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ABSTRACT

Research indicated that English language proficiency may influence student performance, and that standardized assessments may be biased against students who have limited English proficiency (LEP). This study investigated the influence of language on student performance differences in reading and mathematics. The content area of reading was selected because assessment of performance is necessarily affected by students' language background and English language proficiency. Mathematics was selected because assessment performance may not be affected by the demand for English language proficiency. Research questions examined the performance differences in mathematics and reading scores between students who were identified as LEP and general education students who were labeled proficient in English (non-LEP). Student performance varied between LEP and non-LEP. LEP mathematics scores indicate a higher level of "over achievement" in mathematics above reading scores when compared to the reading and mathematics scores of non-LEP students; this is especially true of calculation type mathematics problems versus word type mathematics problems. An appendix includes assessment data for grades 3, 5, and 7. (KFT)

DIFFERENCES BETWEEN THE PERFORMANCE OF LIMITED ENGLISH PROFICIENT STUDENTS AND STUDENTS WHO ARE LABELED PROFICIENT IN ENGLISH ON DIFFERENT CONTENT AREAS: READING AND MATHEMATICS

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Abstract

Research indicates that English language proficiency may influence student performance, and that standardized assessments may be biased against students who have limited English proficiency. This study investigates the influence of language on student performance in Reading and Mathematics. Research questions examine performance differences in Mathematics and Reading scores between students who were identified as Limited English Proficient (LEP) and general education students who were labeled proficient in English (non-LEP). Student performance varied between LEP and non-LEP. LEP Mathematics scores indicate a higher level of "over-achievement" in Mathematics above Reading scores when compared to the Reading and Mathematics scores of non-LEP students.

Differences Between the Performance of Limited English Proficient Students and Students who are Labeled Proficient in English on Different Content Areas: Reading and Mathematics

Studies suggest that English language proficiency may influence student performance on standardized assessments (Abedi, Hofstetter, Baker, & Lord, 1998; Abedi, Lord, & Hofstetter, 1997). Because nationally normed assessments are typically standardized using an English speaking population, these instruments may be biased against students who have limited English proficiency. The tests may be measuring students' English proficiency, rather that the content area (e.g. Mathematics, Science) the test is intended to assess (Abedi & Leon, 1999; American Educational Research Association, et al., 1985).

The purpose of this study was to conduct an investigation regarding the influence of language on the measurement of student performance. We focused on Reading and Mathematics. The content area of Reading was selected because assessment performance is necessarily affected by students' language background and English language proficiency. Mathematics was selected because assessment performance may not be affected by the demand for English language proficiency. The research questions examined the performance difference in Mathematics and Reading scores between students who were identified as limited English proficient (LEP) and general education students who were labeled proficient in English (non-LEP). The questions also considered differences between students with disabilities (SWD), students who were redesignated English Proficient (RFEP), and LEP students with disabilities (LEP & SWD).

Participants

The participants in this study were drawn from the Hawaii public school population. The Hawaii Department of Education (HDOE) has a centralized school system comprised of seven regional districts. Four districts are located on Oahu, one on the island of Hawaii, another on Kauai, and the other district serves Maui, Molokai and Lanai. During the 1998-1999 school year, there were 245 public schools in the state and over 185,000 students enrolled in Kindergarten through Grade 12. All schools and all students that participated in the statewide assessment in Spring 1999 were included in this preliminary analysis. Students in Grade 3 (approximately 13,500), Grade 5 (approximately 12,900), and Grade 7 (approximately 12,000), were involved in the 1999 large-scale assessment. The public school population in Hawaii has a diverse and multicultural population.

Instruments and Data

Information pertaining to student achievement, English proficiency and disability in the 1998-1999 school year was obtained from the HDOE. Because Hawaii has a centralized system, data were available for all regional districts and students.

In Hawaii, the Stanford Achievement Test, 9th Edition (Stanford 9), published in 1997 (Harcourt, 1997) by Harcourt Educational Measurement was used to assess student academic achievement in Mathematics and Reading for the 1998-1999 school year. It is recognized, however, that standardized test scores do not represent the complete spectrum of students learning (Supovitz & Brennan, 1997) and the HDOE is has initiated effort to build a customized criterion referenced test based on the latest version of its student content and performance standards.

Stanford 9 Mathematics and Reading scores for this study are reported in normal curve equivalent (NCE) scores for several different content strands and sub-scales. Complete data were available for a small number of the Stanford 9 strands. In most cases, however, scores were only available for students in particular grades. For example, the composite scores for "Total Reading" and the sub-scores for "Word Reading," "Mathematics," and "Listening" were available for Grades 3, 5 and 7. However, for other strands, such as Language Mathematics, Language Expression, and Thinking Skills, the scores were available only for the higher grades (Grade 5 and 7).

Method and Analysis

We used the composite scores of Total Reading, Total Mathematics and sub-test scores of Math Procedures and Math Problem Solving for a series of analyses. We used students' LEP and SWD status as a grouping variable to create four subgroups: (a) LEP only, (b) SWD only, (c) LEP and SWD, and (d) RFEP. We computed descriptive statistics including mean, standard deviation, and number of subjects for each of these subgroups.

To compare the performance difference between LEP and non-LEP students on Math versus Reading and Math Calculation versus Math Problem Solving, we computed the percent of increase in scores of Math over Reading and of Math Calculation over Math Problem Solving. We designated these indicators as the *percent of over-achievement* (POA). To compute POA for Reading and Math, for example, we subtracted the mean score in Math from the mean score in Reading and divided the result by the Reading score and multiplied it by 100.

Initial Results

Table 1 presents the descriptive statistics for students in Grade 3. As the data in Table 1 show, LEP and SWD students had, in general, lower scores than students that were not identified as LEP or SWD. It should be noted that all groups had NCE scores that were higher for Math than for Reading. Of interest was that the scores of RFEP students were higher than other groups. Table 1 data indicate that students who were not identified as LEP or SWD, had a mean NCE Math score of 51.51 (SD = 20.81) and a mean Reading score of 42.86, (SD = 19.61) This constitutes approximately an 8-point difference in scores. The difference between performance in Reading and Math was even larger for LEP students. The mean Reading score for LEP was 27.94 (SD = 16.39), and 40.94 (SD = 18.64) for Math, with a 13 point difference in scores.

In addition to reporting students' overall Math scores, we separately report sub-test scores for Math Calculation and Math Problem Solving in Table 1. Since there is typically less language involved with Math Calculation items, we expected LEP students to have higher scores on these items than on Math Problem Solving items. As the data in Table 1 suggests, the NCE score for all groups on the Math Calculations sub-test was higher than on the Math Problem Solving sub-test. This difference was larger for LEP than for non-LEP students.

Table 1 also reports the POAs for Reading/Math and for Calculation/Problem Solving. The data in Table 1 clearly show higher POAs for LEP than non-LEP students. For example, the POA of Math/Reading for the overall group was 20% as compared with a POA of 47% for the LEP group. The POA for Calculation/Problem Solving for the entire group was 5% in comparison to a POA of 24% for the LEP group. Several different

factors may have contributed to these differences between LEP and non-LEP populations among which language may have been the leading factor.

Table 1

Descriptive statistics for the Stanford 9 Test Scores by Strands for Grade 3

Stanford 9 Strands/LEP Status	Reading	Math	Math Calculation	Math Problem Solving	Math/ Reading	Calculation/ Problem Solving
Non-LEP/Non-SWD						
Mean	42.86	51.51	52.23	49.61	20%	5%
SD	19.61	20.81	20.89	20.66		
N	10785	10922	10975	10957		
LEP Only						
Mean	27.94	40.94	46.25	37.36	47%	24%
SD	16.39	18.64	20.27	17.75		
N	996	998	1001	1002		
SWD Only						
Mean	27.14	38.21	39.80	37.58		
SD	22.37	22.99	22.34	22.47		
N	782	788	800	796		
LEP and SWD						
Mean	13.88	25.06	32.69	22.49		
SD	13.31	14.57	17.89	13.98		
N	54	54	56	54		
RFEP						
Mean	46.05	59.44	61.76	55.08	29%	12%
SD	16.20	19.99	20.56	19.28		
N	898	906	909	909		

Note. POA = percent of over-achievement. LEP = limited English proficient. SWD = students with disabilities. RFEP = redesignated Fully English Proficient.

Similarly, Table 2 presents means and standard deviations of NCE scores for students in Grade 5. As the data in Table 2 suggest, the trend of results for students in Grade 5 was very similar to the trend of results reported for students in Grade 3. Overall, LEP students performed lower than non-LEP students. Again, the scores of RFEP students were generally higher (except in Reading and Math Problem Solving) than students of other groups. The POAs were higher for the LEP group than for the general population. For example, POA for Math/Reading was 6% for the general population as

compared with a POA of 41% for the LEP group. Similarly, LEP students had a much higher Calculation score than Problem Solving score (POA = 13%) as compared with the performance of the general population (-5%).

Table 2

Descriptive statistics for the Stanford 9 test scores by strands for Grade 5

Stanford 9 Strands/ LEP Status	Reading	Math	Math Calculation	Math Problem Solving	POA Math/ Reading	POA Calculation/ Problem Solving
General Population						
Mean	50.73	54.01	52.19	54.73	6%	-5%
SD	18.92	20.08	20.60	19.84		
N	9840	9807	9846	9855		
LEP Only						
Mean	27.93	39.26	42.70	37.46	41%	13%
SD	14.21	16.21	18.45	15.49		
N	726	720	723	728		
SWD only						
Mean	28.97	33.76	32.84	36.46		
SD	18.32	16.43	17.75	16.88		
N	1002	992	1008	1005		
LEP and SWD						
Mean	17.92	27.93	30.91	29.02		
SD	12.50	11.09	13.82	10.76		
N	80	80	81	80		
RFEP					16%	6%
Mean	47.70	55.57	57.01	53.94		
SD	16.89	19.95	20.94	19.82		
N	1262	1257	1262	1259		

Note. LEP = limited English proficient. SWD = students with disabilities. RFEP = Redesignated Fluent English Proficient.

Table 3 reports descriptive statistics for Reading and Math for students in Grade 7. These data are similar to those that were reported in Tables 1 and 2 for students in Grade 3 and 5 respectively. The trend of performance for Grade 7 students were very similar to those reported for students in Grade 3 and 5. Here again, students had a higher score on Math than on Reading, and LEP students showed greater differences between Reading and

Math and between Computational and Math Problem Solving. Similar to Grade 5, the scores of RFEP students were generally higher (except in Reading and Math Problem Solving) than students of other groups.

Table 3

Descriptive statistics for the Stanford 9 test scores for Grade 7

Stanford 9 Strands/ LEP Status	Reading	Math	Math Calculation	Math Problem Solving	POA Math/ Reading	POA Calculation/ Problem Solving
General Population						
Mean	45.63	49.30	49.09	48.75	8%	.6%
SD	21.10	20.47	20.78	19.61		
N	9217	9118	9278	9250		
LEP Only						
Mean	20.26	36.00	39.20	33.86	77%	16%
SD	16.39	18.48	21.25	16.88		
N	692	687	696	699		
SWD only						
Mean	18.68	27.82	28.42	29.10		
SD	19.70	14.10	15.76	15.14		
N	872	843	883	873		
LEP and SWD						
Mean	9.78	21.37	22.75	22.87		
SD	11.50	10.75	12.94	12.06		
N	93	92	97	94		
RFEP						
Mean	41.33	51.04	52.57	48.84	23%	8%
SD	19.59	21.63	21.92	20.19		
N	1223	1209	1228	1229		

Note. LEP = limited English proficient. SWD = students with disabilities. RFEP = Redesignated Fluent English Proficient.

Conclusions

This study suggests that English language proficiency affects students' assessment scores on standardized norm referenced tests in the content areas of reading and Mathematics. Clearly, the content area of reading, which places a high demand of English language on the test items, is most difficult for all categories of LEP students—Especially

when compared to Non-LEP students. However, even taking in to account students' reading level, LEP performance as indexed by their percent of over-achievement on math items tends to be better than Non-LEP students at each grade level. When the data for mathematics are further analyzed by problem type, i.e. calculation vs. Problem Solving, we note that LEP students tend to do better in calculation type problems vs. Problem Solving type problems. This is no great surprise since conventional wisdom has always stated that LEP students should do better in this respect. However more detailed item analyses should confirm the extent to which these differences are due to differences in the reading load of the item types.

This study also suggests that RFEP students have NCE scores that are generally higher than the other four groups under investigation (Non-LEP/SWD, LEP, SWD and LEP/SWD). See Appendix A for figures that provide a more visual interpretation of the data from Grade 3, Grade 5 and Grade 7. Possibly the length of time that students are in Hawaii's language programs, the small class size as well as the high expectations of educators are reasons that the RFEP students are doing so well.

Limitations

The findings of this study are limited to the accuracy of the data collected by the HDOE. The use of multiple databases as well as the linking of students between data bases narrows this study to those students who participated in the Stanford 9 (and not the total number of enrolled students in public schools) in Hawaii during Spring 1999. Further more, the initial English as a second language category of students when they enrolled in Hawaii public schools was not included in this study. Many times access to these types of data are difficult to obtain. Additional information would have been helpful, especially if

we were able to group students by home language and account for the socio-economic status of the participants in this study. This study also does not investigate the use of accommodations as these scores do not reflect the use of accommodations that may "level the playing field" for LEP students when they take standardized assessments. These data have been difficult to track.

Further Research

Additional research needs to be conducted to compare the performance of LEP and non-LEP students on Stanford items to examine the possibility of differential performance by students with different language backgrounds and to investigate how the students' socio-economic backgrounds interacts with their language background, as these variables may be confounded. Also, we would suggest that further, more complex, multilevel research should be conducted within a multilevel analysis, examining the effect of item difficulty and the demand on the English language.

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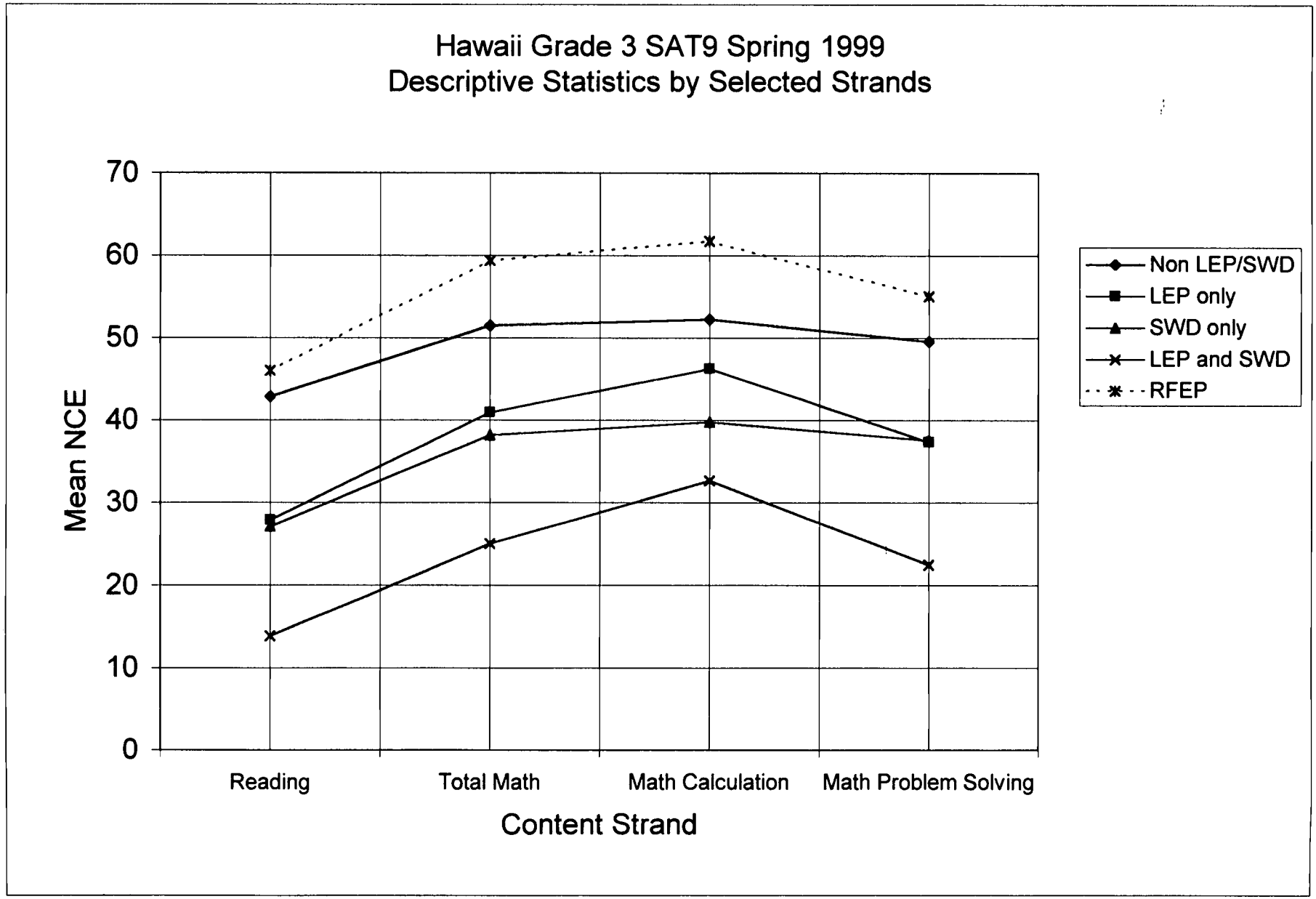
APPENDIX A

WITH FIGURES


Hawaii Grade 3 SAT9 Spring 1999
Descriptive Statistics by Selected Strands
Mean NCE
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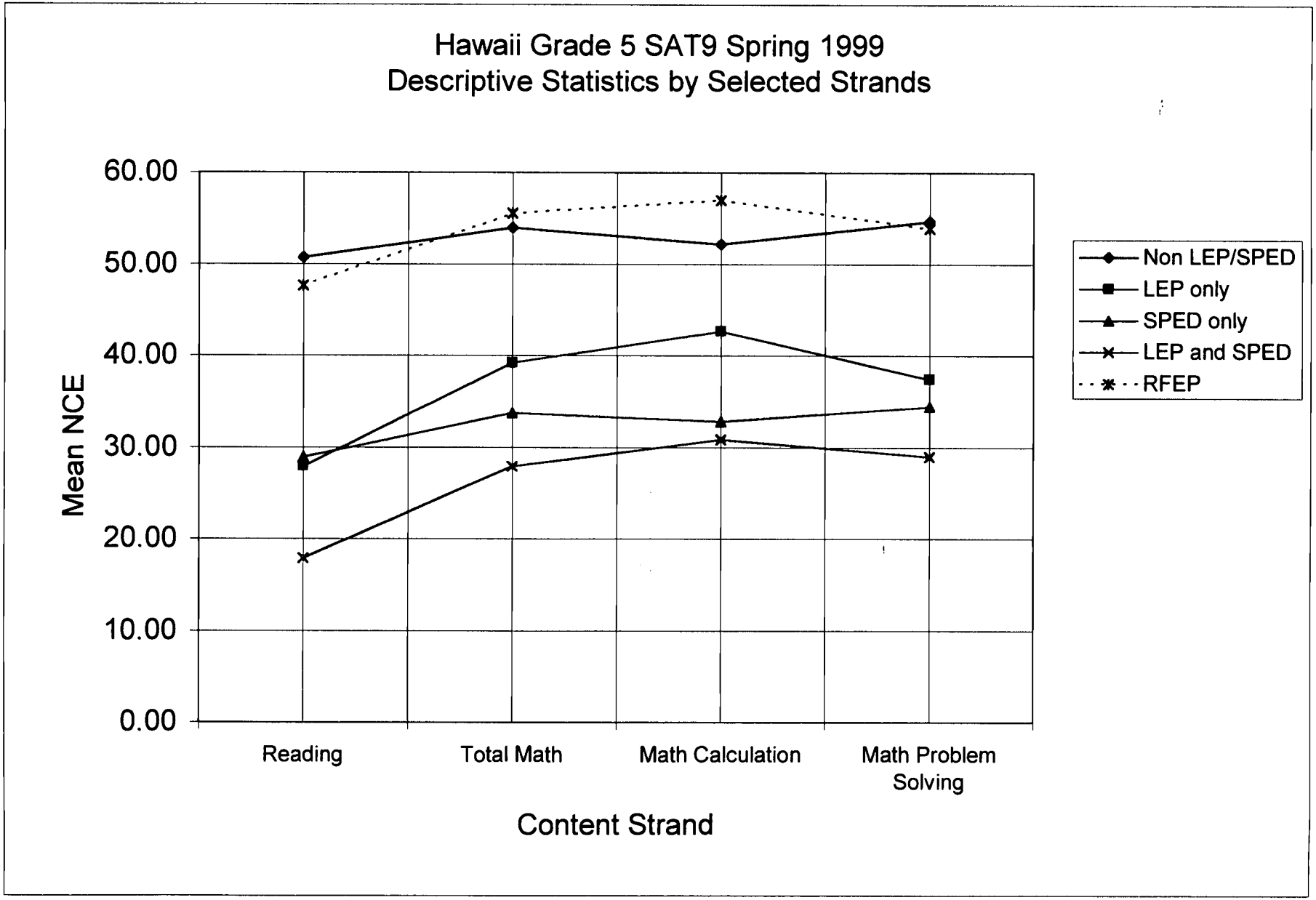
60
50
40
30
20
10
0
Reading
Total Math
Math Calculation
Math Problem Solving
Content Strand
Non LEP/SWD
LEP only
SWD only
LEP and SWD
RFEP


Hawaii Grade 5 SAT9 Spring 1999
Descriptive Statistics by Selected Strands
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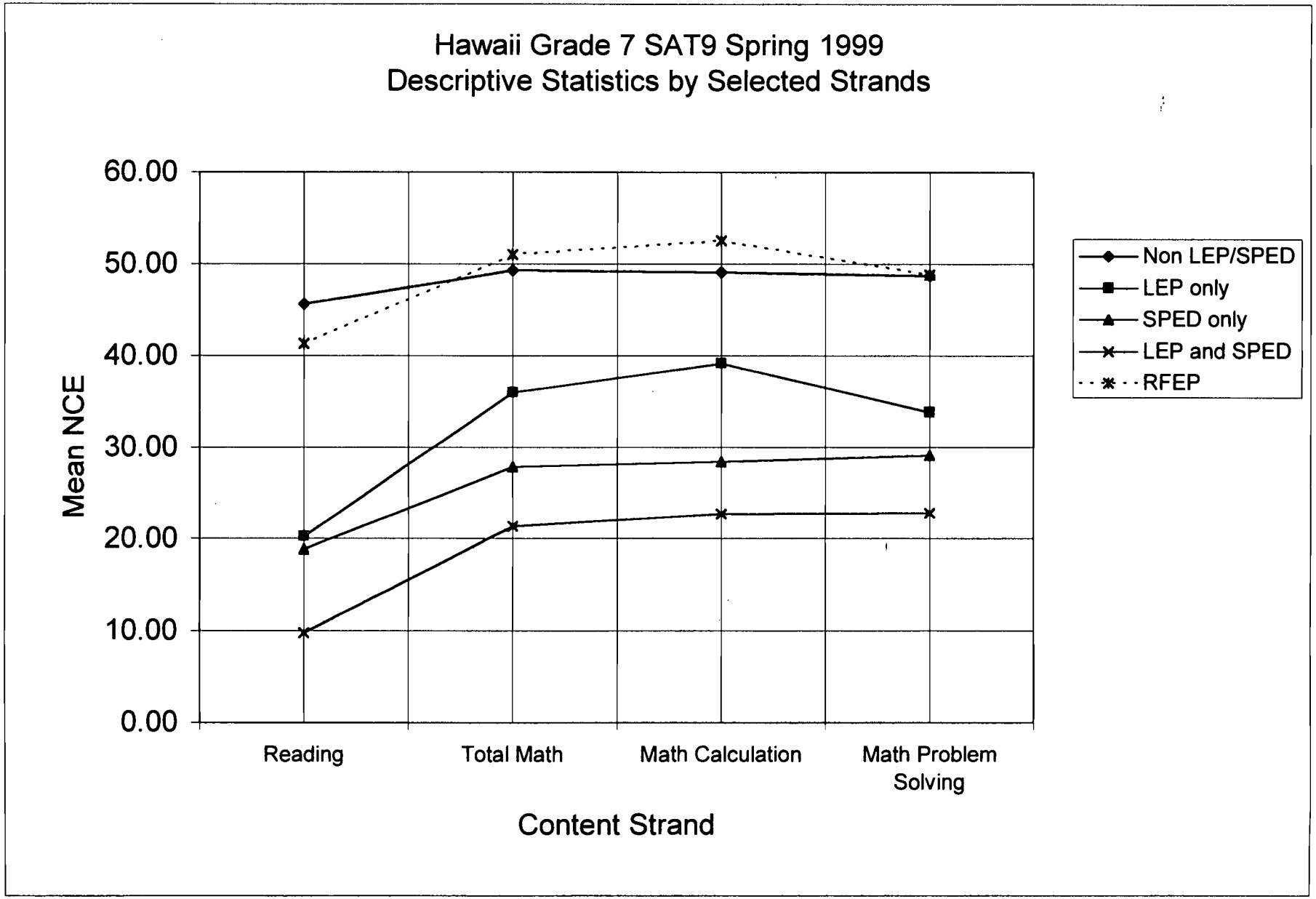
Mean NCE
Reading
Total Math
Math Calculation
Math Problem Solving
Content Strand
Non LEP/SPED
LEP only
SPED only
LEP and SPED
RFEP


Hawaii Grade 7 SAT9 Spring 1999
Descriptive Statistics by Selected Strands
60.00
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10.00
0.00
Mean NCE
Reading
Total Math
Math Calculation
Math Problem Solving
Content Strand
Non LEP/SPED
LEP only
SPED only
LEP and SPED
RFEP

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