reading skills but has no effect on mathematics skills, this possibility seems unlikely. Instead, the specificity of the results suggests that home language is a likely determinant of the early group differences in language skills.

In some respects the search to determine which differences in the groups are causal determinants obscures an important finding. Poor reading performance in the early primary grades leads to poor performance in later years -- no matter what the cause of the poor performance in the early years. Home language and input variables representing other characteristics before the start of school contribuce little or nothing to the accuracy of the prediction of reading in year 6 beyond that which can be predicted by early reading performance. In this respect, reading achievement in early primary grades rather than home language is the critical variable. The path analysis suggests that if the reading deficits of students from non-English speaking families are remedied, then home language may not have an effect on subsequent language achievement.

There are several qualifications to this discouraging state of affairs. First, no specific interventions were attempted with these children beyond the normal efforts employed in this particular school system, and an effective intervention program might lead to different results. Second, while the sample of students was chosen to be representative of the diversity of backgrounds likely to be observed in the metropolitan Sydney area, the conclusions are based upon the longitudinal study of a single age cohort in a single school system. Thus it is important to replicate this study. Third, non-English speaking students in this study represent a diverse group and it may be that the results for particular subgroups differ. The relatively small size of this group and the limited information about home environments prior to the start of school precluded this further analysis. Fourth, even when longitudinal data are examined with sophisticated path analytic techniques and some rival hypotheses can be eliminated, causal conclusions must be examined critically. In particular the supposition that language group has no #nudirect#no effect on reading performance in year 6 and the corollary that eliminating reading differences in early reading performance would eliminate the effect of language group in subsequent reading performance must be viewed as a causal hypothesis that received strong support in this study rather than a proven fact. Nevertheless, the findings do emphasize the importance of early reading problems on subsequent achievement in reading.

The finding that English and non-English speaking students do not differ in mathematics at the end of primary school is both striking and encouraging. It is striking in that other research discussed

earlier has reported that while differences in mathematics achievement are smaller than in language achievement, the differences were still statistically significant. This is particularly so since overall mathematics performance by year 6 could be expected to have a significant verbal component. It is encouraging in that it demonstrates that students from non-English speaking families, even after suffering considerable disadvantages in reading/language skills through six years of primary schooling, are still able and sufficiently motivated to master materials in other content areas at the same level as students from English speaking families.

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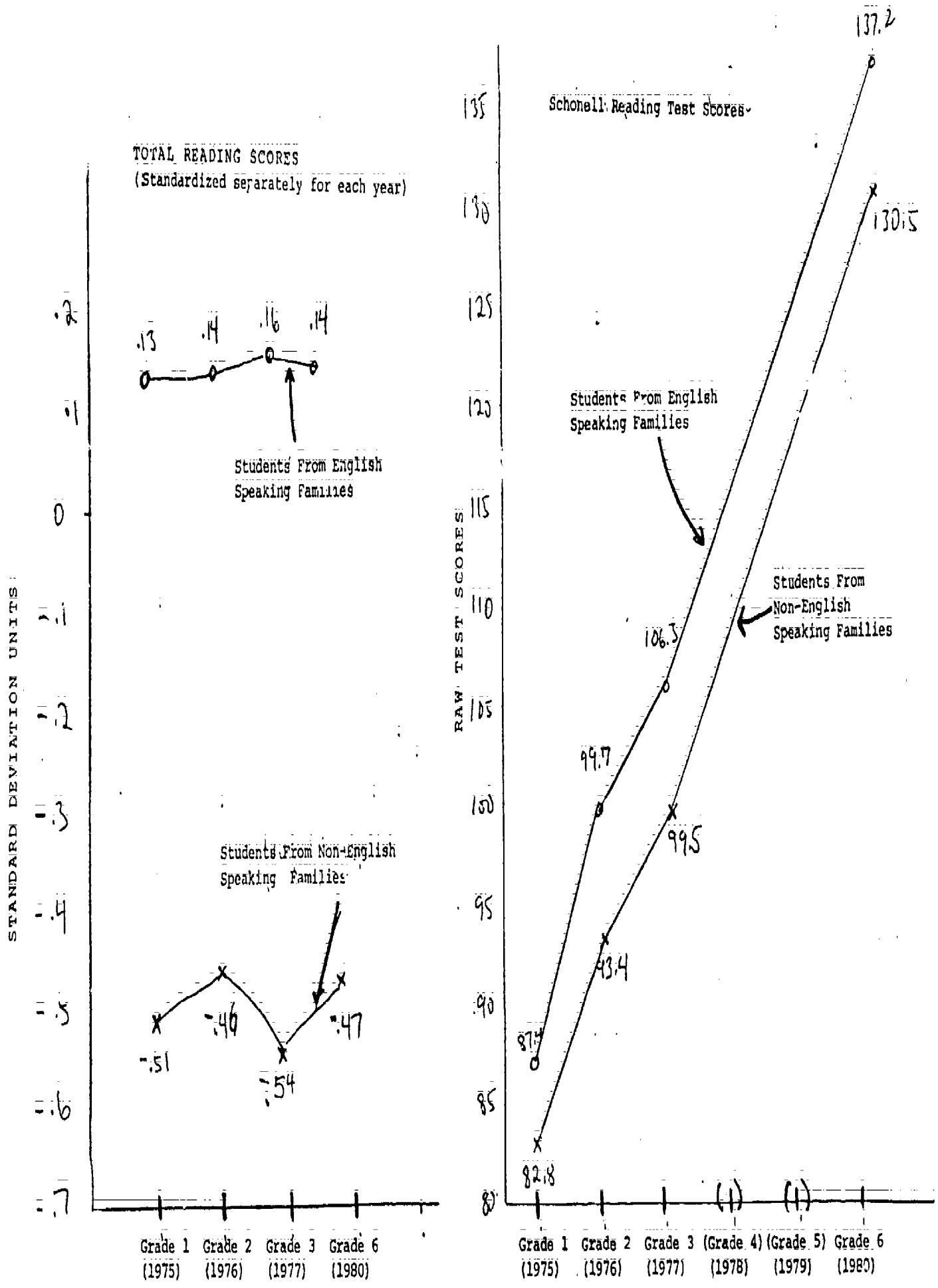

FIGURE 1. Comparison of Students From English & Non-English Speaking Families on Reading Achievement in Grades 1, 2, 3 & 6.

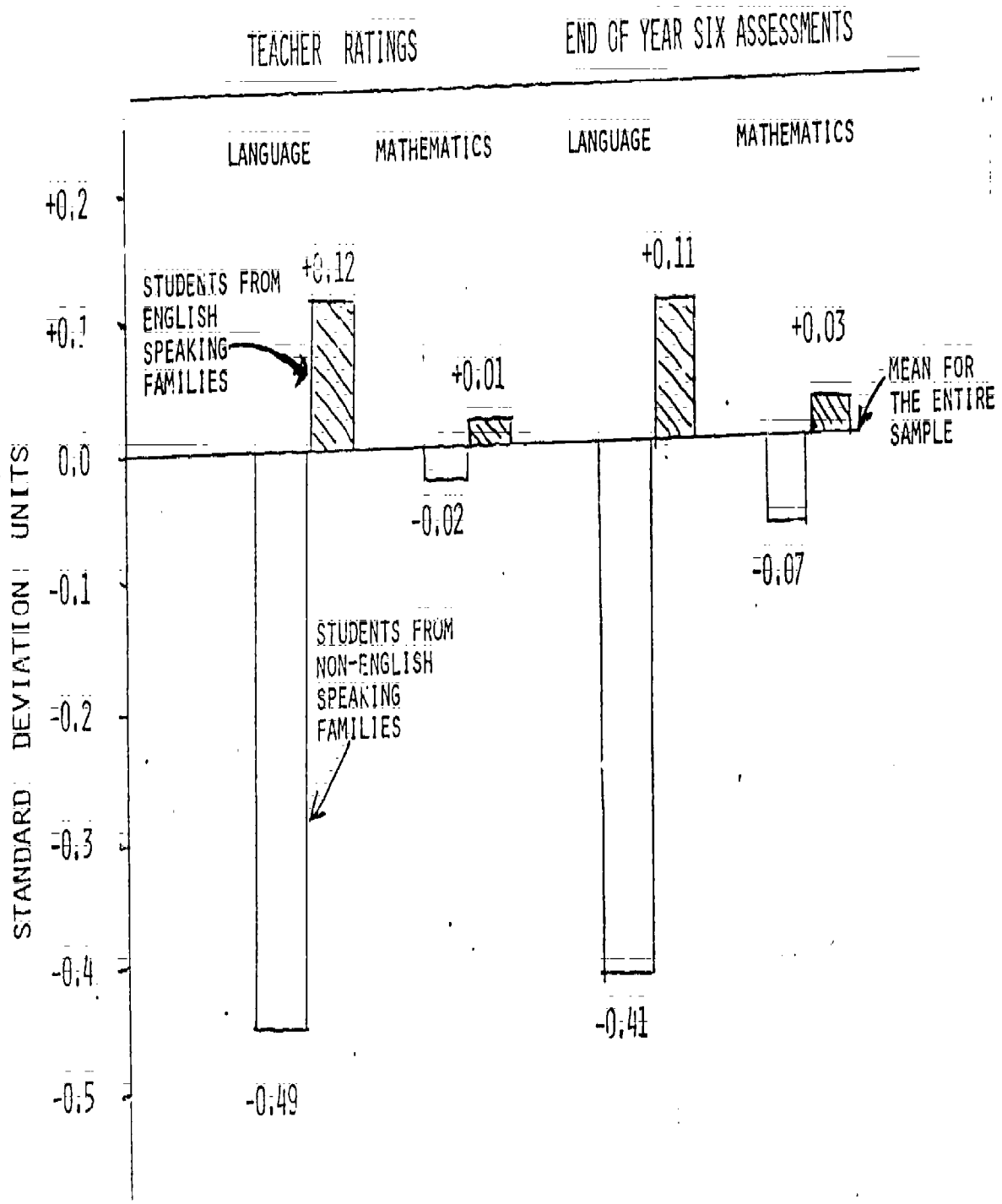

FIGURE 2. COMPARISON OF STUDENTS FROM ENGLISH & NON-ENGLISH SPEAKING FAMILIES IN READING AND MATHEMATICS AT THE END OF YEAR 6.