

**Evaluation of
Waterford Early Reading Program
Hacienda la Puente Unified School District
Whittier City School District
Los Angeles County, CA**

Program Year 1997-98

**Prepared for
Technology for Results in Elementary Education
Los Angeles, CA**

by

**Research, Assessment & Measurement, Inc.
Baltimore, Maryland**

**Evaluation of
Waterford Early Reading Program
Hacienda la Puente and Whittier School Districts
Los Angeles, California**

EXECUTIVE SUMMARY

In December 1997, TREE contracted with Research, Assessment and Measurement, Inc. (RAM.) to conduct a three-year longitudinal study of the effectiveness and impact of the Waterford Early Reading Program in the Hacienda la Puente Unified and Whittier City Elementary school districts. The following is a summary of our findings for program year 1997-98.

Evaluation Objective:

To determine the extent to which Kindergarten students participating in the Waterford Program have attained the following essential skills that children need in order to succeed at reading:

- Letter recognition
- Phonological awareness
- Concepts about print

Methodology:

The study population of 558 Kindergarten students consists of 231 Waterford participants from the Hacienda la Puente Unified school district, 150 Waterford participants from the Whittier City district, and 177 non-Waterford participants from six schools in both districts. Out of this population, 372 Waterford and 45 non-Waterford students were tested in both March and June. The remaining 141 students were tested only in June.

The June test consisted of eight subtests from the Emergent Literacy Development Inventory (ELDI) designed by R.A.M., Inc., to assess students' levels of development in the following dimensions of emergent literacy:

- Letter recognition: Identifying capital letters and lower case letters
- Phonological awareness: Identifying letter sounds, rhyming words, identifying initial phonemes, identifying final phonemes, and sound-letter matching
- Concepts about print: Understanding of the function and organization of print

Scores from the eight subtests were aggregated to provide a measure of students' end-of-year performance for each of these three domains. In addition, we computed each student's weighted average for all eight subtests (Total Score) to provide a simple, clear measurement of achievement in all skills tested.

Findings:

- On average, the Waterford Program was used in the classrooms for one-half of the school year. Even then, the end-of-year performance of Waterford participants in the three key dimensions of emergent literacy development was impressive:
 - Letter recognition: Average score of 91.2 percent
 - Phonological awareness: Average score of 78.8 percent
 - Concepts about print: Average score of 90.7 percent
 - Total Score: Average of 85.2 percent

- Waterford participants' end-of-year average achievement scores were compared with those of non-Waterford students from six schools in the same two districts, some reportedly among the best schools in the districts. Waterford participants' averages were significantly higher ($p < .05$) in two of the three dimensions (letter recognition and phonological awareness) and slightly but not significantly higher in the third dimension (concepts about print). This finding is particularly noteworthy since several researchers suggest letter recognition is the single most powerful predictor of success in early reading achievement, followed closely by phonemic awareness.
- The end-of-year average Total Score of 85.2 for Waterford students was significantly higher ($p .0008$) than the average Total Score of 79.6 for non-Waterford students.
- In addition to significant differences between the two groups' average scores, we found significant differences between the two groups with regard to the proportion of students who demonstrated full mastery of the skills tested (Total Score of 96 to 100). In the Waterford group, the proportion of students (39.6 percent) who demonstrated this level of mastery was almost twice that of the comparison group (22.0 percent). In each of the three domains, the proportion of students who demonstrated full mastery of the skills tested was greater in the Waterford group than in the comparison group. In letter recognition and phonological awareness, these differences were significant at $p < .05$.

- Growth measures of Waterford students with limited English proficiency (LEP students) were compared with those of non-LEP students in the Waterford group to gauge the effectiveness of the program in helping LEP students close the gap between themselves and their English-proficient cohort. Between the first and second tests, the LEP group gained twice as much as the English proficient group in two of the three dimensions and almost twice as much in the Total Score. In the relatively short interval between the two tests, the LEP group had narrowed the gap considerably. In letter recognition, they came close to closing the gap, ending the year with an average score less than 5 percent lower than that of their English-proficient cohort.
- On average, second grade students in the non-Waterford schools participating in our study performed considerably better than those in the Waterford schools in recent Statewide standardized reading tests. Kindergarten students from the comparison schools might therefore be expected to perform better on reading-related measures than those in the Waterford group. The fact that we observed the reverse can be seen as a testimony to the effectiveness of the Waterford program.
- An analysis of Waterford students' performance on the February/March test relative to time on task indicated that for every 1,000 minutes' use of the Waterford Program, the average expected gain was 49 percent in letter recognition and 30 percent in phonological awareness. Given that the Waterford program was in use for approximately one-half of the 1997-98 school year, we believe that if the program had been fully implemented for the entire year, Waterford students' achievement profile would be even more impressive.

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Introduction:

In fall 1997, Technology for Results in Elementary Education (TREE) received a grant from the Rio Hondo Memorial Foundation to implement the Waterford Early Reading Program in 14 Kindergarten classes in the Hacienda la Puente Unified and Whittier City Elementary School Districts in Los Angeles County, California. The Waterford Program is a CD-ROM based, interactive early reading instructional program designed to help Kindergarten children develop the emergent literacy skills they need to enter the first grade ready to become successful readers. The Program was implemented in six classes in the Whittier City District and eight in the Hacienda la Puente District in November and December 1997. The grant application stipulated that a longitudinal study be conducted to determine the immediate impact of the Program on participants at the end of their Kindergarten year as well as the sustained effect as participants progress through the first and second grades.

Program Objectives:

While it is widely recognized that reading is the most important academic skill and the foundation for all academic learning, national and State-wide reports indicate that a majority of California's children cannot read at basic levels. The urgency of this problem led to the 1996 California Reading Initiative, a comprehensive strategy to reform reading instruction in California's public schools. As part of this Initiative, the State has recently revised its Language Arts Content Standards for Kindergarten. The new State-wide standards call for Kindergarten curricula that enable children to develop the emergent literacy skills they need to enter the first grade ready to read. These standards are based on 20 years of research that shows the following skills are critical to children's success in learning to read:

- Letter recognition: Reading depends first and foremost on visual letter recognition. Until children can discriminate the shape of one letter from another, they cannot grasp the idea that all words are made of sequences and patterns of letters. Children's ability to recognize the letters of the alphabet has been shown to be a powerful predictor of early reading success.
- Phonological awareness: the understanding that spoken words and syllables are made up of sequences of elementary speech sounds. This understanding is essential for learning to read an alphabetic language because it is these elementary sounds, or *phonemes*, that letters represent. Research has shown that phonological awareness, like letter recognition, is a powerful predictor of success in learning to read.
- Concepts about print: Awareness of the forms, functions, and uses of print provides not only the motivation to read but the foundation upon which reading and writing skills are built. Children's performance on tests designed to measure concepts about print has been found to predict future reading achievement and to be strongly related to other, more traditional measures of reading readiness.

The development of children's letter recognition skills, phonological awareness, and understanding of print concepts are primary objectives of the Waterford Early Reading Program. The Waterford curriculum consists of more than 900 activities designed to provide daily, systematic, individualized instruction in these skills. To support this instruction, the Waterford Program provides materials to help teachers integrate the program into their classroom activities. In addition, the Waterford program supports the home-school connection by providing books and videotapes for children and parents to use and keep at home.

Evaluation Questions:

In December 1997, TREE contracted with R.A.M., Inc., to conduct an independent assessment of the effectiveness of the Waterford Program. For program year 1997-98, the objectives of the evaluation were to answer the following questions:

1. To what extent have Waterford participants achieved the following skills that they need to enter the first grade prepared for success in learning to read?

Letter recognition
Phonological awareness
Understanding of print concepts

2. How does the end-of-year performance of Waterford participants compare with that of a comparison group of non-Waterford participants from the same school districts?
3. To what extent has the Waterford Program been effective in helping students with limited English proficiency develop the necessary emergent literacy skills?

Methodology:

Study Population: The study population of 558 Kindergarten students consists of 381 Waterford participants and 177 non-Waterford participants (the comparison group) drawn from the Hacienda la Puente Unified and Whittier City Elementary School Districts in Los Angeles County. The distribution of the study population by school district is shown in **Table 1** below. Demographic characteristics of the population are presented in **Table 2**.

Table 1. Study Population

District	Waterford Group	Comparison Group
Hacienda la Puente	231	121
Whittier	150	56
Total	381	177

Table 2. Demographic Characteristics of Study Population

	Waterford Participants*	Comparison Group*
Male	49%	42%
Female	51%	58%
Asian/Pacific Islander	3.9%	17.0%
Hispanic	78.5%	71.9%
African American	1.6%	1.2%
White non-Hispanic	14.7%	7.6%
Other ethnic minority	1.4%	2.4%
Total ethnic minority	85.3%	92.4%
Limited English-Proficient	17.0%	NA

*Percentages shown are based on the number of students for whom data is available. Ethnicity data were not available for 36 of the 177 comparison students and sex data were available for 3 students in this group. Data on English proficiency were not available for 4 of the 381 students in the Waterford group.

Since we do not have detailed statistical information on income and other socioeconomic characteristics of the study population, we examined some demographic characteristics of the schools from which each subset of the study population is drawn. As **Table 3** illustrates, a relatively high proportion of students in both Waterford and comparison schools are recipients of Federal Free or Reduced Price Meals, which are provided to students from low-income families. Both groups of schools enroll high proportions of minority students, which is consistent with the high minority populations

in the Hacienda la Puente and Whittier districts from which they are drawn. The proportion of students with limited English proficiency (LEP students) is higher in the comparison schools than in the Waterford schools (39 percent vs. 27 percent) and the average Kindergarten class size slightly lower.

Table 3. Characteristics of Schools Participating In Waterford Study*

	Waterford Schools (N = 7)	Comparison Schools (N = 6)
AFDC recipients, '97-98	13.6%	19.1%
Percent of students receiving Federal Free or Reduced Price Meals, '97-98	69.2%	60.2%
Ethnic composition, '97-98:		
Asian/Pacific Islander	6.6%	22.0%
Hispanic	74.8%	64.3%
Black non-Hispanic	2.7%	1.3%
White non-Hispanic	14.4%	11.0%
Other ethnic minority	1.6%	1.3%
All ethnic minorities	85.6%	89.0%
LEP Students, '97-98	27%	39%
Average class size, Kindergarten, '96-97	31.8	29.8
Stanford 9 mean scaled 2 nd grade reading score (weighted avg.), spring '98	540.4	566.0
Estimated national percentile rank	16	33 or 34

*Source: California Department of Education (<http://www.cde.ca.gov>)

One difference between the two groups of schools that is particularly relevant to this study is the fact that second grade students in schools from which the comparison

group is drawn performed considerably better than those in schools from which the Waterford group is drawn on the Stanford 9 Reading Test, which was administered in spring 1998 to all students in California. We estimate that the weighted average of the two groups' scaled scores on this test places the schools from which the comparison group is drawn in the 33rd or 34th percentile nationally, compared with the 16th percentile for schools in the Waterford group. Moreover, two of the six schools in the comparison group were among the three highest-scoring schools in their entire district on this test, scoring in the 64th and 66th percentile nationally, which is well above the average for both districts in our study. These figures suggest that we might expect students from the comparison group to out-perform students in the Waterford group on tests of skills related to reading.

Data Collection and Analysis: In February and June 1998, students in both the Waterford and comparison groups were tested using the Emergent Literacy Development Inventory (ELDI), an inventory designed by R.A.M., Inc., to assess children's skill levels in several dimensions of emergent literacy development. Testing procedures are described in the **Appendix**. The Inventory administered in June contained the following eight subtests:

Letter recognition:

- 1) Upper case letter recognition (26 letters)
- 2) Lower case letter recognition (26 letters)

Phonological awareness:

- 3) Sounding out each letter of the alphabet (26 letters)
- 4) Rhyming words (8 items)
- 5) Recognizing initial phonemes (10 items)
- 6) Recognizing final phonemes (10 items)
- 7) Sound-letter matching (5 items)

Concepts about print:

- 8) 12 items that test the child's understanding of how print is organized

For simplicity in analyzing and presenting the findings in this study, we have classified each of the eight subtests as belonging to one of three domains. However, we should point out that many of the skills measured by the ELDI do not fit neatly into discrete categories. To successfully identify the letter sounds, for example, a child must be able to visually discriminate between the letters.

The ELDI administered in the first test (February/March) contained all items in the second test (June) except for letter sounds and sound-letter matching. In the first test, children were also tested in writing their names and reciting the alphabet. Since almost all students demonstrated mastery of these skills, these two subtests were excluded from the second test.

Between the two testing periods, two of the four classes that had been identified as the comparison group were withdrawn from the study and four new classes were added. Of the 54 students in the original comparison group who participated in the February/March test, some have since left the school or were absent for the June test. Consequently, the present comparison group of 177 has only 45 students who took both the February/March and June tests. Since these 45 students constitute only one-fourth of the total comparison group, we do not believe analysis of growth between the two testing periods would give an accurate picture of the relative growth of Waterford and comparison students.

Because the Waterford program was implemented well into the school year, students were not pre-tested at the beginning of the year as is customary in the evaluation of academic programs. By the time the first test was administered, almost two-thirds of the school year had elapsed and the Waterford computers had already been in place for

several months. In addition, the two school districts started the program at different times. For these reasons, our analysis focuses on end-of-year achievement results rather than pre- and post-test results.

Findings:

Evaluation Question 1: To what extent have Kindergarten students participating in the Waterford program achieved mastery of the essential skills in (1) letter recognition, (2) phonological awareness, and (3) concepts about print?

To address this question, we have aggregated each student's subtest scores to produce a single score for each of the three domains. (Again, we point out that this treatment of the data is for simplicity in analyzing and presenting the findings of the study and that emergent literacy skills are not discrete.) Each student's score in **letter recognition** is the average of percent correct responses for the two letter recognition subtests (capital letters and lower case letters). The student's score for **phonological awareness** is the weighted average of percent correct responses for five subtests (letter sound identification, identification of initial phonemes, identification of final phonemes, rhyming words, and sound-letter matching). The score for **concepts about print** is the percent correct responses for the 12 concepts tested. The **Total Score** is the weighted average of the student's scores on all eight subtests (similar to the Grade Point Average), and is used to provide a simple, clear measure of achievement in all skills tested.

Table 4 shows the end-of-year average for both Waterford and comparison groups in each of the three domains of emergent literacy development, as well as the average Total Score for each group. The table shows that by the end of the school year,

the average Waterford student could recognize slightly more than 47 of the 52 upper and lower case letters (91.2 percent), demonstrated a high level of phonological awareness (78.8 percent correct) and knew approximately 11 of the 12 concepts about print tested (90.7 percent). These figures indicate that **on average, Waterford students have made impressive progress toward mastering the emergent literacy skills tested.**

**Table 4. End-of-Year Average Achievement Scores:
Waterford and Comparison Groups**

Skill	Waterford Group (N = 381)	Comparison Group (N = 177)	Difference Significant At p < .05
Letter recognition	91.2	85.9	Yes
Phonological awareness	78.8	71.9	Yes
Concepts about print	90.7	89.7	No
Total Score	85.2	79.6	Yes

Evaluation Question 2: How does the end-of-year achievement of Waterford participants compare with that of students in the comparison group?

Table 4 also allows a comparison of end-of-year average scores for Waterford participants with those of the comparison group. As the table illustrates, the average letter recognition score of 91.2 for Waterford participants was significantly higher than the average of 85.9 for the comparison group. Waterford participants also achieved a significantly higher average score in phonological awareness than students in the comparison group (78.8 vs. 71.9). In concepts about print, the average score for the

Waterford group was higher than that of the comparison group (90.7 vs. 89.7), but this difference was not significant at $p < .05$. The average Total Score of 85.2 for Waterford participants is significantly higher ($p .0008$) than the average of 79.6 for students in the comparison group. These figures indicate that **overall, Waterford participants' end-of-year average performance was significantly better than that of the comparison group.**

In addition to comparing end-of-year average scores for the two groups, we compared the distribution of scores within each group. In **Figs. 1-4**, we compare the proportions of students in each group who demonstrated complete mastery of the skills tested as indicated by scores of 96 to 100 percent. As shown in **Fig. 1**, **the proportion of Waterford students (39.6 percent) who achieved a Total Score in this range was almost twice the proportion of the comparison group (22.0 percent).** In letter recognition and phonological awareness, the proportion of Waterford students who demonstrated complete mastery was also significantly greater (at $p < .05$) than that of the comparison group (**Figs. 2 and 3**). In concepts about print (**Fig. 4**), a greater proportion of Waterford students demonstrated complete mastery of the 12 concepts tested, but this difference was not significant at $p < .05$.

Fig. 1 shows the proportion of students in each group who demonstrated complete mastery as indicated by a Total Score (weighted average for all eight subtests) of 96 to 100 percent. As the figure illustrates, **the proportion of students in the Waterford group who achieved complete mastery (39.6 percent) is almost twice that of the comparison group (22.0 percent).**

Fig. 1
Percent of Students Achieving Complete Mastery (Total Score 96-100):
Waterford Group (N = 381) vs. Comparison Group (N = 177)

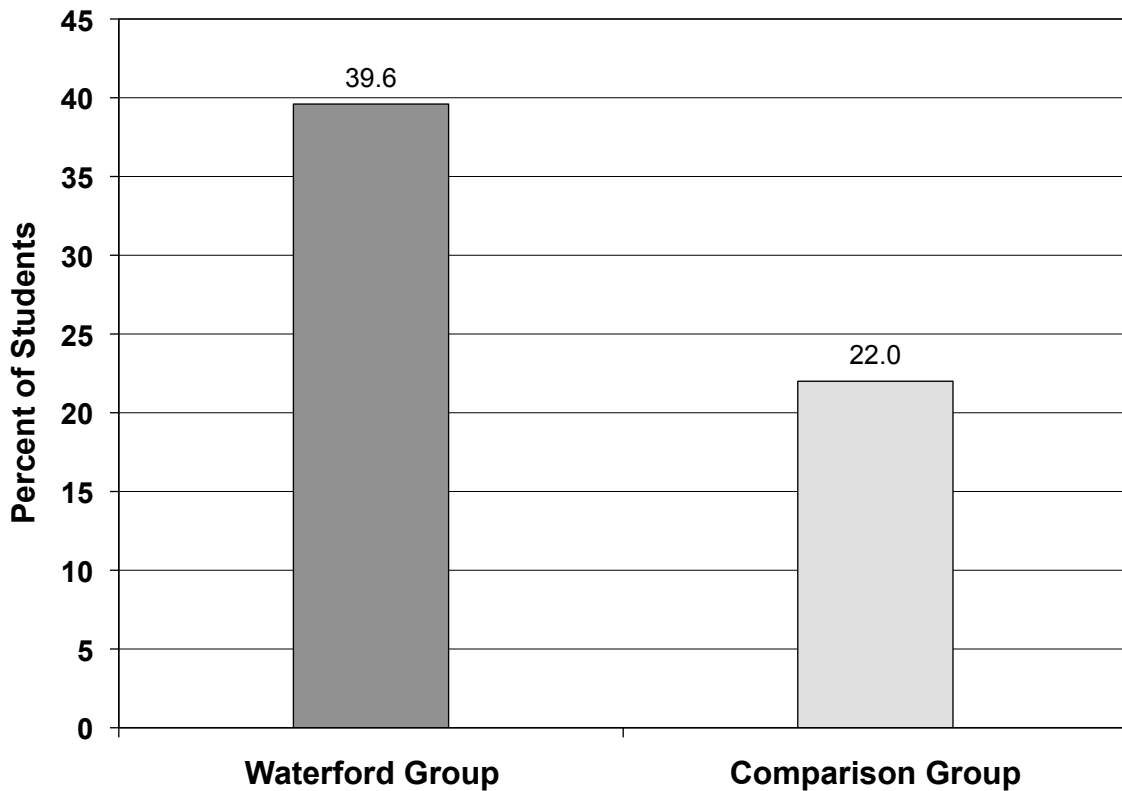


Fig. 2 shows the proportion of students in each group who demonstrated complete mastery (score of 96 to 100 percent) in the letter recognition tests. **The proportion of Waterford students (66.9 percent) who demonstrated complete mastery in letter recognition is significantly greater than the proportion in the comparison group (57.1 percent).**

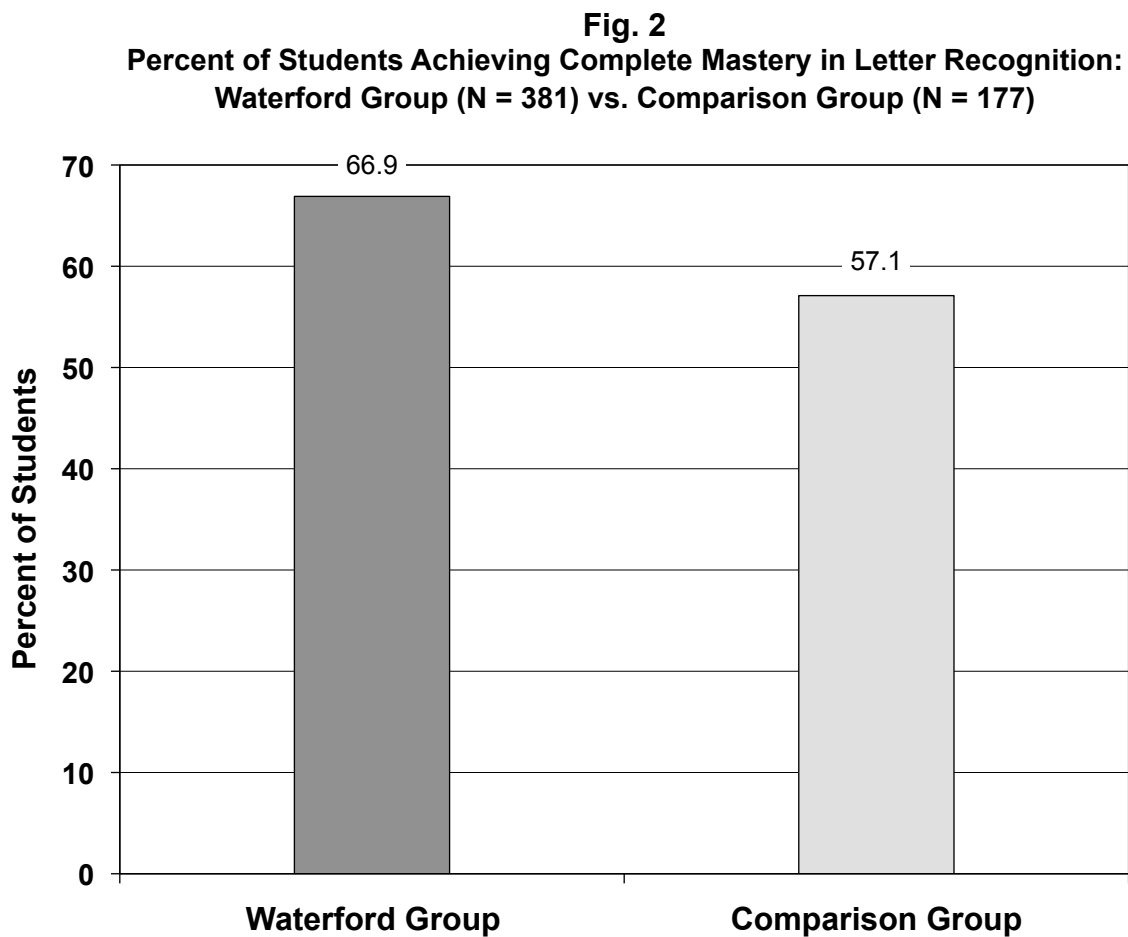


Fig. 3 shows the proportion of students in each group who demonstrated complete mastery (96 to 100 percent) of the skills tested in phonological awareness. **The proportion of Waterford students (29.1 percent) who demonstrated complete mastery in phonological awareness is 72 percent greater than the proportion in the comparison group (16.9 percent).**

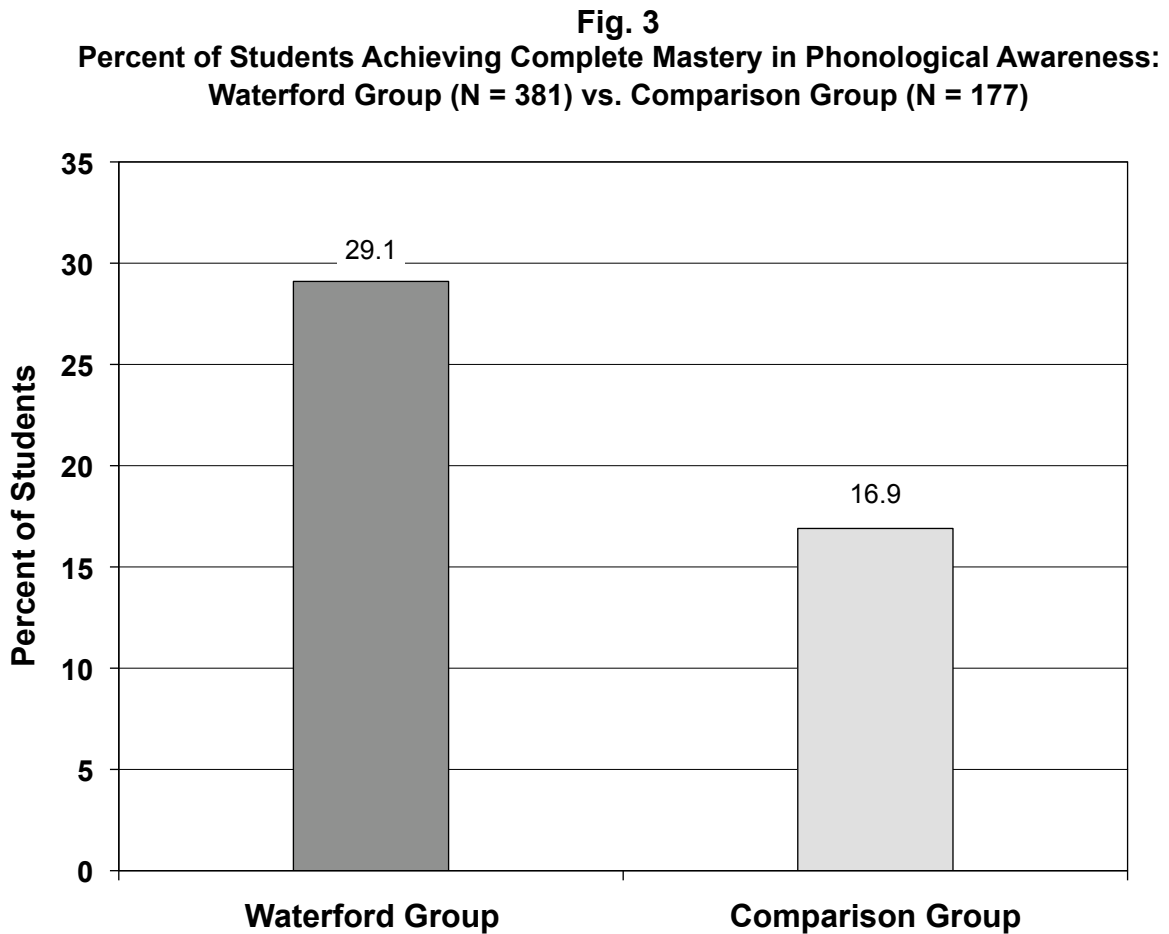
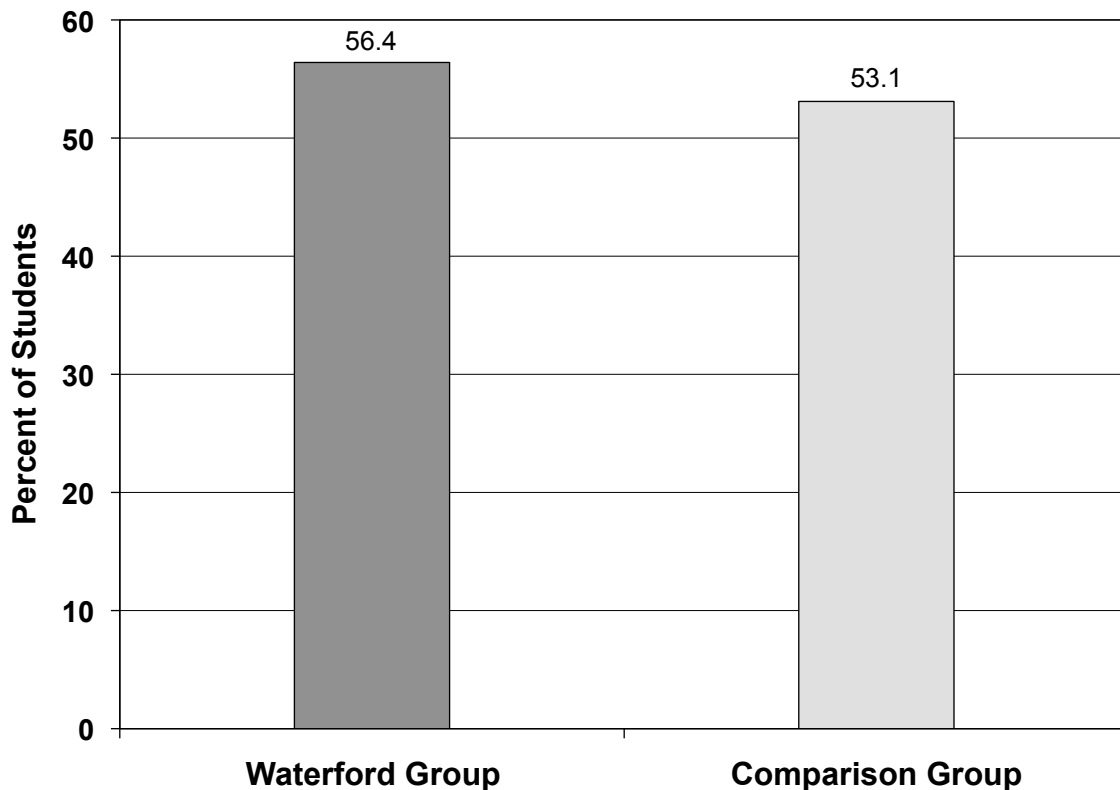


Fig. 4 shows the proportion of students in each group who demonstrated complete mastery with scores of 96 to 100 percent for the 12 concepts about print tested. **The proportion of Waterford students (56.4 percent) who demonstrated complete mastery in concepts about print is greater than that of the comparison group (53.1 percent), but this difference is not significant at $p < .05$.**

Fig. 4
Percent of Students Achieving Complete Mastery in Concepts About Print:
Waterford Group (N = 381) vs. Comparison Group (N = 177)



The end-of-year average scores for both the Waterford and comparison groups in each of the eight subtests are presented in the **Appendix**. Since the five subtests in our **phonological awareness** domain encompass a variety of skill assessments, it should be noted that the Waterford group performed significantly better than the comparison group in three of these subtests (letter sound identification, rhyming, and identifying ending phonemes) and better but not significantly so in one subtest (identifying beginning phonemes). The average scores for the two groups were almost identical in one subtest (sound-letter matching). The most pronounced difference between the two groups' performance in phonological awareness was in rhyming, where Waterford students' average score was 28.5 percent higher than that of the comparison group.

Evaluation Question 3: To what extent has the Waterford Program been effective in helping students with limited English proficiency develop the necessary emergent literacy skills?

Our findings in relation to this question need to be viewed in light of the following considerations:

- By the time the first test was administered, almost two-thirds of the school year had elapsed and most students had already achieved a good deal of growth in emergent literacy skills. In capital letter recognition, for example, Waterford students averaged 83.4 percent correct in the February/March test. While their end-of-the-year average of 93.0 is impressive, it represents only an 11 percent increase over their first test score. Even if all students in this group had achieved perfect scores in the second test, it would represent only a 19.9 percent increase over their first test score.

- The time interval between the administration of the two tests was less than one-third of the school year. Given this short time interval, we could not realistically expect students to demonstrate a great deal of growth.

With the above caveats in mind, we examined the relative growth of limited English proficient (LEP) students and English proficient (EP) students in the Waterford group to determine the extent of support the Waterford program provides for the emergent literacy development of LEP students. Since we did not have complete information on the LEP classification of students in the comparison group, we were not able to make comparisons between end-of-year achievement of LEP populations in the Waterford and non-Waterford groups. **Table 5** shows the growth of both LEP and EP students in the Waterford group in the three domains of emergent literacy skills.

**Table 5. Growth of LEP and non-LEP Waterford Participants
Between the Two Test Periods**

	EP (N = 307)*	LEP (N = 62)*
	Avg. % Correct	Avg. % Correct
Letter recognition:		
Test 1	82.9	72.2
Test 2	92.0	87.9
% change	11.0	21.7
Phonological awareness:		
Test 1	61.6	35.9
Test 2	72.6	56.0
% change	17.9	41.8
Concepts about print:		
Test 1	77.6	61.6
Test 2	93.1	78.5
% change	20.0	27.6
Total Score:		
Test 1	78.8	64.1
Test 2	87.1	76.3
% change	10.5	19.0

*Includes only students who took both tests.

The following observations are noteworthy:

- Overall, the LEP group attained almost twice as much growth as the EP group. The greatest growth of the LEP group was in phonological awareness, where LEP students gained 41.8 percent compared with 17.9 percent for EP students.

- In letter recognition, LEP students grew 21.7 percent and almost closed the gap between themselves and their EP cohort, ending the year with an average score less than 5 percent lower than that of the EP group.
- A similar growth pattern can be observed in phonological awareness and concepts about print: LEP students achieved greater growth and narrowed the achievement gap between themselves and the EP group. In the short time interval between the two tests, the LEP students in our study reduced the overall achievement gap between themselves and their EP cohort from 23 percent to 14 percent.

Conclusions:

On average, the Waterford Program was used for one-half of the school year in the Hacienda la Puente and Whittier school districts. Our findings suggest that even in this short time period, the Waterford Program has been effective in helping participants attain the emergent literacy skills they need to enter the first grade ready to learn to read.

- By the end of the school year, Waterford students' average achievement scores in three essential dimensions of emergent literacy development were impressively high: 91.2 percent in letter recognition, 78.8 percent in phonological awareness, and 90.7 percent in concepts about print. The average Total Score (weighted average of all subtest scores) for Waterford participants was 85.2.
- Waterford participants' end-of-year average achievement scores were compared with those of non-Waterford students from six schools in the same two districts.

Waterford participants' average Total Score (weighted average for all subtests) of 85.2 was significantly higher than the comparison group's average of 79.6. In each of the three domains of emergent literacy development (letter recognition, phonological awareness, and concepts about print), the average score for Waterford students was higher than that of the comparison group. In phonological awareness and letter recognition, these differences were significant at $p < .05$.

- In addition to significant differences between the two groups' average scores, we found significant differences between the two groups with regard to the proportion of students who demonstrated full mastery of the skills tested (Total Score of 96 to 100). The proportion of students in the Waterford group (39.6 percent) who demonstrated this level of mastery was almost twice that of the comparison group (22.0 percent). In each of the three domains, the proportion of students who demonstrated full mastery of the skills tested was greater in the Waterford group than in the comparison group. In letter recognition and phonological awareness, these differences were significant at $p < .05$.
- Growth measures of Waterford students with limited English proficiency (LEP students) were compared with those of non-LEP Waterford participants to gauge the effectiveness of the program in helping LEP students close the gap between themselves and their English-proficient cohort. Between the first and second tests, the LEP group gained twice as much as the English-proficient group in two of three domains of emergent literacy skills and almost twice as much in the Total Score for

all subtests. In the relatively short interval between the two tests, the LEP group had narrowed the gap considerably.

- Results of the most recent Statewide standardized tests show that on the average, second grade students in the comparison schools performed considerably better in reading than those in the Waterford schools. Kindergarten students from the comparison schools might therefore be expected to perform better on reading-related measures than those in the Waterford group. The fact that we observed the reverse can be seen as a testimony to the effectiveness of the Waterford program.

Significance of Findings:

One of the most significant findings of our study is the difference between the proportion of students in the Waterford and comparison groups (39.6 percent vs. 22.0 percent) whose Total Scores were in the range of 96 to 100 percent. To appreciate the practical implication of this difference, we need to translate it into numbers. In a population of 4,000 Kindergarten students, for example, use of the Waterford program could potentially increase the number of students who achieve full mastery of the skills tested by more than 700 students.

As with any educational intervention, an important factor that may profoundly influence outcomes is the level of implementation. Our analysis of students' time on task as of the first test indicated that for every 1,000 minutes spent at the Waterford computer, students could gain 49 percent in letter recognition and 30 percent in phonological awareness. At that time, computer usage logs showed considerable variation between districts, schools, classes, and individual students with respect to the

amount of time students spent working at the computers. Some of this difference is due to the fact that the two districts implemented the program at different times, and some can be attributed to student absenteeism and individual teachers' classroom practices.

Unfortunately we were not able to obtain computer usage logs for a similar analysis of end-of-year results. However, our findings in this study and our experience in evaluating the Waterford program in other school districts suggest that if the program had been consistently implemented throughout the school year, Waterford students' progress would have been considerably greater than what we observed.

Limitations of the Study:

R.A.M., Inc. had no control over the selection of comparison groups, the timing of testing, or the testing procedures. Consequently we cannot confirm the comparability of the two groups in the study population or the reliability of testing procedures. Most children were tested by external testers, and there was considerable variation in test scores related to testers. In the June test, some children were tested by classroom teachers while others were tested by external testers. These factors may influence the reliability of test results.

Appendix

**End of Year Averages in All Subtests:
Waterford and Comparison Students**

Subtest	Waterford Group (N = 381)		Comparison Group (N = 177)		Significance
	Mean	S.D.	Mean	S.D.	
Recognize capital letters	92.9	15.75	87.6	22.38	.0015
Recognize lower case letters	89.6	17.88	84.2	23.18	.0027
Identify letter sounds	79.1	25.31	72.5	31.40	.0082
Identify beginning phoneme	85.6	25.91	81.1	28.60	.0646
Identify final phoneme	75.0	33.84	68.0	36.20	.0273
Rhyming words	68.4	37.80	53.2	40.51	.0000
Concepts about print	90.7	14.70	89.7	14.60	.4669
Sound-letter matching	88.2	23.76	88.5	21.60	.8919
Total Score	85.2	17.12	79.6	20.80	.0008

Testing Procedures

The Emergent Literacy Development Inventory (ELDI) was administered to each child on a one-to-one basis. A script was provided for each subtest, and test administrators were asked to follow the script verbatim. In most cases, tests were administered by external test administrators.

Students were tested between mid-February and mid-March 1998 using the following subtests of the ELDI:

- 1) Write first name: Children were given a crayon or pencil and asked to write their first names directly in the test booklet.
- 2) Recite the alphabet (26 letters): Children were asked to sing the ABC song or recite the alphabet from memory. One point was scored for each letter recited correctly.
- 3) Recognize capital letters (26 letters): Children were shown a Capital Letter Sheet with the letters randomly arranged and asked to name each letter as the test administrator pointed to it. One point was scored for each letter correctly named.
- 4) Recognize lower case letters (26 letters): Children were shown a Lower Case Letter Sheet with the letters randomly arranged and asked to name each letter as the test administrator pointed to it. One point was scored for each letter correctly named.
- 5) Rhyme words (8 items): For each item, children were asked to supply a real or nonsense word that would rhyme with two one-syllable words given. One point was scored for each correct response.
- 6) Identify initial phoneme (10 items): Children were asked to supply the beginning sound in each of ten one-syllable words given. One point was scored for each correct response.
- 7) Identify final phoneme (10 items): Children were asked to supply the ending sound in each of ten one-syllable words given. One point was scored for each correct response.
- 8) Concepts about print (12 items): Children were presented with an age-appropriate book and tested on their understanding of 12 concepts about print, e.g., front, top, title; directional rules (top to bottom, left to right and return); word and letter boundaries; and that print (not pictures) tells the story.

The ELDI was administered again between June 8 and June 23, 1998. The second administration included items (3) through (8) above and two additional subtests:

- 1) Identify letter sounds (26 sounds): This subtest was administered in conjunction with the subtest on recognizing capital letters. Immediately after testing a given capital letter name, the test administrator asked the child to generate sound that letter represents. One point was scored for each letter sound correctly generated.
- 2) Sound-letter matching (5 items): Students were shown a picture of a familiar item (e.g., a sock), which was identified by the test administrator. Students were then asked to select from among four letters the one that would match the beginning sound of the picture. One point was scored for each picture correctly matched.

Fig. 5
Distribution of End-of-Year Total Scores:
Waterford Group (N = 381) vs. Comparison Group (N = 177)

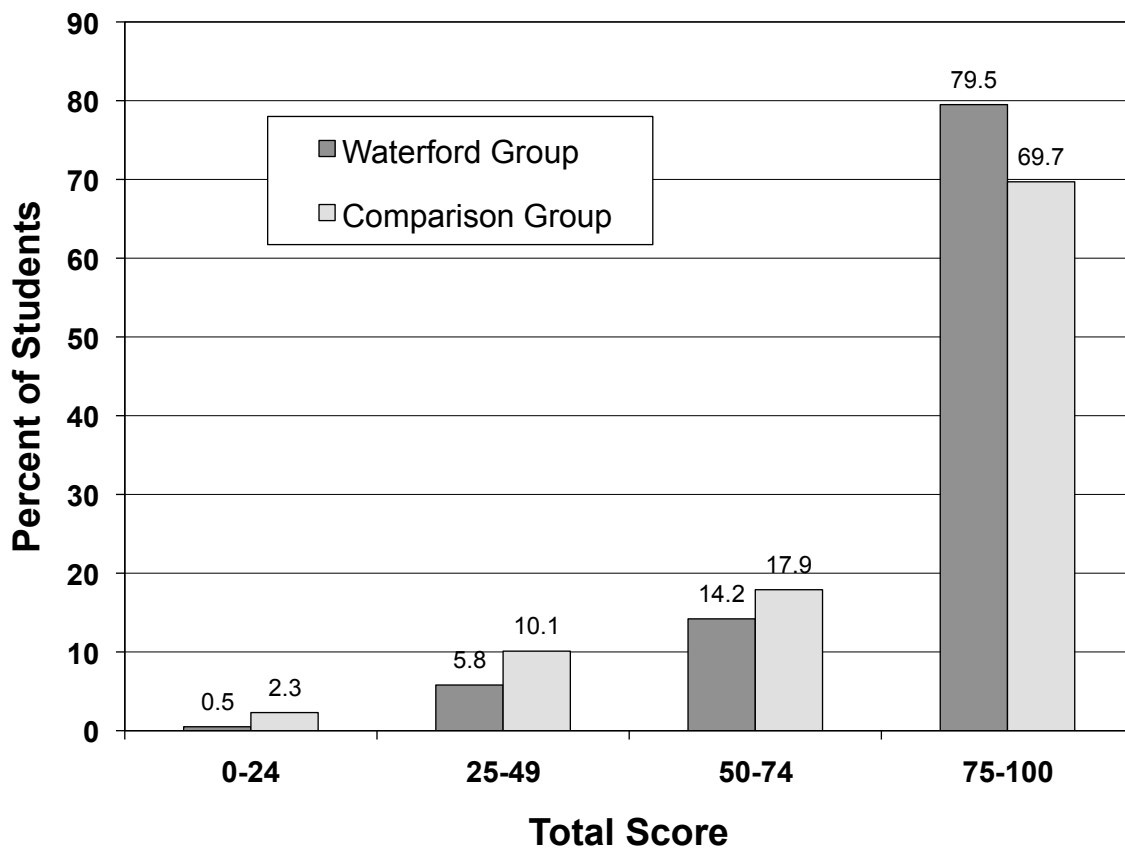


Fig. 6
Distribution of End-of-Year Letter Recognition Scores:
Waterford Group (N = 381) vs. Comparison Group (N = 177)

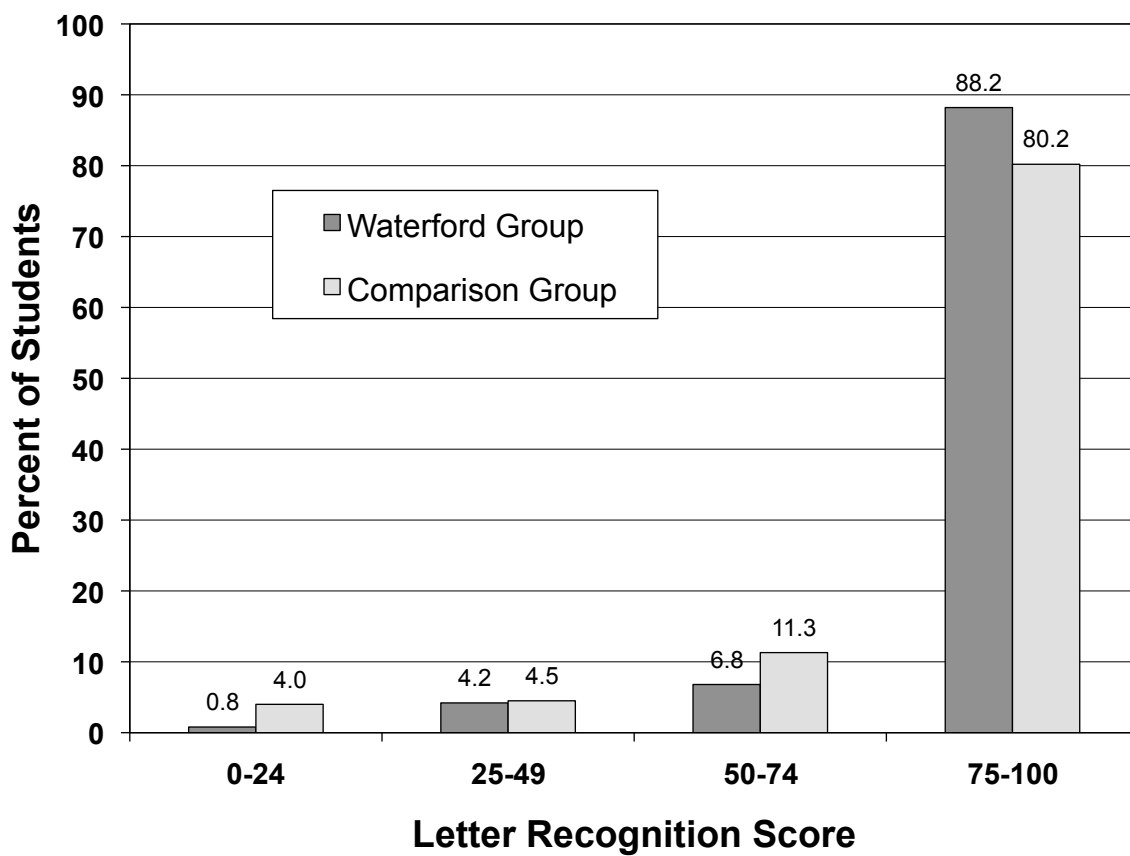


Fig. 7
Distribution of End-of-Year Scores in Phonological Awareness:
Waterford Group (N = 381) vs. Comparison Group (N = 177)

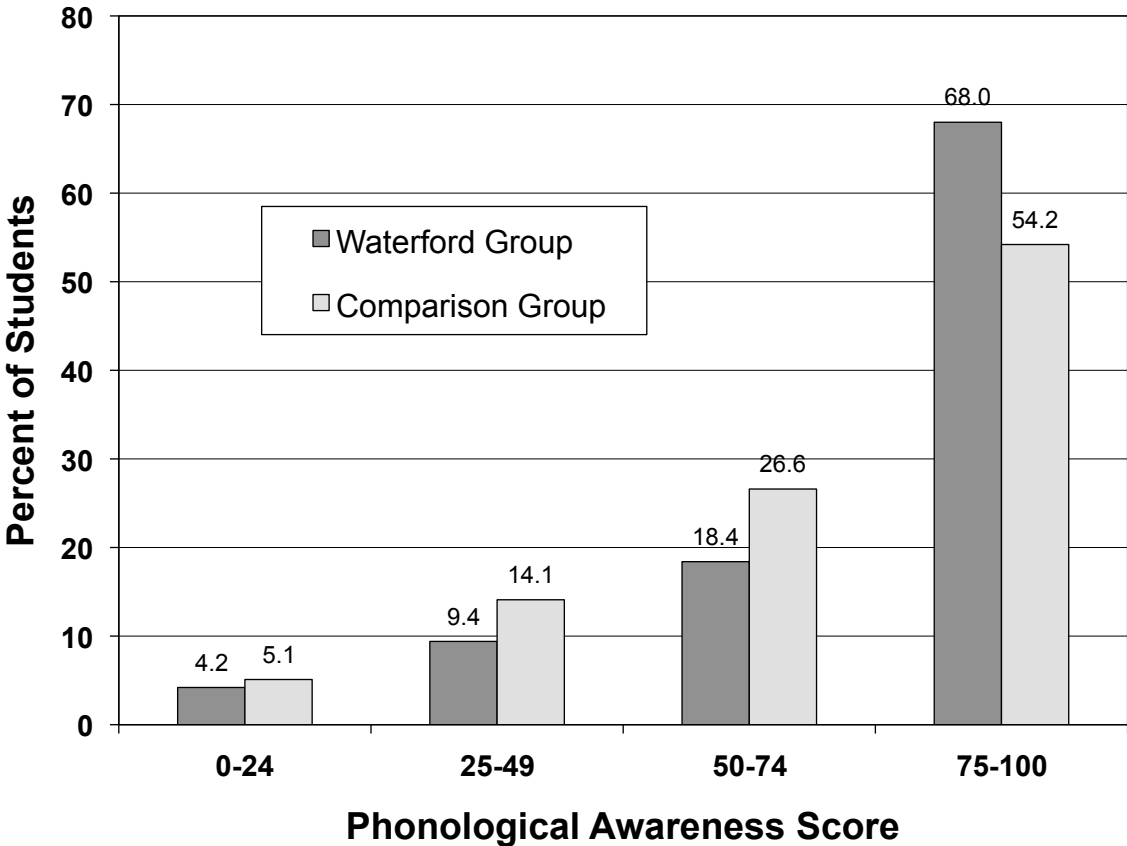


Fig. 8
Distribution of End-of-Year Scores in Concepts About Print:
Waterford Group (N = 381) vs. Comparison Group (N = 177)

