# Experimental Investigations of Instruction and the Language of Instruction with Spanish-speaking English-language Learners

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# Overview of Symposium

- *Randomized Trials of Research-based Instruction*
  - Coleen D. Carlson, University of Houston
- *A Randomized Study of Language of Reading Instruction: First Year Findings*
  - Robert E. Slavin, Johns Hopkins University
- *Project ELLA*
  - Rafael Lara-Alecio, Texas A&M University
- *Discussion*
  - Larry V. Hedges, Northwestern University
- *Funding for all projects provided by Institute of Education Sciences, National Center for Education Evaluation*

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# Randomized Trials of Research-based Instruction for Spanish-speaking ELLs: Effects under two Language of Instruction Models

University of Houston

University of Texas at Austin

Center for Applied Linguistics

University of Miami

project SAILL

SUCCESS THROUGH ACADEMIC INTERVENTIONS IN LANGUAGE & LITERACY

# Research Team and Acknowledgements

- University of Houston, TIMES
  - David Francis, Coleen Carlson, Hector Rivera
- Center for Applied Linguistics
  - Diane August, Debbie Short, Carolyn Ager
- University of Texas – Austin
  - Sylvia Linan-Thompson, Sharon Vaughn
- University of Miami
  - Maria Carlo
- Institute of Education Sciences, NCEE
  - Susan Sanchez, Project Officer

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# Primary Objectives

- ☐ Optimize the language, literacy, and academic outcomes of ELLs

- ☐ Reframe the current debate around language of instruction for ELLs

- ☐ Focus on improving the use of language in instruction in order to optimize achievement outcomes through all approaches

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# Primary Objectives

☐ Develop, implement, and test research enhanced versions of two instruction models

- Structured English Immersion (English Only) model
- Transitional Bilingual Education model

☐ Use random assignment of teachers to provide a strong test of the efficacy of the enhanced versions over current approaches

☐ Use quasi-experimental design to compare the two research enhanced approaches with respect to English and Spanish language outcomes

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# Overview of Study Design

- Brownsville Independent School District

- Two Language of Instruction Models
  - English only (EO: Non-LEP/PD)
  - Transitional Bilingual Education (TBE)

- School continues to implement the general model(s) that the school has adopted

- Study is implemented in one grade per year

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# Study Design: Program Models

- **English Only**

  - Kindergarten: emphasis on English language and literacy development with some Spanish language support

  - Grades 1–3: emphasis on English language and literacy development

- **TBE**

  - K– Grade 1: emphasis on Spanish language and literacy development with English oral language development

  - Grades 2-3: emphasis on Spanish and English language and literacy development

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# Study Design: Assignment

- In 2004-2005, Kindergarten teachers were randomly assigned to: 1) implement the research enhanced instruction (TX), or; 2) continue to implement current practice (CO)

- In 2004-2005, G1 teachers were also randomly assigned to TX and CO so that training could begin for G1 teachers in 2004-2005

- In 2005-2006, students in the K TX classrooms matriculated into the G1 TX classrooms, and K CO into G1 CO classrooms

- Teachers assigned to implement current practice have the option to receive training in the research enhanced methods the following year

# Study Design: Student Sampling

|  |  |  |
|---|---|---|
| 2004-2005 | 2005-2006 | 2006-2007 |

K ⟶ 1 ⟶ 2

1 ⟶ 2

2

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# Overview of Study Design (continued)

☐ Students are assessed in English and in Spanish

☐ Student assessment in the beginning of each school year and at the end of the year

☐ Assessment coordinated with school, but conducted by research team

☐ School, district, and state assessments of language and achievement will be incorporated with permission from parents

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# 3-Tier Model of Instruction

- ☐ Tier I (core instruction)
    - ■ Enhanced Language Enrichment/Esperanza (Grades 1-2)
    - ■ Enhanced McMillan (Grades 1-2)
    - ■ SIOP (Grades K-2)
    - ■ LECTURA (English and Spanish) (Grades K-2)
- ☐ Tier II - Secondary Intervention (Grades K-2)
    - ■ Classroom-based supplemental reading instruction
- ☐ Tier III - Tertiary Intervention (Grade 2)
    - ■ Intensive small-group pull-out intervention

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# The SIOP Model

- ☐ A means for making grade-level academic content (science, social studies, math) more accessible for ELLs while at the same time promoting their English language development.

- ☐ The practice of highlighting key language features and incorporating strategies that make the content comprehensible to students.

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# The SIOP Model

- ☐ Preparation
- ☐ Building Background
- ☐ Comprehensible Input
- ☐ Strategies

- ☐ Interaction
- ☐ Practice & Application
- ☐ Lesson Delivery
- ☐ Review & Assessment

Sheltered Instruction for Academic Achievement   (Echevarria, Vogt, & Short, 2004)

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# Study Questions

☐ Compare outcomes between research enhanced and current practice classrooms within each language of instruction model

☐ Compare outcomes between language of instruction models

☐ Compare
  ■ Language and literacy outcomes
  ■ Outcomes in both English and Spanish
  ■ Outcomes over time

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# Study Questions (continued)

☐ Go beyond simple mean comparisons:

- ■ examine student growth over time
- ■ identify characteristics of students that relate to optimal growth under each instruction model
- ■ identify characteristics of instruction that lead to optimal growth
- ■ examine if/how differences between language outcomes change over time

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# Kindergarten Sample

**Schools** = 14[*] 2 programs

    *English*     *8*

    *Spanish*    *13*

**Teachers** = 55

<u>English</u>

    Treatment   9

    Control     10

<u>Spanish</u>

    Treatment  18

    Control      18

**Students** = 1,192

| Study | Group | Tier 2 No | Tier 2 Yes |
|-------|-------|-----|-----|
| English | TX | 163 | 33 |
| English | CO | 184 | 38 |
| Spanish | TX | 314 | 69 |
| Spanish | CO | 324 | 67 |

Overall Attrition (Fall-Spring) 10.2%

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# Outcome Measures

- ☐ Letter Names and Sounds
- ☐ Phonological Awareness (CTOPP and TOPPS)
- ☐ Woodcock Language Proficiency Battery
  - ■ Picture Vocabulary
  - ■ Letter Word ID
  - ■ Listening Comprehension

# Analyses of Kindergarten Student Outcomes

- ☐ Mixed model ANCOVA (PROC MIXED) with
  - ◼ Pre-test performance as student-level covariate
  - ◼ Selection into Tier 2 as student-level covariate
  - ◼ Treatment as a teacher-level effect
  - ◼ Interaction of Pre-test and Tier-2 status as cross-level effects
  - ◼ Random effects of teacher within school
- ☐ Analyses conducted within each Program Model

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# Results for English Only Program

- ☐ Pre-Test
  - ■ Students in Tier 2 performing significantly lower than those not in Tier 2 on all skills.
  - ■ No Differences between Treatment and Control

- ☐ Post-Test:
  - ■ Shown on next slides

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# English Means and Standard Deviations

| Measure | Group | Tier 2 | Pre-Test Mean | sd | Post-Test Mean | sd | Measure | Group | Tier 2 | Pre-Test Mean | sd | Post-Test Mean | sd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Letter-Name Identification | Comparison | 0 | 20.95 | 7.92 | 23.32 | 5.64 | WLPB: Letter Word Identification | Comparison | 0 | 98.66 | 18.06 | 102.81 | 19.29 |
| | | 1 | 14.91 | 10.21 | 19.50 | 7.86 | | | 1 | 84.53 | 15.73 | 89.84 | 15.71 |
| | Treatment | 0 | 23.12 | 5.05 | 24.43 | 4.27 | | Treatment | 0 | 102.77 | 14.87 | 107.84 | 14.79 |
| | | 1 | 19.40 | 6.82 | 23.35 | 4.52 | | | 1 | 91.76 | 10.03 | 99.41 | 13.96 |
| Letter Sound Identification | Comparison | 0 | 19.99 | 7.58 | 23.27 | 5.02 | WLPB: Picture Vocabulary | Comparison | 0 | 75.37 | 23.52 | 83.29 | 23.92 |
| | | 1 | 11.30 | 9.51 | 19.53 | 8.18 | | | 1 | 69.55 | 24.64 | 77.59 | 18.92 |
| | Treatment | 0 | 21.67 | 6.01 | 24.47 | 2.81 | | Treatment | 0 | 82.93 | 18.94 | 87.92 | 19.45 |
| | | 1 | 16.55 | 7.67 | 22.00 | 5.23 | | | 1 | 75.24 | 12.82 | 78.89 | 14.80 |
| Phonological Awareness | Comparison | 0 | 37.92 | 13.45 | 49.54 | 12.38 | WLPB: Listening Comprehension | Comparison | 0 | 60.37 | 19.96 | 68.98 | 22.88 |
| | | 1 | 24.00 | 7.23 | 34.78 | 8.60 | | | 1 | 52.56 | 19.75 | 58.81 | 21.13 |
| | Treatment | 0 | 42.87 | 15.21 | 54.78 | 14.55 | | Treatment | 0 | 68.68 | 17.98 | 75.51 | 19.22 |
| | | 1 | 27.64 | 8.26 | 40.66 | 11.19 | | | 1 | 53.16 | 17.46 | 63.62 | 14.73 |

# English Program / English Outcomes

| Measure | Effect | Num DF | Den DF | F Value | Pr > F |
|---|---|---|---|---|---|
| **Letter Naming** | **Wave 1** | 1 | 346 | 321.50 | **<.0001** |
| | Tier 2 | 1 | 346 | 0.54 | 0.4637 |
| | **Treatment** | 1 | 17 | 10.41 | **0.0050** |
| | Wave 1 * Tier 2 | 1 | 346 | 0.18 | 0.6687 |
| | **Wave 1 * Treatment** | 1 | 346 | 8.82 | **0.0032** |
| | Tier 2 * Treatment | 1 | 346 | 3.68 | 0.0558 |
| | Wave 1 * Tier 2 * Treatment | 1 | 346 | 2.94 | 0.0874 |
| **Letter Sound Identification** | **Wave 1** | 1 | 346 | 224.91 | **<.0001** |
| | Tier 2 | 1 | 346 | 1.38 | 0.2401 |
| | **Treatment** | 1 | 17 | 5.39 | **0.0330** |
| | Wave 1 * Tier 2 | 1 | 346 | 1.48 | 0.2251 |
| | **Wave 1 * Treatment** | 1 | 346 | 5.04 | **0.0254** |
| | Tier 2 * Treatment | 1 | 346 | 0.12 | 0.7329 |
| | Wave 1 * Tier 2 * Treatment | 1 | 346 | 0.04 | 0.8363 |

For all other measures, there were no main effects or interactions involving TX.

**EARLY ENGLISH PROGRAM**
**ENGLISH**
**LETTER NAMING**



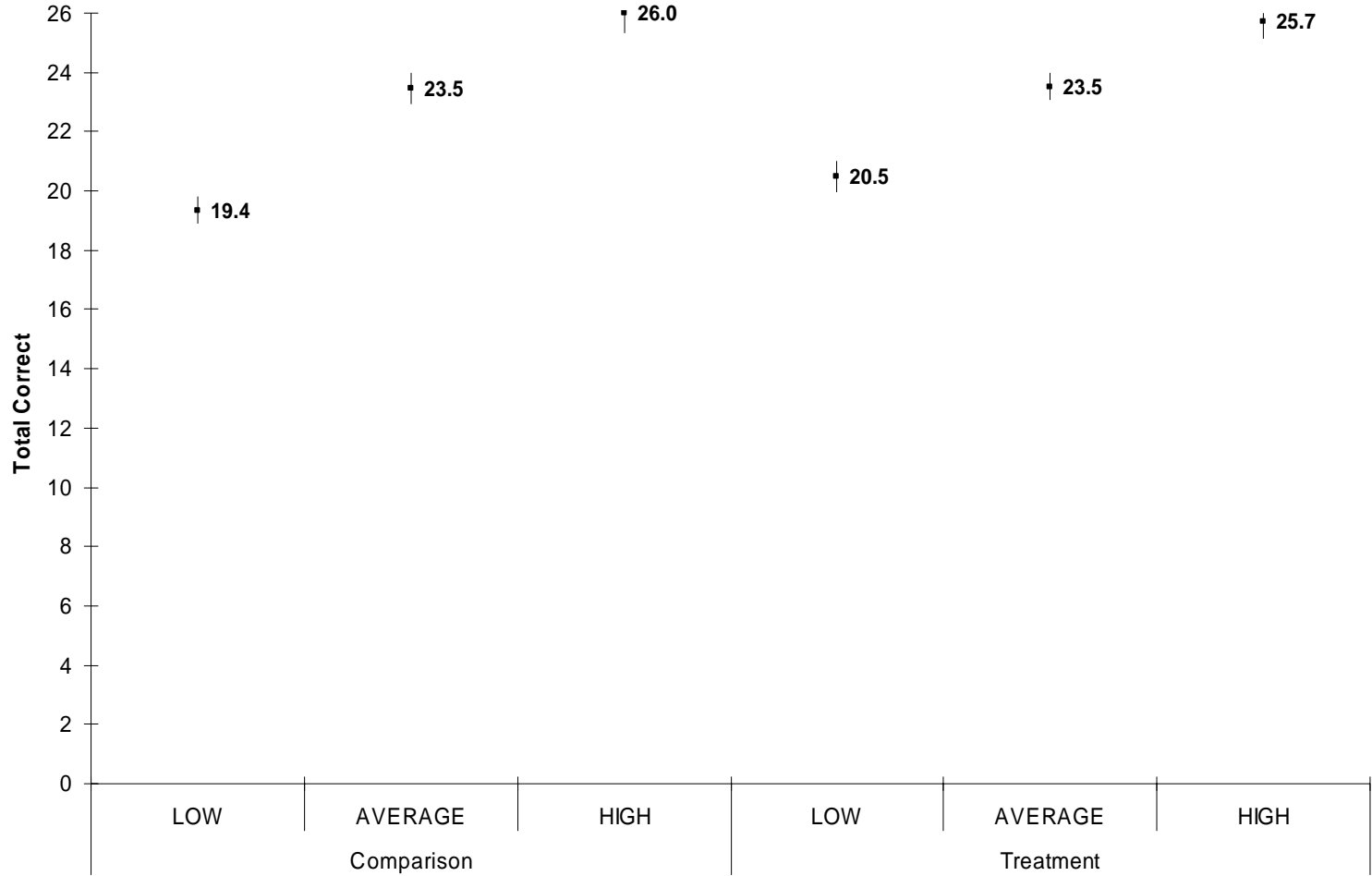| | Comparison | | | Treatment | | |
|---|---|---|---|---|---|---|
| | LOW | AVERAGE | HIGH | LOW | AVERAGE | HIGH |
| Total Correct | 18.5 | 23.5 | 26.0 | 20.2 | 23.7 | 25.8 |

Main Effect: Wave 1 (p<.001)
Main Effect: Treatment Group (p<.03)
**Interaction:  Wave 1 * Treatment Group  (p<.02)**

**EARLY ENGLISH PROGRAM**
**ENGLISH**
**LETTER SOUND IDENTIFICATION**

Total Correct

26 — 26.0
24 — 23.5          23.5
22
20 — 20.5
      19.4
18

LOW    AVERAGE    HIGH    LOW    AVERAGE    HIGH
        Comparison                    Treatment

# Variance Components for English-Only Instruction

| Measure | Covariates Only | | | Treatment Plus Covariates | | |
|---|---|---|---|---|---|---|
| | Residual | Teacher | ICC | Residual | Teacher | ICC |
| Letter Name | 10.95 | 0.54 | 0.05 | 10.60 | 0.34 | 0.03 |
| Letter Sounds | 9.87 | 1.27 | 0.13 | 9.71 | 0.98 | 0.10 |
| PA | 67.50 | 7.77 | 0.12 | 65.88 | 7.10 | 0.11 |
| WLPB: LC | 190.43 | 92.22 | 0.48 | 184.41 | 90.12 | 0.49 |
| WLPB: LW | 88.83 | 18.67 | 0.21 | 86.17 | 15.26 | 0.18 |
| WLPB: PV | 123.90 | 16.12 | 0.13 | 119.94 | 18.74 | 0.16 |

# Results for Transitional Bilingual Education Program – Spanish Outcomes

☐ Pre-Test:

■ Students in Tier 2 performing significantly lower than those not in Tier 2 on all skills.

■ No Differences Between Treatment and Control

☐ Post-program

■ Shown on next slides

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# Spanish Means and Standard Deviations

| Measure | Group | Tier 2 | Pre-Test Mean | sd | Post-Test Mean | sd | Measure | Group | Tier 2 | Pre-Test Mean | sd | Post-Test Mean | sd |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Letter-Name Identification | Comparison | 0 | 22.11 | 8.10 | 26.78 | 4.89 | WLPB: Letter Word Identification | Comparison | 0 | 101.26 | 20.27 | 117.44 | 25.68 |
| | | 1 | 14.18 | 9.24 | 18.97 | 9.72 | | | 1 | 84.63 | 14.49 | 86.71 | 17.47 |
| | Treatment | 0 | 21.22 | 8.33 | 25.64 | 5.96 | | Treatment | 0 | 101.22 | 21.36 | 112.82 | 25.73 |
| | | 1 | 14.06 | 9.42 | 20.24 | 8.41 | | | 1 | 84.46 | 14.41 | 90.08 | 16.61 |
| Letter Sound Identification | Comparison | 0 | 22.45 | 7.51 | 26.87 | 5.44 | WLPB: Picture Vocabulary | Comparison | 0 | 80.32 | 24.78 | 87.38 | 28.29 |
| | | 1 | 12.49 | 9.07 | 18.05 | 10.14 | | | 1 | 64.11 | 27.22 | 65.45 | 26.17 |
| | Treatment | 0 | 20.56 | 8.89 | 25.74 | 6.12 | | Treatment | 0 | 78.22 | 27.39 | 85.17 | 32.41 |
| | | 1 | 11.41 | 8.77 | 18.66 | 9.18 | | | 1 | 64.02 | 17.93 | 68.90 | 20.35 |
| Phonological Awareness | Comparison | 0 | 36.69 | 14.35 | 52.40 | 17.53 | WLPB: Listening Comprehension | Comparison | 0 | 80.71 | 17.57 | 84.72 | 18.45 |
| | | 1 | 23.86 | 8.13 | 32.21 | 13.22 | | | 1 | 66.96 | 24.25 | 66.54 | 25.44 |
| | Treatment | 0 | 37.31 | 15.74 | 50.45 | 16.95 | | Treatment | 0 | 79.18 | 18.03 | 84.82 | 19.28 |
| | | 1 | 24.21 | 7.14 | 32.89 | 11.57 | | | 1 | 68.34 | 18.54 | 73.44 | 16.63 |

# Spanish Program / Spanish Outcomes

| Measure | Effect | Num DF | Den DF | F Value | Pr > F |
|---|---|---|---|---|---|
| **Letter Naming** | **Wave 1** | 1 | 620 | 516.79 | **<.0001** |
| | **Tier 2** | 1 | 620 | 44.81 | **<.0001** |
| | Treatment | 1 | 34 | 3.02 | 0.0915 |
| | **Wave 1 * Tier 2** | 1 | 620 | 37.06 | **<.0001** |
| | Wave 1 * Treatment | 1 | 620 | 2.32 | 0.1280 |
| | **Tier 2 * Treatment** | 1 | 620 | 8.77 | **0.0032** |
| | **Wave 1 * Tier 2 * Treatment** | 1 | 620 | 6.30 | **0.0123** |
| **Letter Sound Identification** | **Wave 1** | 1 | 616 | 379.68 | **<.0001** |
| | **Tier 2** | 1 | 616 | 41.23 | **<.0001** |
| | Treatment | 1 | 34 | 4.33 | 0.0450 |
| | **Wave 1 * Tier 2** | 1 | 616 | 31.45 | **<.0001** |
| | **Wave 1 * Treatment** | 1 | 616 | 10.63 | **0.0012** |
| | Tier 2 * Treatment | 1 | 616 | 0.00 | 0.9920 |
| | Wave 1 * Tier 2 * Treatment | 1 | 616 | 1.59 | 0.2084 |

For all other measures, there were no main effects or interactions involving TX.

Main Effect: Wave 1 (p<.0001)
Main Effect: Tier 2 (p<.0001)
Interaction:  Wave 1 * Treatment Group  (p<.0001)
Interaction:  Wave 1 * Tier 2 (p<.003)
**Interaction:  Wave 1 * Treatment Group * Tier 2 (p<.01)**

**BILINGUAL PROGRAM
SPANISH
LETTER NAMING**

**Total Correct**

30 —
28 —
26 —
24 —
22 —
20 —
18 —
16 —
14 —
12 —
10 —
8 —
6 —
4 —
2 —
0 —

23.2
25.9
28.7
14.0
20.8
27.7
21.1
25.4
29.8
14.1
20.6
27.0

| LOW | AVERAGE | HIGH | LOW | AVERAGE | HIGH | LOW | AVERAGE | HIGH | LOW | AVERAGE | HIGH |

Tier 2 = 0          Tier 2 = 1          Tier 2 = 0          Tier 2 = 1

Comparison                                    Treatment
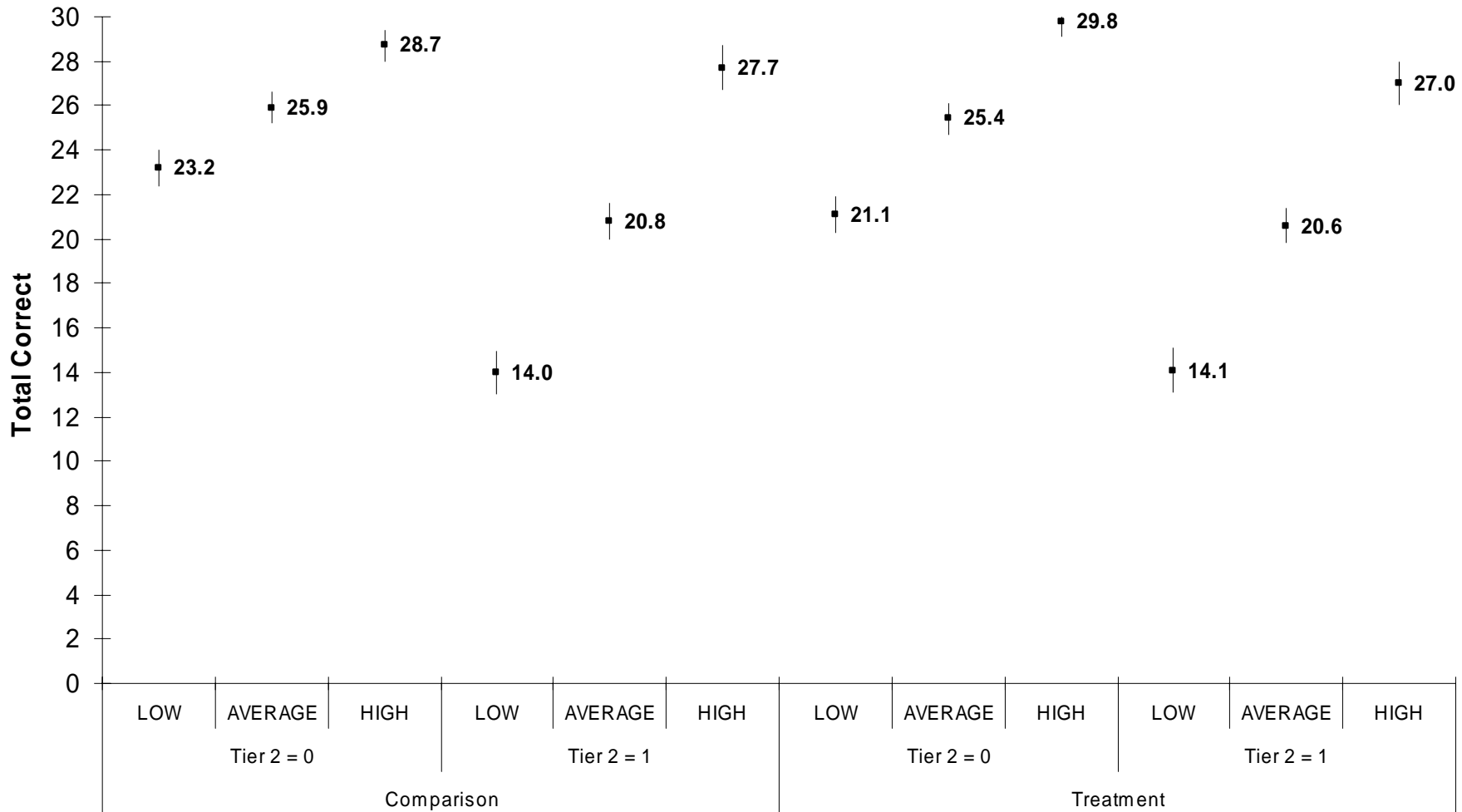
Main Effect: Wave 1 (p<.001)
Main Effect: Tier 2 (p<.001)
Interaction:  Wave 1 * Treatment Group  (p<.001)
**Interaction:  Wave 1 * Tier 2 (p<.001)**

**BILINGUAL PROGRAM
SPANISH
LETTER SOUND IDENTIFICATION**
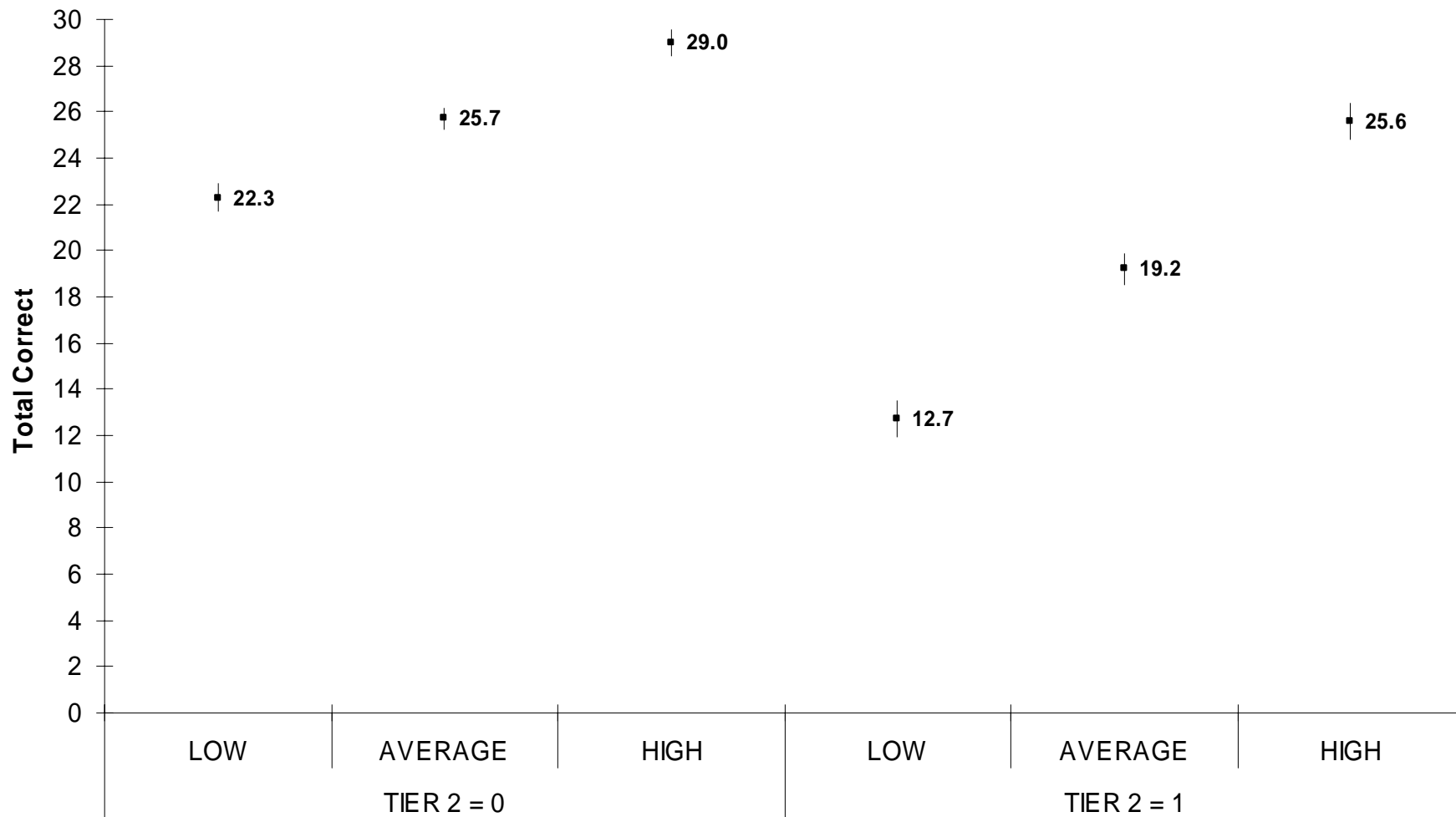
**Total Correct**

30
28 — 29.0
26 — 25.7 — 25.6
24
22 — 22.3
20
18 — 19.2
16
14
12 — 12.7
10
8
6
4
2
0

LOW          AVERAGE          HIGH          LOW          AVERAGE          HIGH

TIER 2 = 0                                    TIER 2 = 1

Main Effect: Wave 1 (p<.0001)
Main Effect: Tier 2 (p<.0001)
**Interaction:  Wave 1 * Treatment Group  (p<.0001)**
Interaction:  Wave 1 * Tier 2 (p<.0001)

**BILINGUAL PROGRAM
SPANISH
LETTER SOUND IDENTIFICATION**
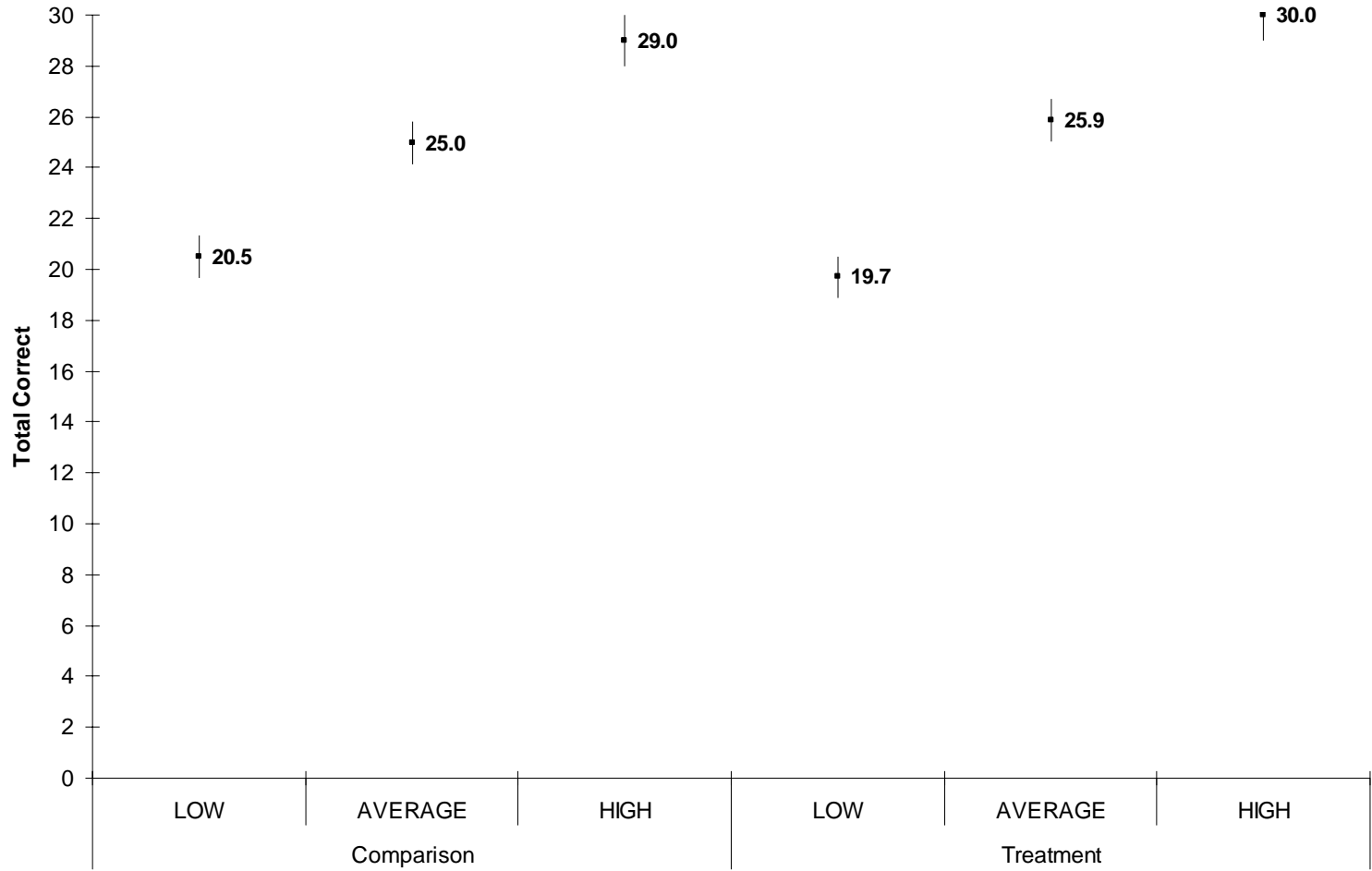
# Variance Components for Transitional Bilingual Instruction

| Measure | Covariates Only | | | Treatment Plus Covariates | | |
|---|---|---|---|---|---|---|
| | Residual | Teacher | ICC | Residual | Teacher | ICC |
| Letter Name | 15.98 | 7.97 | 0.50 | 14.59 | 7.33 | 0.50 |
| Letter Sounds | 21.02 | 8.95 | 0.43 | 19.33 | 9.18 | 0.48 |
| PA | 99.14 | 31.96 | 0.32 | 92.78 | 26.74 | 0.29 |
| WLPB: LC | 147.27 | 21.63 | 0.15 | 143.81 | 19.05 | 0.13 |
| WLPB: LW | 257.83 | 85.70 | 0.33 | 243.62 | 71.30 | 0.29 |
| WLPB: PV | 309.73 | 20.17 | 0.07 | 305.68 | 18.54 | 0.06 |

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# Percent Observed Language of Instruction (in RD/LA)
## Across Language Models and Program Group

**Legend:** ■ English ■ Spanish ▢ None/Inaudible



**Early English**

TX:
- English: 87%
- Spanish: 11%
- None/Inaudible: 2%

CO:
- English: 69%
- Spanish: 30%
- None/Inaudible: 1%

**Bilingual**

TX:
- English: 12%
- Spanish: 86%
- None/Inaudible: 2%

CO:
- English: 17%
- Spanish: 81%
- None/Inaudible: 2%

Y-axis: Average Percentage of Time (0% – 100%)
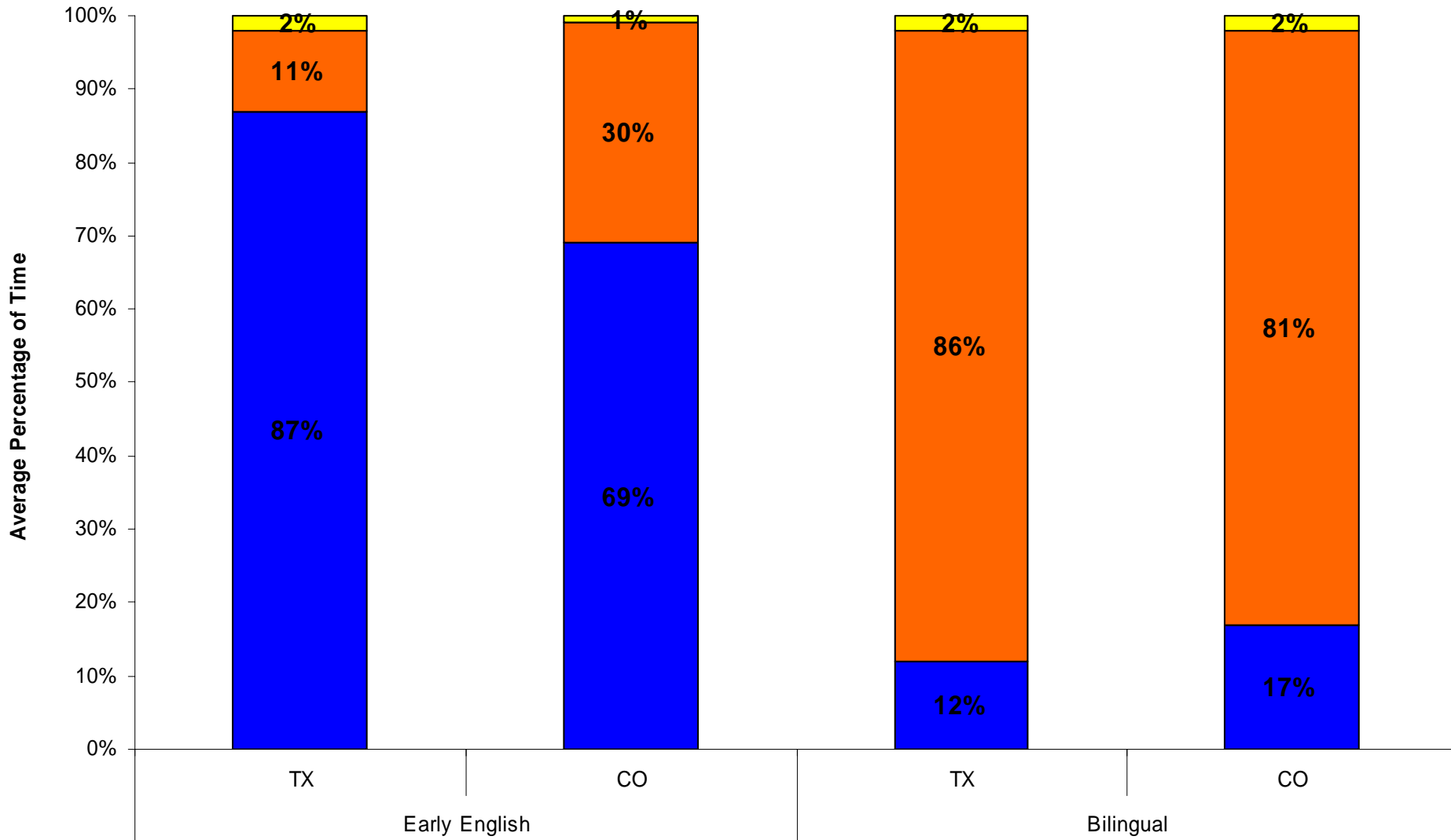
**Percentage of Observational Time Instructional Language was English Across Language Models and Program Group (+/- 1 SD)**
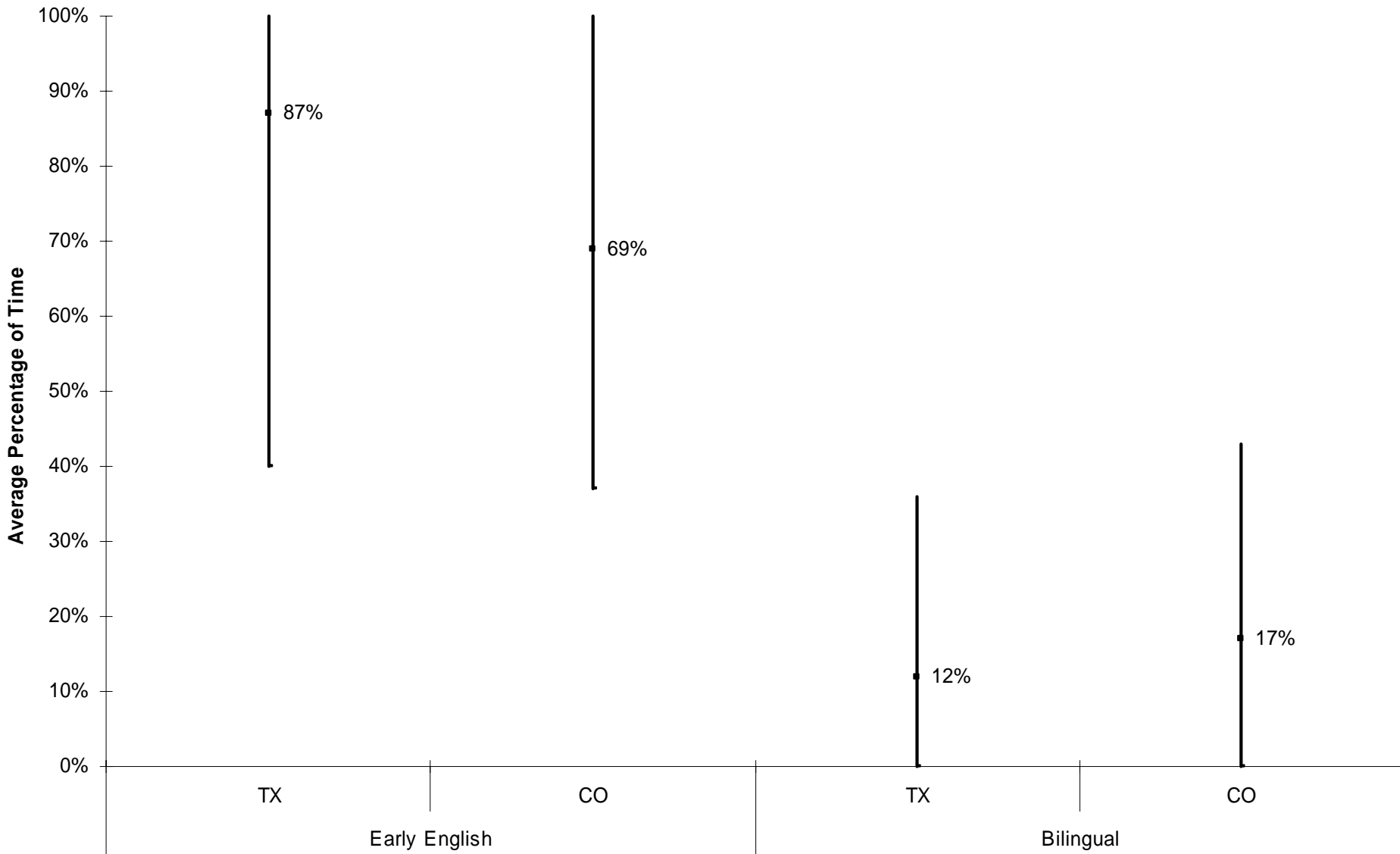
# Discussion

- Effects observed so far are small and in the form of interactions with baseline performance
  - In general, TX mitigates the effect of baseline performance
  - Increased exposure and implementation in Grade 1
- Gains
  - TX and CO gains on PA, LC, PV, and LW were large (.3 to 1.0 sd on WLPB standard scores)
  - Smaller gains were noted for students in Tier 2 instruction
  - It will be instructive to monitor growth of students

# Discussion

- Important to keep in mind context for intervention (11 of 13 Schools are RF schools; Texas Reading Initiative)

- ICCs for Spanish outcomes in TBE instruction are generally large relative to those in English
  - Exception to the rule is English Listening Comprehension
  - Suggests significant opportunity to impact English LC through instruction

- Next Steps: Cross-language and cross-program comparisons

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**SECTION C**

Detailed Progress Report Narrative

### Report on Student Performance Data

**David J. Francis, University of Houston**
**Coleen D. Carlson, University of Houston**
**Hector Rivera, University of Houston**

## *Design and Data Collections*

Of the fourteen schools participating in the project during the 2004-2005 school year, 13 continued participation in the 2005-2006 school year (one school using only structured English immersion, six schools using only transitional bilingual education, and six schools using both programs). One school of the original 14 (using both programs) refused participation in this second year of the study because the teachers felt the program took too much time and effort.

In the 2004-2005 school year, first grade teachers were randomly assigned to treatment or control conditions within language programs within each school. These teachers participated in trainings during the 2004-205 school year but did not implement and were not assigned mentors. In 2005-2006, the first grade teachers began implementing the program and were assigned mentors. Of the 33 first grade teachers from the 2004-2005 school year who were assigned to treatment conditions, eight left their teaching positions at the school or were moved to higher grade levels by principal decision. Therefore, 25 teachers who received training in the 2004-2005 school year remained in the project during the 2005-2006 school year. Only seven new teachers were hired within the schools to replace the 8 teachers who left the project (one school had a smaller first grade population than in the previous year and did not replace the teacher who left). In all, a total of 65 teachers participated in the project in the 2005-2006 school year. In the 7 schools using structured English immersion, a total of 21 teachers participated (11 in treatment and 10 in control). In the 12 schools using transitional bilingual education, 44 participated (21 in treatment and 23 in control). Due to the relatively high number of first grade teachers who were trained in 2004-2005 and lost due to attrition (8 of 33 or 24%), and the high cost associated with training teachers who leave the school prior to implementation, it was decided that second grade teachers would not be selected or trained until the summer of 2006.

In the memorandum of understanding signed with the schools, principals agreed to keep the Kindergarten students from the 2004-2005 school year in the same type of classroom in first grade (2005-2006) to which they had been assigned in Kindergarten (i.e., treatment or control, and English immersion or Transitional bilingual). A total of 1,214 students participated in the project in the 2005-2006 school year. Students in the current year were either: 1) those that participated in Kindergarten and were followed into first grade; or 2) those that were selected to replace students lost to attrition. All first grade students in each participating classroom (returning and new students) were selected to participate in the student assessment portion of the project. Table 1 below outlines the number of students in the study during the 2005-2006 school year.

Students were administered a battery of language and literacy related skill assessments twice during the school year; once in October/November and again in April/May. Data from the second assessment has been scanned and verified and is currently undergoing quality checks. Student assessment data for the entire first grade year (fall and spring) will be ready for analyses by August 1, 2006. A summer project

meeting is scheduled for August 21, 2006, at which preliminary analyses from the first grade year will be presented and discussed. Additional analyses on longitudinal performance form K to grade 1 will be completed in the fall of 2006.

In addition, to student assessments, mentors visited with teachers assigned to the treatment groups on a weekly basis beginning in the fall of 2005. Furthermore, observers visited each treatment teacher's classroom three times during the year to code fidelity to treatment. At each of the three time points, 4 fidelity observations were conducted over the course of an entire day: (1) SIOP, (2) Tier II intervention, (3) Language and Literacy classroom intervention instruction (English and/or Spanish), (3) Language Enrichment (English)/Esperanza (Spanish), and (4) McMillan (English and/or Spanish). General observations of classroom instruction were also completed three times per year, on a separate day, in all treatment and control classrooms during the reading and language arts block.

## *Analyses*

Previous analyses were completed to examine the effectiveness of the randomization and tests of fixed effects (i.e., mean differences between Treatment and Control groups) indicated that we can be confident that the randomization was carried out effectively and that no serious pre-treatment bias existed between treatment and control classrooms in either arm of the study. Analyses of all Kindergarten spring performance data were completed to determine the effect of treatment on student achievement during the kindergarten year. We fit models estimating random effects at the teacher level, with teachers nested within school. We did not estimate separate random effects at the school level, but did estimate separate random effects for teachers in English-Only and Teachers in Transitional Bilingual Education classrooms. Specifically, analyses were completed using multilevel mixed models with pre-test performance and Tier 2 designation as student level covariates and with students nested within classrooms. Treatment was examined as a teacher –level effect and the interactions of pre-test, tier 2 status and treatment as cross-level effects. Tables 1 and 2 present the pre-test and end of year means and standard deviations for each performance measure by Treatment group and Tier 2 status. Table 2 presents English performance measures for the English only program model group, while Table 3 presents Spanish performance measures of the Bilingual Education group.

Results of the mixed model analyses are presented in Tables 4 and 5 (English and Spanish, respectively). Significant effects involving treatment were found for letter naming and sound identification in English for the English only group, and in Spanish for the Bilingual Education group. Specifically, for the English only group, for both letter naming and letter sound identification there were significant interactions between pre-test performance and treatment group. Figures 1 and 2 illustrate the interactions from these two models. As can be seen in these figures, treatment and control students who begin the year in the mid to high performance range tend to be performing similarly at the end of the year. However, of the students who begin the year performing at lower levels, those in the treatment group tend to be performing at higher levels at the end of the year than those in the control group. Thus, the impact of treatment on English performance in the English only group appears to on increasing the alphabetic skills of students who begin the year with lower levels of performance.

In the Bilingual Education group, there was a significant interaction for letter naming between pre-test performance, tier 2 status and treatment. In addition, a significant interaction was found between pre-test performance and treatment group for letter sound identification. Figure 3 illustrates the interaction found for Spanish letter naming performance. As seen in this graph, the impact of treatment appears to function primarily to decrease the spread of scores within the group of students who are designated as Tier 2, especially those who also begin the year with lower scores within the Tier 2 group. Figure 4 illustrates the interaction found for Spanish letter sound identification performance. As seen in this figure, the impact of treatment appears to be primarily with those students who began the year in the mid- to high performance range, who, at the end of the year, are performing slightly higher than students in the control group who began the year at similar levels.

In addition to providing tables of means and standard deviations and results of statistical comparisons of Treatment and Control classrooms by Program Model, we provide information in Tables 6 and 7

about variability across classrooms. In Tables 6 and 7 we report the estimate of variance at the teacher (i.e., classroom) level as well as an estimate of the pooled within-classroom variance, and the computed Intra-class correlation (ICC) for models including only covariates, and those including covariates and treatment group for EO and TBE classrooms respectively (Table 5 = EO and Table 6 = TBE). The ICC is the ratio of the between classroom variance to the sum of the between classroom variance and within-classroom variance. As can be seen in both tables, there is a significant amount of both within and between classroom variance in student performance scores at the end of the kindergarten year that are not accounted for by information from the pre-test performance and Tier 2 status alone (Covariates Only). Examination of the variance in the models that also account from treatment group (Treatment Plus Covariates) suggests that within and between classroom variance tends to be reduced when treatment group is added to the model. Because treatment was only provided for 12 weeks during the Kindergarten year, we would expect that this trend will be stronger when examining performance differences in first grade and across the kindergarten and first grade years.

It is important to keep in mind that the results reported here are for Kindergarten data only. Analyses in the summer and fall of 2006 will examine student growth over time, identify characteristics of students that relate to optimal growth under each instructional model, identify characteristics of instruction that lead to optimal growth, and examine if/how differences between language outcomes change over time.

Table 1. Sample information for first grade 2005-2006

| 2005-2006 (First Grade) | | N |
|---|---|---|
| **Total number of students in Wave 1** | | **1214** |
| | *Returning students* | 856 |
| | *New Grade 1 students* | 358 |
| Gender | Male | 626 |
| | Female | 586 |
| | Unknown | 2 |
| Ethnicity | Caucasian | 6 |
| | Hispanic | 1181 |
| | African-American | 0 |
| | Other/Unknown | 27 |
| **Number of students leaving from Wave 1 to Wave 2** | | **157** |
| **Total number of students participating in Wave 2** | | **1057** |
| Gender | Male | 545 |
| | Female | 510 |
| | Unknown | 2 |
| Ethnicity | Caucasian | 5 |
| | Hispanic | 1052 |
| | African-American | 0 |
| | Other/Unknown | 0 |

Table 2. – Means and Standard Deviations for English Language Measures for English Only Students by Tier 2 status.

| Measure | Group | Tier 2 | Pre-Test | | Post-Test | |
|---|---|---|---|---|---|---|
| | | | *Mean* | *sd* | *Mean* | *sd* |
| Letter-Name Identification | Comparison | 0 | 20.95 | 7.92 | 23.32 | 5.64 |
| | | 1 | 14.91 | 10.21 | 19.50 | 7.86 |
| | Treatment | 0 | 23.12 | 5.05 | 24.43 | 4.27 |
| | | 1 | 19.40 | 6.82 | 23.35 | 4.52 |
| Letter Sound Identification | Comparison | 0 | 19.99 | 7.58 | 23.27 | 5.02 |
| | | 1 | 11.30 | 9.51 | 19.53 | 8.18 |
| | Treatment | 0 | 21.67 | 6.01 | 24.47 | 2.81 |
| | | 1 | 16.55 | 7.67 | 22.00 | 5.23 |
| Phonological Awareness | Comparison | 0 | 37.92 | 13.45 | 49.54 | 12.38 |
| | | 1 | 24.00 | 7.23 | 34.78 | 8.60 |
| | Treatment | 0 | 42.87 | 15.21 | 54.78 | 14.55 |
| | | 1 | 27.64 | 8.26 | 40.66 | 11.19 |
| WLPB: Letter Word Identification | Comparison | 0 | 98.66 | 18.06 | 102.81 | 19.29 |
| | | 1 | 84.53 | 15.73 | 89.84 | 15.71 |
| | Treatment | 0 | 102.77 | 14.87 | 107.84 | 14.79 |
| | | 1 | 91.76 | 10.03 | 99.41 | 13.96 |
| WLPB: Picture Vocabulary | Comparison | 0 | 75.37 | 23.52 | 83.29 | 23.92 |
| | | 1 | 69.55 | 24.64 | 77.59 | 18.92 |
| | Treatment | 0 | 82.93 | 18.94 | 87.92 | 19.45 |
| | | 1 | 75.24 | 12.82 | 78.89 | 14.80 |
| WLPB: Listening Comprehension | Comparison | 0 | 60.37 | 19.96 | 68.98 | 22.88 |
| | | 1 | 52.56 | 19.75 | 58.81 | 21.13 |
| | Treatment | 0 | 68.68 | 17.98 | 75.51 | 19.22 |
| | | 1 | 53.16 | 17.46 | 63.62 | 14.73 |

Table 3. – Means and Standard Deviations for Spanish Language Measures for Transitional bilingual Students by Tier 2 status.

| Measure | Group | Tier 2 | Pre-Test | | Post-Test | |
|---|---|---|---|---|---|---|
| | | | *Mean* | *sd* | *Mean* | *sd* |
| Letter-Name Identification | Comparison | 0 | 22.11 | 8.10 | 26.78 | 4.89 |
| | | 1 | 14.18 | 9.24 | 18.97 | 9.72 |
| | Treatment | 0 | 21.22 | 8.33 | 25.64 | 5.96 |
| | | 1 | 14.06 | 9.42 | 20.24 | 8.41 |
| Letter Sound Identification | Comparison | 0 | 22.45 | 7.51 | 26.87 | 5.44 |
| | | 1 | 12.49 | 9.07 | 18.05 | 10.14 |
| | Treatment | 0 | 20.56 | 8.89 | 25.74 | 6.12 |
| | | 1 | 11.41 | 8.77 | 18.66 | 9.18 |
| Phonological Awareness | Comparison | 0 | 36.69 | 14.35 | 52.40 | 17.53 |
| | | 1 | 23.86 | 8.13 | 32.21 | 13.22 |
| | Treatment | 0 | 37.31 | 15.74 | 50.45 | 16.95 |
| | | 1 | 24.21 | 7.14 | 32.89 | 11.57 |
| WLPB: Letter Word Identification | Comparison | 0 | 101.26 | 20.27 | 117.44 | 25.68 |
| | | 1 | 84.63 | 14.49 | 86.71 | 17.47 |
| | Treatment | 0 | 101.22 | 21.36 | 112.82 | 25.73 |
| | | 1 | 84.46 | 14.41 | 90.08 | 16.61 |
| WLPB: Picture Vocabulary | Comparison | 0 | 80.32 | 24.78 | 87.38 | 28.29 |
| | | 1 | 64.11 | 27.22 | 65.45 | 26.17 |
| | Treatment | 0 | 78.22 | 27.39 | 85.17 | 32.41 |
| | | 1 | 64.02 | 17.93 | 68.90 | 20.35 |
| WLPB: Listening Comprehension | Comparison | 0 | 80.71 | 17.57 | 84.72 | 18.45 |
| | | 1 | 66.96 | 24.25 | 66.54 | 25.44 |
| | Treatment | 0 | 79.18 | 18.03 | 84.82 | 19.28 |
| | | 1 | 68.34 | 18.54 | 73.44 | 16.63 |

Table 4. – Mixed model results with significant treatment effects for English language measures for English only students

| Measure | Effect | Num DF | Den DF | F Value | Pr > F |
|---------|--------|--------|--------|---------|--------|
| | **Wave 1** | 1 | 346 | 321.50 | **<.0001** |
| | Tier 2 | 1 | 346 | 0.54 | 0.4637 |
| | **Treatment** | 1 | 17 | 10.41 | **0.0050** |
| Letter Naming | Wave 1 * Tier 2 | 1 | 346 | 0.18 | 0.6687 |
| | **Wave 1 * Treatment** | 1 | 346 | 8.82 | **0.0032** |
| | Tier 2 * Treatment | 1 | 346 | 3.68 | 0.0558 |
| | Wave 1 * Tier 2 * Treatment | 1 | 346 | 2.94 | 0.0874 |
| | **Wave 1** | 1 | 346 | 224.91 | **<.0001** |
| | Tier 2 | 1 | 346 | 1.38 | 0.2401 |
| Letter Sound Identification | **Treatment** | 1 | 17 | 5.39 | **0.0330** |
| | Wave 1 * Tier 2 | 1 | 346 | 1.48 | 0.2251 |
| | **Wave 1 * Treatment** | 1 | 346 | 5.04 | **0.0254** |
| | Tier 2 * Treatment | 1 | 346 | 0.12 | 0.7329 |
| | Wave 1 * Tier 2 * Treatment | 1 | 346 | 0.04 | 0.8363 |
| | Wave 1 | 1 | 346 | 128.82 | <.0001 |
| | Tier 2 | 1 | 346 | 0.39 | 0.5331 |
| Phonological Awareness | Treatment | 1 | 17 | 0.98 | 0.3371 |
| | Wave 1 * Tier 2 | 1 | 346 | 5.89 | 0.0157 |
| | Wave 1 * Treatment | 1 | 346 | 0.03 | 0.8542 |
| | Tier 2 * Treatment | 1 | 346 | 0.21 | 0.6485 |
| | Wave 1 * Tier 2 * Treatment | 1 | 346 | 0.06 | 0.8026 |
| | Wave 1 | 1 | 340 | 108.43 | <.0001 |
| | Tier 2 | 1 | 340 | 0.03 | 0.8696 |
| Listening Comprehension | Treatment | 1 | 17 | 0.84 | 0.3727 |
| | Wave 1 * Tier 2 | 1 | 340 | 1.35 | 0.2468 |
| | Wave 1 * Treatment | 1 | 340 | 0.48 | 0.4871 |
| | Tier 2 * Treatment | 1 | 340 | 0.04 | 0.8404 |
| | Wave 1 * Tier 2 * Treatment | 1 | 340 | 0.02 | 0.9013 |
| | Wave 1 | 1 | 345 | 211.12 | <.0001 |
| | Tier 2 | 1 | 345 | 0.45 | 0.5030 |
| Letter Word Identification | Treatment | 1 | 17 | 1.36 | 0.2597 |
| | Wave 1 * Tier 2 | 1 | 345 | 0.65 | 0.4207 |
| | Wave 1 * Treatment | 1 | 345 | 0.58 | 0.4463 |
| | Tier 2 * Treatment | 1 | 345 | 2.05 | 0.1529 |
| | Wave 1 * Tier 2 * Treatment | 1 | 345 | 1.90 | 0.1694 |
| | Wave 1 | 1 | 346 | 249.61 | <.0001 |
| | Tier 2 | 1 | 346 | 0.42 | 0.5197 |
| Picture Vocabulary | Treatment | 1 | 17 | 2.52 | 0.1308 |
| | Wave 1 * Tier 2 | 1 | 346 | 0.99 | 0.3214 |
| | Wave 1 * Treatment | 1 | 346 | 2.41 | 0.1216 |
| | Tier 2 * Treatment | 1 | 346 | 0.52 | 0.4722 |
| | Wave 1 * Tier 2 * Treatment | 1 | 346 | 0.60 | 0.4402 |

Table 5. – Mixed model results with significant treatment effects for Spanish language measures for Transitional bilingual students

| Measure | Effect | Num DF | Den DF | F Value | Pr > F |
|---|---|---|---|---|---|
| Letter Naming | **Wave 1** | 1 | 620 | 516.79 | **<.0001** |
| | **Tier 2** | 1 | 620 | 44.81 | **<.0001** |
| | Treatment | 1 | 34 | 3.02 | 0.0915 |
| | **Wave 1 * Tier 2** | 1 | 620 | 37.06 | **<.0001** |
| | Wave 1 * Treatment | 1 | 620 | 2.32 | 0.1280 |
| | **Tier 2 * Treatment** | 1 | 620 | 8.77 | **0.0032** |
| | **Wave 1 * Tier 2 * Treatment** | 1 | 620 | 6.30 | **0.0123** |
| Letter Sound Identification | **Wave 1** | 1 | 616 | 379.68 | **<.0001** |
| | **Tier 2** | 1 | 616 | 41.23 | **<.0001** |
| | Treatment | 1 | 34 | 4.33 | 0.0450 |
| | **Wave 1 * Tier 2** | 1 | 616 | 31.45 | **<.0001** |
| | **Wave 1 * Treatment** | 1 | 616 | 10.63 | **0.0012** |
| | Tier 2 * Treatment | 1 | 616 | 0.00 | 0.9920 |
| | Wave 1 * Tier 2 * Treatment | 1 | 616 | 1.59 | 0.2084 |
| Phonological Awareness | Wave 1 | 1 | 621 | 193.78 | <.0001 |
| | Tier 2 | 1 | 621 | 14.91 | 0.0001 |
| | Treatment | 1 | 34 | 0.04 | 0.8471 |
| | Wave 1 * Tier 2 | 1 | 621 | 0.03 | 0.8566 |
| | Wave 1 * Treatment | 1 | 621 | 0.24 | 0.6280 |
| | Tier 2 * Treatment | 1 | 621 | 0.10 | 0.7502 |
| | Wave 1 * Tier 2 * Treatment | 1 | 621 | 0.20 | 0.6522 |
| Listening Comprehension | Wave 1 | 1 | 622 | 549.78 | <.0001 |
| | Tier 2 | 1 | 622 | 0.01 | 0.9028 |
| | Treatment | 1 | 34 | 0.41 | 0.5258 |
| | Wave 1 * Tier 2 | 1 | 622 | 1.51 | 0.2193 |
| | Wave 1 * Treatment | 1 | 622 | 0.02 | 0.8818 |
| | Tier 2 * Treatment | 1 | 622 | 1.01 | 0.3159 |
| | Wave 1 * Tier 2 * Treatment | 1 | 622 | 0.67 | 0.4138 |
| Letter Word Identification | Wave 1 | 1 | 616 | 209.59 | <.0001 |
| | Tier 2 | 1 | 616 | 1.08 | 0.2986 |
| | Treatment | 1 | 34 | 1.24 | 0.2737 |
| | Wave 1 * Tier 2 | 1 | 616 | 0.01 | 0.9364 |
| | Wave 1 * Treatment | 1 | 616 | 0.97 | 0.3255 |
| | Tier 2 * Treatment | 1 | 616 | 0.05 | 0.8224 |
| | Wave 1 * Tier 2 * Treatment | 1 | 616 | 0.03 | 0.8522 |
| Picture Vocabulary | Wave 1 | 1 | 611 | 412.20 | <.0001 |
| | Tier 2 | 1 | 611 | 0.58 | 0.4483 |
| | Treatment | 1 | 34 | 1.63 | 0.2107 |
| | Wave 1 * Tier 2 | 1 | 611 | 0.00 | 0.9947 |
| | Wave 1 * Treatment | 1 | 611 | 2.08 | 0.1495 |
| | Tier 2 * Treatment | 1 | 611 | 0.24 | 0.6266 |
| | Wave 1 * Tier 2 * Treatment | 1 | 611 | 0.49 | 0.4823 |

Figure 1. Mixed model interaction (pre-test by treatment) effect for letter naming in English - for English only students

Main Effect: Wave 1 (p<.001)
Main Effect: Treatment Group (p<.005)
**Interaction:  Wave 1 * Treatment Group  (p<.003)**

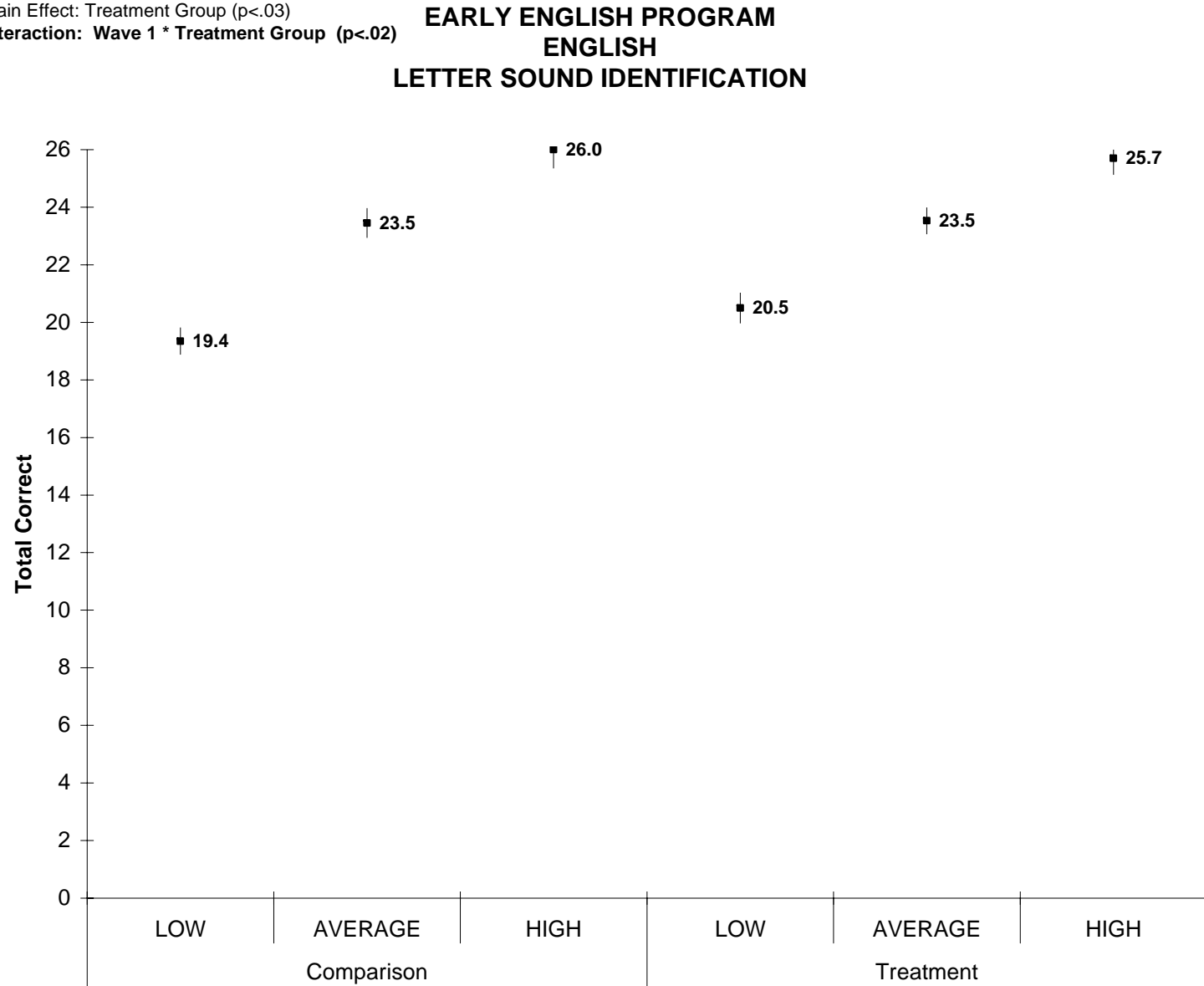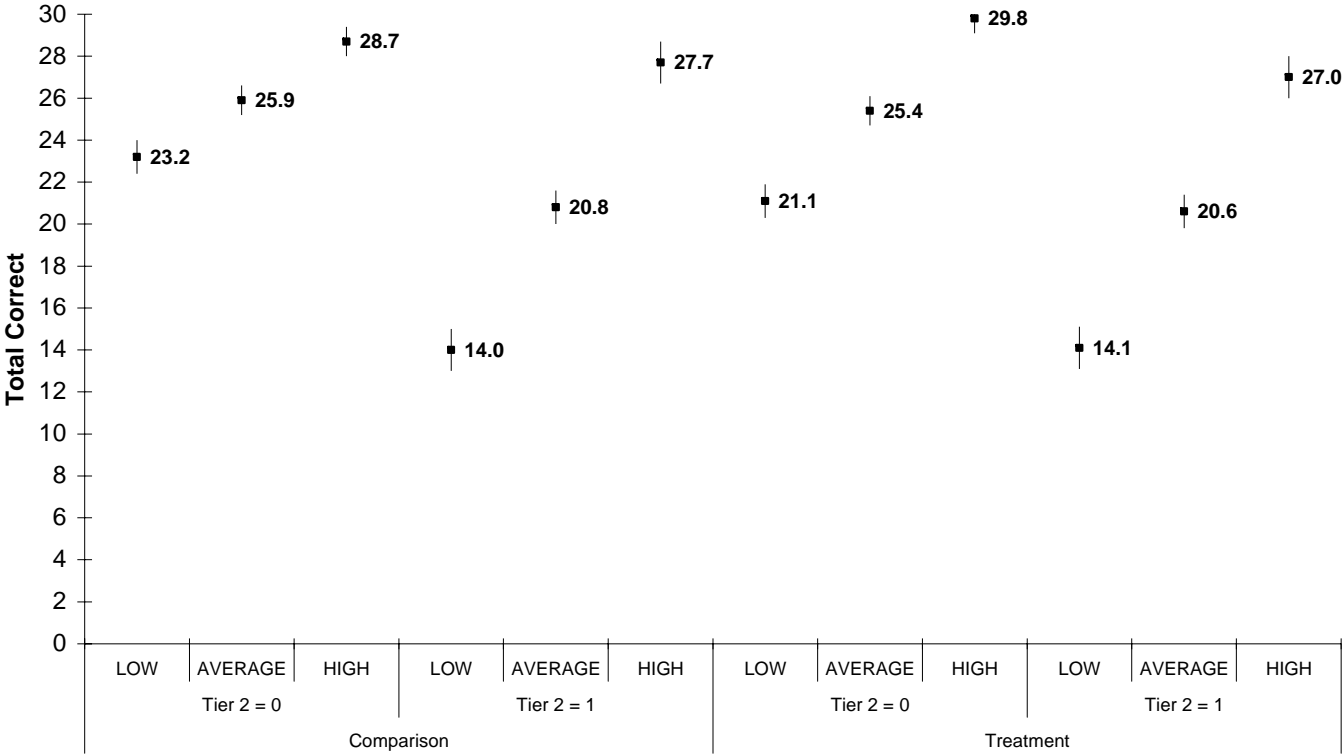**EARLY ENGLISH PROGRAM
ENGLISH
LETTER NAMING**
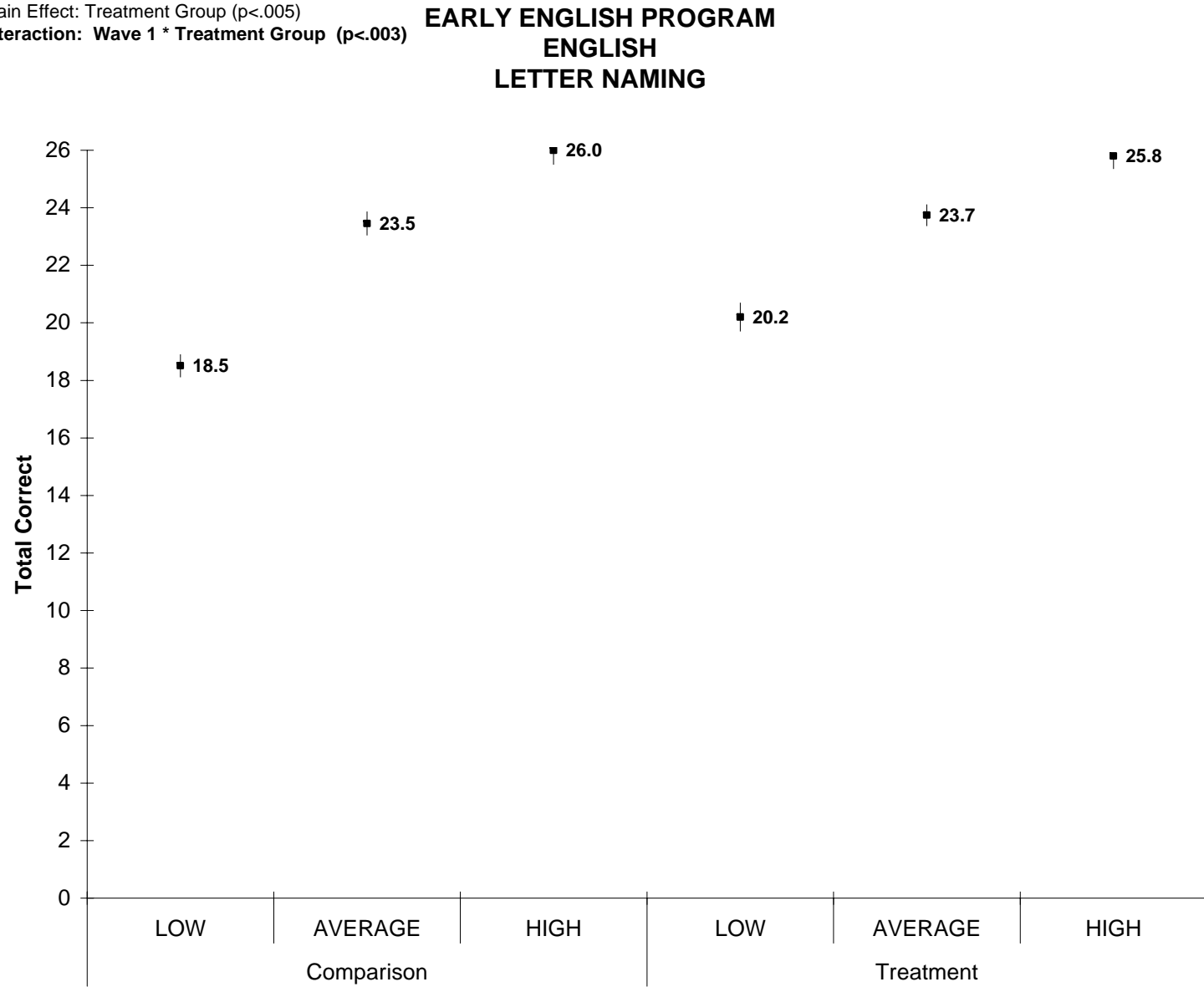
Figure 2. Mixed model interaction (pre-test by treatment) effect for letter sound identification in English - for English only students

Main Effect: Wave 1 (p<.001)
Main Effect: Treatment Group (p<.03)
**Interaction:  Wave 1 * Treatment Group  (p<.02)**

**EARLY ENGLISH PROGRAM
ENGLISH
LETTER SOUND IDENTIFICATION**

Total Correct

26    ■ 26.0    ■ 25.7

24    ■ 23.5    ■ 23.5

22

20    ■ 20.5

19.4

18

16

14

12

10

8

6

4

2

0

| LOW | AVERAGE | HIGH | LOW | AVERAGE | HIGH |
|-----|---------|------|-----|---------|------|

Comparison      Treatment

Figure 3. Mixed model interaction (pre-test by treatment) effect for letter naming in Spanish - for Bilingual Education students



Main Effect: Wave 1 (p<.0001)
Main Effect: Tier 2 (p<.0001)
Interaction:  Wave 1 * Treatment Group  (p<.0001)
Interaction:  Wave 1 * Tier 2 (p<.003)
**Interaction:  Wave 1 * Treatment Group * Tier 2 (p<.01)**

**BILINGUAL PROGRAM
SPANISH
LETTER NAMING**

Figure 4. Mixed model interaction (pre-test by treatment) effect for letter sound identification in Spanish - for Bilingual Education students



Main Effect: Wave 1 (p<.0001)
Main Effect: Tier 2 (p<.0001)
**Interaction:  Wave 1 * Treatment Group  (p<.0001)**
Interaction:  Wave 1 * Tier 2 (p<.0001)

**BILINGUAL PROGRAM
SPANISH
LETTER SOUND IDENTIFICATION**
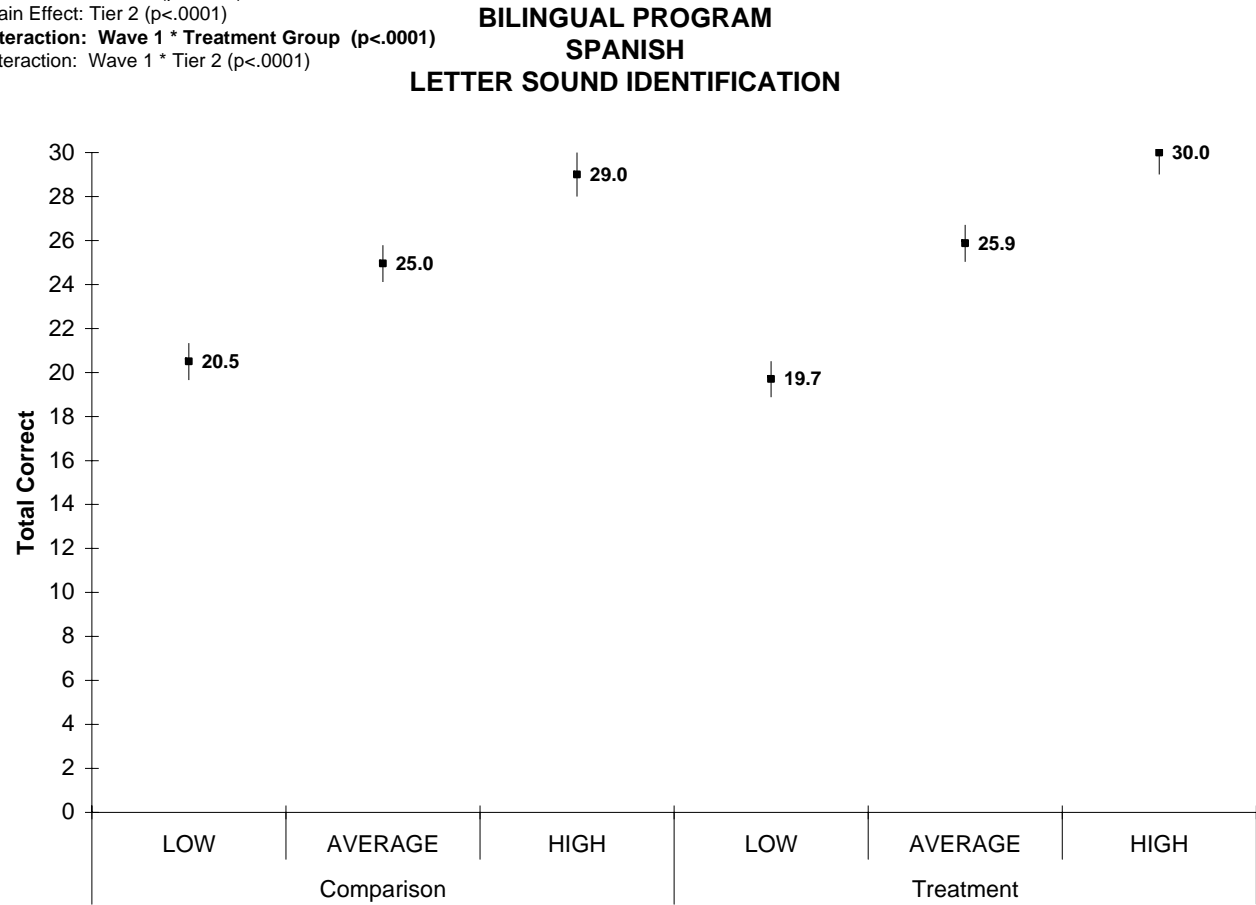
Table 6. – Variance Components and Intra-Class Correlations for English Outcome Measures for Teachers in English-Only (EO) Classrooms.

| Measure | Covariates Only | | | Treatment Plus Covariates | | |
|---|---|---|---|---|---|---|
| | Residual | Teacher | ICC | Residual | Teacher | ICC |
| Letter Name | 10.95 | 0.54 | 0.05 | 10.60 | 0.34 | 0.03 |
| Letter Sounds | 9.87 | 1.27 | 0.13 | 9.71 | 0.98 | 0.10 |
| Phonological Awareness | 67.50 | 7.77 | 0.12 | 65.88 | 7.10 | 0.11 |
| WLPB: LC | 190.43 | 92.22 | 0.48 | 184.41 | 90.12 | 0.49 |
| WLPB: LW | 88.83 | 18.67 | 0.21 | 86.17 | 15.26 | 0.18 |
| WLPB: PV | 123.90 | 16.12 | 0.13 | 119.94 | 18.74 | 0.16 |

Table 7. – Variance Components and Intra-Class Correlations for Spanish Outcome Measures for Teachers in Transitional Bilingual (TBE) Classrooms.

| Measure | Covariates Only | | | Treatment Plus Covariates | | |
|---|---|---|---|---|---|---|
| | Residual | Teacher | ICC | Residual | Teacher | ICC |
| Letter Name | 15.98 | 7.97 | 0.50 | 14.59 | 7.33 | 0.50 |
| Letter Sounds | 21.02 | 8.95 | 0.43 | 19.33 | 9.18 | 0.48 |
| Phonological Awareness | 99.14 | 31.96 | 0.32 | 92.78 | 26.74 | 0.29 |
| WLPB: LC | 147.27 | 21.63 | 0.15 | 143.81 | 19.05 | 0.13 |
| WLPB: LW | 257.83 | 85.70 | 0.33 | 243.62 | 71.30 | 0.29 |
| WLPB: PV | 309.73 | 20.17 | 0.07 | 305.68 | 18.54 | 0.06 |

**Progress in Development and Implementation of the Language and Literacy Curriculum**

**Diane August, Center for Applied Linguistics**
**Maria Carlo, University of Miami**
**Elsa Hagan, Texas Institute for Measurement, Evaluation and Statistics**

### Tier 1: Curriculum and Instruction

For the first grade classrooms, we developed scripted materials that were used during the 90 minute reading block to build phonological awareness, phonics, fluency, vocabulary, and comprehension in English-language learners. as well as 30 minutes of English-as-a-second language materials for the first grade students to be used during the 60 minute ESL period. The materials for the ESL period included scripted teacher read-alouds using high quality children's literature and picture cards to teach vocabulary aligned with the read-alouds. The materials developed for the bilingual program were in Spanish while those developed for the structured English immersion program were in English. See Appendix A for a sample week lesson in English.

For both the bilingual program model and the structured English-immersion program model we have developed curriculum that is closely aligned with state and district standards. We are working closely with the district Directors of Reading First and Bilingual Education to ensure that this is the case. We also developed review lessons to help students consolidate what they had learned. In addition, our materials provided for ongoing assessment to help teachers carefully monitor student progress.

### Tier 1: Strategies that Integrate Language Acquisition and Academic Achievement

For the first grade English-as-a-second language program, we have developed prototype curriculum that uses children's literature to teach content knowledge, as well as language and literacy. Scripting of actual lessons and development of curriculum materials for grade 2 will be completed during the summer months.

### Tier 1: English Proficiency through Peer Interaction

All of our materials used Partner Talk and Partner Reading to give students an opportunity to talk with each other. Teachers are instructed to pair children so children strong in English proficiency and literacy skills are paired with students who are acquiring these skills.

### Tier 1: Professional Development

We provided professional development to all first grade treatment teachers throughout the school year (training was also made available for Kindergarten control teachers from the previous year). We developed a high quality 30 minute training video that demonstrated the strategies needed to implement the first grade curriculum. We provided two-days of professional development prior to the implementation of the curriculum with three days of follow-up visits to observe teachers implementing the curriculum and to work with teachers to refine their skills. Each teacher was assigned a mentor to assist with the implementation of the curriculum. Classroom observations were conducted as well as feedback sessions on a bi-weekly basis. In addition, the principal investigator conducted bi-weekly telephone conferences with the mentors to provide further guidance on the effective implementation of the curriculum. We are also training second grade teachers this summer in preparation for the upcoming school year

**The SIOP Model Intervention for Grade 1**

**Debbie Short, Center for Applied Linguistics**

During the 2005-2006 school year, one major accomplishment was delivery of the professional development program on the SIOP Model of sheltered instruction to the Grade 1 teachers (in the bilingual and ESL programs), to the mentors who provide site-based coaching, and to the observers who collect data on teacher implementation of the model. The professional development program consisted of 5 days of workshop training for all teachers by CAL SIOP researchers, distributed throughout the year. The focus was on using the SIOP Model in mathematics. During these sessions, the teachers learned about and practiced instructional techniques that integrate academic language development with content area instruction, observed and analyzed videotaped instruction of teachers using the SIOP Model in real classrooms, and developed lesson plans that they could deliver to their students.

Mentors were trained on the SIOP Model before the school year began and attended most of the teachers' sessions as well. The mentors conducted biweekly observations and feedback sessions with first grade teachers on their SIOP math instruction. In these sessions, mentors used the SIOP observation form to organize their observation notes; and in follow-up sessions with teachers, the mentors were able to offer concrete guidance for the teachers' instructional practices. In addition, a closed listserv was set up so the mentors and CAL SIOP researchers could communicate regularly. Combined, these professional development activities enabled the first grade teachers to reach a high level of implementation by the year's end.

Two waves of teacher implementation data were conducted this past year so researchers could determine the fidelity of implementation to the model. CAL researchers also made informal observations in intervention classrooms to assess the teachers' level of implementation and to determine needs for future workshops.

Finally, the SIOP researchers presented information about the study and the first year's efforts at several professional conferences, including the National Association of Bilingual Education, the International Reading Association, and the Teachers of English to Speakers of Other Languages association. A Web page describing the project was developed and can be found on the Center for Applied Linguistics' Web site (www.cal.org).

## Development and Implementation of Tier 2 and 3 Intervention

**Sharon R. Vaughn, University of Texas at Austin**
**Sylvia Linan-Thompson, University of Texas at Austin**

### Summer 2005

The Austin team updated the Spanish Tier 2 intervention for first grade, *Lectura Proactiva para Principiantes: Intensive Small Group Instruction for Spanish Speaking Readers* — a 400-page, daily-scripted, supplemental instruction program in Spanish that maps the acquisition of reading in Spanish for bilingual students. In addition they developed and piloted a two-day professional development to train tutors, teachers, mentors and observers.

### Fall 2005

Each month the researchers in Austin participated in weekly conference calls held among all the principle investigators. These calls served as a forum for discussing issues and making decisions pertaining to the study.

Twenty-one Brownsville teachers, 7 mentors and observers received professional development from Sharolyn Pollard-Durodola. The Austin team provided all of the materials needed to begin implementing the Spanish Tier 2 intervention for first grade, Lectura Proactiva para Principiantes.

### Winter 2006

The Austin team prepared Reading Games/Juegos de lectura materials needed for 30 Spanish and 10 English Brownsville Kindergarten control group teachers. Teachers received a Game Plan book of 75 lessons and all supporting materials necessary for implementation of this kindergarten reading intervention. Kathryn Prater provided professional development for 40 teachers.

### Spring 2006

Twenty-one Brownsville first grade teachers implemented, Lectura Proactiva para Principiantes from October through April and then tests were conducted to gauge the effectiveness of the intervention. The Austin team worked on the development of Tier 3 instructional materials.

Much of the information in these descriptions will remain unchanged over the life of a multi-year study. Updated information should be incorporated in the descriptions under the appropriate elements, (1 – 8) above, for subsequent reports.

Element 9 (update) should summarize progress since the last performance report. For this element, please describe the steps you have undertaken to fulfill grant requirements, and describe how you expect the research to proceed during the next year. In addition, please describe any difficulties encountered during this performance period and how you have addressed those difficulties (or how you propose to address them).

**Appendix A – Sample Lesson Plan for Core Reading (MacMillan)**

# <u>Week 17:</u> Grammar and Writing Chart

| | Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|---|---|---|---|
| **Grammar and Usage** | | Review Contractions with Not | Review Contractions with Not | | |
| **Grammar Mechanics** | Review of Writing Sentences | | | Review of Writing Sentences | |
| **Generative Writing** | Writing to a prompt: Generative writing using mechanics reviewed above | Pre-writing/shared writing of narratives | Draft: shared writing of narratives | Revise and edit: shared writing of narratives | Publish and shared reading of narratives Echo Reading of their story |
| **Materials** | *Transparency Day 1- Photo<br><br>*Transparencies: Grammar Mechanics | *Transparency: week 17- Parts of speech<br><br>*Week 17: Day 2 transparency:<br><br>*Transparency Day 2:-2a – d<br><br>*Transparency: 17- Day 2 Photo | Transparency Day 3 | Transparency Day 4 | |
| **Practice or Assessment** | *McGraw-Hill Grammar Practice Book:* pp. 29 and 30 | *McGraw-Hill Grammar Practice Book:* pp.89 Optional – p.90 | *McGraw-Hill Grammar Practice Book:* p. 91 Optional 92 | *McGraw-Hill Grammar Practice Book:* pp. 31 and 32 | Grammar assessment - *McGraw-Hill Grammar Practice Book:* pp. 94 |

# Week 17 DAY 1

**Materials:**
Erasable Transparency Markers
Week 17 – Day 1: Grammar Mechanics Transparency
*McGraw-Hill Grammar Practice Book:* pp. 29 and 30
Week 17 Day 1 - Photo

## 1. Writing Mechanics: Writing Sentences

**<u>Introduce a Concept</u>**

**Remember there are different kinds of sentences. There are statements, questions and exclamations.**

**A statement tells us something and ends with a period.**

**A question asks something and ends with a question mark.**

**An exclamation is a sentence that shows strong feelings and ends with an exclamation mark.**

**When we write sentences we need to begin each sentence with a capital letter and end it with the correct punctuation mark. Let's look at this transparency.**

(Direct student's attention to the transparency: Week 17 Grammar Mechanics Day 1).

**Who would like to read the first sentence?** (Select a volunteer).

The dog is black and white.

**This is a statement because it tells us something. It tells us that the dog is black and white.**

**Who would like to read the second sentence?** (Select a volunteer).

Is the dog black and white?

**This is a question because it is asking something.  It is asking if the dog is black and white.**

**Who would like to read the third sentence?** (Select a volunteer).

That is a big dog!

**This is an exclamation because it shows emotion. The person is surprised that the dog is so big.**

## Model

Direct children's attention to the following sentences on the transparency.

> 4. *the baby snake is very little*
> 5.  *do you know about baby snakes*
> 6.  *that boy would like to have a snake for a pet*
> 7. *what a big snake*

Read the first sentence aloud. *Say:* **I know that this is a statement because this sentence is telling me something. It is telling me that the baby snake is little. But this sentence is not correct. It does not begin with a capital letter. It is a statement so it must end with a period.** Select a volunteer to make the corrections.

Read the next sentence aloud. *Say:* **I know that this is a question because this sentence is asking me something. It is asking me if I know about baby snakes. But this sentence is not correct. It does not begin with a capital letter. It is a question so it must end with a question mark.** Select a volunteer to make the corrections.

Follow the same procedure to with the remaining two sentences.

## Practice

Direct children's attention to page 29 of the *McGraw Hill Grammar Practice*

*Book*. Read the title. Read the instructions. Work with the class to complete the first question. Allow children to work independently to complete the remainder of the activity.

Direct children's attention to page 30 of the ***McGraw Hill Grammar Practice Book***. Make sure children understand the instructions. Complete question one with the entire class. Allow children to work independently to complete the remainder of the activity.

## 2. Generative Writing

### Present Concept

Direct the class' attention Writing Photo Week 17-1 *My Story Writing* and have students discuss the picture.
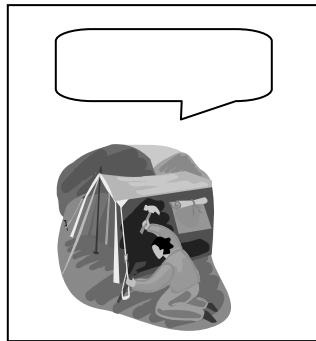


**We are going to write a sentence about this picture.**
**Do you remember Chet and Jake?  They had backpacks and they went camping at the lake.**

### Model Concept

**Look at this picture. Who can tell what the man is doing?**  Solicit responses from the children and elaborate on them.  Write one response on the board, but omit all punctuation and capitalization. Guide the students to correct punctuation and capitalization on the board.

### Practice

Have students write their own sentence about the picture in their notebook.  Have them attend to capitalization and punctuation.

# Week 17 DAY 2

**Materials:**
Transparency: Week 17 Day 2
Overhead Transparency- Grammar: Macmillan SAILL - Week 17- Day 2 Photo
*McGraw-Hill Grammar Practice Book:* pp. 29 & 30

## 1. Grammar

**Lesson Background**
The overhead transparency for the grammar concept contains a chart with six columns. The columns are labeled: nouns, verbs, pronouns, adjectives, adverbs and other. Words that are placed in the nouns, verb, pronoun and adjective columns need to be accompanied with an explanation. The words that belong in the remaining 2 columns do not require any reason. The teacher simply states: *I will put this word in this column.*

## Introduce a Concept

Direct children's attention to Transparency Week 17-2.

| | |
|---|---|
| **My mom and dad camp with me. It is fun. We set up the tent by the lake but we can't swim. We tramp in the woods with our backpacks. We can get fish for dinner. At night we sleep in the tent and dream.** | |

| Noun | Verbs | Pronouns | Adjective | Adverbs | Other |
|------|-------|----------|-----------|---------|-------|
|      |       |          |           |         |       |
|      |       |          |           |         |       |
|      |       |          |           |         |       |
|      |       |          |           |         |       |
|      |       |          |           |         |       |
|      |       |          |           |         |       |

Have the class read the story on the overhead transparency. Review the description of nouns, verbs, pronouns and adjectives.

## Model

Place the overhead transparency so children can see the headings. Review each of the parts of speech: noun [words that names a person, place or thing], verb [words of being or action words], pronoun [words that takes the place of a noun], and adjective [words that tell about or describe nouns are adjectives].

**First, I'm going to show you what to do. Let's see, the first word I am going to talk about is *my*. I am going to put it in the verb column. The next word is *mom*. *Mom* names a person so it is a noun. I will place *mom* in the noun column. I will put *and* in this column.** (The column labeled 'other'). ***Dad* is a noun, too. *Camp* is a word that does two jobs. It is a word that is a name of a thing so it goes in this column** [Noun]. ***Camp* is also an action word so it goes in the verb column, too.**

<u>Practice</u>

**Let's put the rest of the words into different columns?** As children tell you the words, write them on the overhead transparency. Organize them according to function: nouns in one column, verbs in another column, etc. (nouns, verbs pronouns, adjectives, adverbs, and other). You can elaborate as to why nouns, action verbs, pronouns and adjectives are being placed in the particular column. However, you do not need to explain why the words are placed in the remaining columns at this time.

Have children read all of the words in each column.
The completed chart should look like this**.**

| Nouns | Verbs | Pronouns | Adjectives | Adverbs | Other |
|-------|-------|----------|------------|---------|-------|
| mom | camp | me | my | up | the |
| Dad | set | we | fun | at | by |
| camp | is | it | our | | in |
| tent | put | | | | with |
| lake | tramp | | | | for |
| woods | can | | | | can't |
| backpacks | fish | | | | |
| Fish | sleep | | | | |
| dinner | dream | | | | |
| night | | | | | |
| dream | | | | | |

<u>**Introduce a Concept:**</u>

**We are going to be talking about two words in the chart- *can* and**

*can't*.  **Remember, we talked about two words that we can squeeze together and they make one word. These words are called contractions. But when we squeeze the words together, some letters get squeezed out. We use an apostrophe to show that these letters have been taken out.**

**For example, some people can sing and some people cannot sing. We can say:** *The man cannot sing* **or we can say** *The man can't sing*. **These sentences mean the same thing.**

**Write** *The man cannot sing & The man can't sing* **on the board.**  *Can't* **is the short form – the contraction- for cannot. What changes have we made to cannot to shorten it?** [deleted n & o]. **Good. What do we do to show that letters are missing?** [use an apostrophe].

**Let's look at these words on the transparency. Read them with me.**
   *are not*     *is not*
**These are the long forms of the words. We can squeeze two words together to make the short forms – the contractions. The first two words are** *are not.* **I can make a new word:** *aren't.* Write *aren't* beside *are not*. **When we squeeze the two words together, what letters oozed out?** [n o ]. **Correct. But I see an apostrophe. It takes the place of those two letters.** Follow the same procedure for *is not.* **Look at these sentences.** [Read the first sentence aloud ].

*1. They are not working on the picture.*
 *They _____ working on the picture.*
*2. The girl is not here.*
 *The girl _____ here.*

**I know that** *aren't* **means the same thing as are not. So I will write** *aren't* **in the blank.** Write *aren't* in the blank.  Follow the same procedure for the

next question.

## Practice

Direct children's attention to the last four sentences on the transparency.
3. The boys are not playing ball.
4. The snake isn't very big.
5. Those children aren't going to swim in the lake.
6. The dog is not eating.
**Read sentence number 3. Does this sentence have the long form of two words or the short form?** [long form].
Proceed in the same manner to complete the last three sentences.

Distribute page 89 of the *McGraw-Hill Reading Grammar Practice Book*. Discuss the material in the box. After reviewing the instructions and completing the first question as an example, allow children to complete this activity.

Distribute page 90 of the *McGraw-Hill Reading Grammar Practice Book*. Discuss the material in the box. After reviewing the instructions and completing the first question as an example, allow children to complete this activity.

## 2. Generative Writing

### Introduce a Concept

**This week we are going to write a story together. There are many steps in writing a story. We have to think about ideas for a story. Then we have to organize our thoughts and write them down. Next, we make sure that we have written our sentences correctly. Finally, we make our story ready to share with others. Today, we are going begin the first step in writing a story. The first step we take is that we have to think about things we write about. In order to write a story we need to think about and share ideas with each other. We will use an illustration to guide us in this step. This step is known as the**

**prewriting stage.** Show the picture for Week 17.

**Model**

**What do we see in this picture? Let's generate ideas. As we discuss these ideas I will take notes so tomorrow I will be reminded of all the ideas we generated today.**

Show the transparencies Day 2-a through Day 2-d to model the pre-writing phase of the writing process. Fill it out as you discuss the questions with the students. Use point form to address the questions so it takes on the appearance that ideas were brainstormed. The pre-writing stage is not written in sentences.

**Today we generated a bunch of ideas. Tomorrow we will write a draft form of our story. A draft form is when you first write the story. It is not ready to share with other people because it is not completely finished. So tomorrow we will continue to work on our story.**

# Week 17: DAY 3

**Materials:**
*Week 17: Transparency – Day 3*
*McGraw-Hill Grammar Practice Book:* p. 91

## 1. Grammar: Contractions with *Not*

<u>Introduce a Concept</u>

**Yesterday we learned about joining two words together to make a short form or a contraction. When we join two words together some letters are squeezed out. We use an apostrophe to take the place of the letters that are left out.**
Direct children's attention to the first sentence on the transparency.
> *This isn't a big ship.*

***Isn't* is a short form of the two words *is not*. When the two words were joined together the letter *o* was squeezed out. The apostrophe is there to show that this letter is missing. *Isn't* is the contraction for is not.**

<u>Model</u>

**Let's look at these sentences on the transparency.**
> 1. *The man <u>is not</u> packing to go on a trip.*
> 2. *They <u>are not</u> playing ball in the park..*
> 3. *Dan and Bob <u>are not</u> making a mask for the school play.*
> 4. *The lamp <u>is not</u> lit.*

Read each sentence with the class. **Each of these sentences have two underlined words. We are going to write the contraction for these words. The two underlined words in sentence number 1are *is not*. I know that when we make a contraction we put two words together. When we join two words some letters are left out. An apostrophe takes the place of the missing letter. I know that the contraction for *is not* is *isn't*. When we squeeze together *is* and *not* the letter *o* gets oozed out. So I will write the contraction and put an apostrophe**

**where the *o* was. I will write the two words close together to make one word.** [Write the word on the transparency]. **Now the sentence reads** *The man isn't packing to go on a trip.*

Follow the same procedure for the remaining sentences. Select volunteers to write the contraction on the transparency.

Direct children's attention to the remaining sentences on the transparency.
1.  That isnt my dog.
2.  They <u>arent</u> sleeping in the tent.
3. The girl isnt  jumping up and down.
4. The frogs arent jumping on that branch.

**Let's read the first sentence. I know that *isn't* is a contraction. But I know a contraction must have an apostrophe to show that letters have been left out. What letter is missing when we join *is* and *not*?** [o]. **Good. So I must put an apostrophe in the place where the letter *o* was. So I will put the apostrophe between the letters *n* and *t*.** Follow the same procedure for the remaining sentences. Allow students to place the apostrophe in the appropriate place on the transparency.
.

**Practice**

Distribute page 91 of the ***McGraw-Hill Reading Grammar Practice Book***. Discuss the material in the box. After reviewing the instructions and completing the first question as an example, allow children to complete this activity.

## 2. Generative Writing

**Introduce a Concept**  The Writing Process- Draft

**Yesterday we looked at a picture of people camping. We talked about many different ideas. We talked about the characters and the setting of the story. We even talked about things that were happening and things that might happen next. We wrote down all of our ideas.**

[Show the completed transparencies from the previous day—

transparencies for Day 2-a through Day 2-d. Review the content of these transparencies.]

**Today, we will use these ideas as we focus on the next phase for writing the story. Today we are going to write a draft of our story. This is the part of the writing process where we organize our ideas and write them on paper. We are going to focus on putting our story ideas into sentences. We are not going to worry about capital letters and punctuation. We are just going to try to get our ideas into sentences so that they make sense.**

<u>**Practice**</u>

After reviewing the transparencies from the previous day guide children to form a sequence of events using transparencies e-g.  Guide them to generate complete sentences. Write these sentences on a transparencies e-g.  Write all words in lower case letters and omit some of the ending punctuation.

**We have created our draft of the story. Tomorrow we will proceed to the next phase of writing stories. We will edit and revise our story so that it will be ready to share with others.**

# Week 17 DAY 4

**Materials:**
*McGraw-Hill Grammar Practice Book:* pp. 31 and 32
Transparency Grammar Week 17: Day 4


## 1. Grammar-Writing Sentences

<u>Introduce a Concept</u>

**On Monday we worked with writing sentences. All sentences begin with a capital letter and must have an ending mark. Some sentences end with a period, some sentences end with a question mark and some sentences end with an exclamation mark.**

Direct children's attention to the transparency: Week 17- Day 4.

**Look at the sentences on the transparency.**
> *I saw three geese in the pond*
> *what did you see in the woods*
> *that bear is big*

**What type of sentence is the first one?** [a statement]. **What do we need to put at the end of this sentence?**[ a period.] **What kind of sentence is** *what did you see in the woods***?** [a question]. **What do we need to put at the end of this sentence?** [ a question mark.] **What kind of sentence is** *that bear is big***?** [an exclamation ]. **What do we need to put at the end of this sentence?** [ an exclamation mark.]

<u>Model</u>

**Here are some sentences. Look at the part with the line under it. Is there a mistake?**
*1. The boys went fishing in the lake. <u>Did they get a fish</u> They like to eat fish for dinner.*
*2. Where do you want to go? <u>the girl wants to go to the shop.</u> There are lots of toys in that shop.*
*3. <u>The duck is in the pond</u>. It likes to swim. It can swim very fast.*
**I will read the first set.** Read sentence 1. **I know that the underlined**

**sentence is asking a question. It is asking if the boys caught any fish when they went fishing. But there is a mistake. A question must end with a question mark. I will put a question mark on this sentence to make it right.** Follow the same procedure for the next 2 questions. Note: there are no mistakes in question 3.

<u>**Practice**</u>

Distribute page 31 and 32 of the ***McGraw-Hill Reading Grammar Practice Book***.. Read the instructions. Work with the class to complete the first question and have them complete this activity.

## 2. Generative Writing

<u>**Introduce a Concept**</u> The Writing Process- Revise and Edit

**We have been working on writing a story. On Tuesday we generated ideas for our story. Yesterday we completed the draft of our story. Today we will edit and revise our story. Let's look at our draft.** Refer to transparencies e-g completed the previous day.

**Let's look at our sentences very carefully. Where do we need to put capital letters?** Begin with the first sentence and let children state that this sentence needs to begin with a capital letter. **Does every sentence end with a period?** Select volunteers to report where ending punctuation is needed.

During this phase of the writing process, the teacher will use markers to edit the sentences on the overhead projector. The teacher should rewrite each sentence onto the poster paper after the lesson for use on day 5.

# Week 17 DAY 5

## 1. Grammar

**Materials:**
*McGraw-Hill Grammar Practice Book:* p. 93
*McGraw-Hill Grammar Practice Book:* p. 94


**1. Grammar Assessment** (10 minutes)

Administer assessment for questions and exclamations on **page 94** of the *McGraw Hill Grammar Practice Book*. Let the children know that they should do their very best on this test; it will be used to help the teacher understand how well the children are progressing.

## 2. Generative Writing

<u>**Introduce a Concept**</u> The Writing Process- Publish

**Today we are going to complete the last phase of story writing. Now that we have completed the editing and revision our story is now ready to share with everyone.  We have written a wonderful story and now we will read it together. Then we will post our story in the classroom so that we can read it all the time.**

<u>**Echo Reading**</u>   [See page 3 of Teacher's Guide: McMillan-English/SAILL ]

First, read a sentence while the children. Next, have children read the same sentence along with you. Finally, instruct children to read the sentence with you, but teacher stops reading after the first two words so children can finish the sentence on their own. Then proceed to the next sentence and follow the same procedure for each sentence thereafter. Read with proper intonation.

**First I'm going to read a sentence of the story and you are going to follow what I am reading by looking at the chart. Don't read it with me this time; just follow with your eyes.** [Read sentence.] **Now, I am going to read this sentence again and you are going to follow with**

**your eyes and read with me.** [Read sentence again with children.] **Now, we are going to read the sentence one more time. But this time I am going to stop reading after the first few words. You need to keep reading until the end of the sentence.** [Read the line once more and stop after the first few words. Repeat until the story is read.]

# Appendix B – Sample Lesson Plan for Language Enrichment

Day One Hundred Thirty Five

**Check LLP**
**Reading Deck Activity**
Let's begin with a review of these cards from our reading deck.
Tell me the name of the letter, the key word, and the sound.

**New Concept Introduction**
Students take out you mirrors so that you review a concept you
have already learned.

Listen and echo each word after me while you look in your
mirrors.
**Sinless, nameless, useless**

What do you hear in the final position of each of these words?
Yes, the /less/ sound
Look at the board.

sin + less = sinless,                              name + less = nameless,
                     use + less = useless

Each of these words has /less/ at the end. I have added /less/ to the
base word. If you take off /less/ from each of these words there is a
base word. This is suffix -less . Suffix -less means without. We
code suffix -less with a box.  Good Job!

What comes next?
**Reading Practice**
Now we will apply what you have learned. Take out a sheet of
paper. I will say words with suffix –less. You will write the word.

We will check the word that you have written. We will read the words you have written. The first word is: restless. The next word is: spotless, endless, helpless, hapless
Now let's read the words.
restless, spotless, endless, helpless, hapless
Now I will check your work.
Good job reading and writing the suffix –less.

What comes next?
**Review**
Now we will review what you have learned.

(Teacher shows the Suffix Deck Card and asks.) What can you tell me about suffix -less? (Students respond "Suffix –less means without.) " (If the students are not able to respond, the teacher says.) "My turn. Suffix -less means without.)

(Teacher shows the Closed Syllable Concept Card and asks.) What can you tell me about closed syllables? (Students respond "A closed syllable ends in at least one consonant. The vowel in a closed syllable is short; coded with a breve.") (If the students are not able to respond, the teacher says.) "My turn." "A closed syllable ends in at least one consonant. The vowel in a closed syllable is short; coded with a breve."

Good Job!

"What comes next?" The students will respond, "Oral Language and Reading Comprehension."

Day One Hundred Thirty Six

Check LLP
## Reading Deck Activity
Students each day our lesson will begin with a review of these cards from our reading deck. Each day you will tell me the name of the letter, the key word, and the sound.

"What comes next?"
## New Concept Introduction
Students take out you mirrors so that you can discover a new sound, a key word to unlock the sound and the letter or letters that represent that sound.

Listen and echo each word after me while you look in your mirrors.
Listen for the sound that is the same in all these words.
**Boot, soon, smooth, shampoo, monsoon**
Tell me the sound that is the same in all these words.
Yes, the sound is /oo/.
Say the sound again while looking in your mirror. Is the sound open or blocked?
Yes, it is open.
Place your fingers on your vocal cords and say the sound one more time.
Is the sound voiced or unvoiced?
Yes, it is voiced.
Is this a vowel sound or a consonant sound?
Yes, it is a vowel sound because it is open and voiced.

Listen to this riddle and discover the key word that will unlock this sound.

The astronauts who blasted off
Made headlines very soon.
They thought they'd gone to heaven
When they landed on the (MOON).

Let me write the words on the board.
**Boot, soon, smooth, shampoo, monsoon**
What letter or letters are the same in all these words?
(Teacher shows students the reading deck card.)
Yes, the name of the vowel pair syllable is ____. (oo)
The key word is ____. (Moon)
The sound is ____. (/oo/)

Look at the reading deck card. The vowel pair syllable is pronounced / oo /. The / oo/ sound is open and voiced.

The OO is a vowel pair syllable. It will be placed with the section of the reading deck named vowel pair syllable.

"What comes next?" The students will respond:
## Reading Practice
Now we will apply what you have learned. We will code the first row together.

| | | |
|---|---|---|
| 1. boot | scoop | rooster |
| 2. goose | root | wood |
| 3. proof | wool | room |
| 4. igloo | gloom | soon |
| 5. moon | shoot | broom |

## Review

Now we will review what you have learned.
(Show students the IRD card (2.64). Students say the name of the letter, the key word, and the sound). If the students don't remember the information, the teacher says, "My turn. **OO**, Moon, / oo /, Your turn" (Students respond).

(Teacher shows the Vowel Concept Card and asks.) What can you tell me about a vowel? (Students respond "Vowels are open and voiced. The vowels are a, e, i, o, u.). (If students are not able to respond, the teacher says.) "My turn. Vowels are open and voiced. The vowels are a, e, i o, u. Your turn" (Students respond.)

(Teacher shows the vowel pair syllables and asks.) What can you tell me about vowel pair syllables? (Students respond "A vowel pair syllable has two adjacent vowels.") (If the students are not able to respond, the teacher says.) "My turn." "A vowel pair syllable has two adjacent vowels.")

Good Job!

"What comes next?" The students will respond, "Oral Language and Reading  Comprehension":

# Reading Practice 136
## OO= /oo/

1. boot          scoop          rooster

2. goose         root           wood

3. proof         wool           room

4. igloo         gloom          soon

5. moon          shoot          broom

Day One Hundred Thirty Seven

Check LLP
## Reading Deck Activity
Students each day our lesson will begin with a review of these cards from our reading deck. Each day you will tell me the name of the letter, the key word, and the sound.

"What comes next?"
## New Concept Introduction
Students take out you mirrors so that you can review a new sound, a key word to unlock the sound and the letter or letters that represent that sound.

Listen and echo each word after me while you look in your mirrors.
Listen for the sound that is the same in all these words.
**Boon, soon, smooth, monsoon**
What medial sound is the same?
Yes, the letters are sound is **/oo/**

The letters **OO** are pronounced / **oo /.** These two letters produce one sound. This combination is called a diagraph. The sound o-o is elongated so we code it with a long macron. The long macron shows that the sound is elongated. The macron does not show that the sound is long.

What comes next?
## Reading Practice
Now we will apply what you have learned. Take out a sheet of paper. I will say words with the diagraph **OO**. You will write each

word. We will check the words that you have written. We will read the words you have written. The first word is: doom. The next word is: shampoo, roof, stool, Cooper
Now let's read the words.
doom, shampoo, roof, stool, Cooper
Now let's check your work.
Good job reading and writing the diagraph **OO.**

What comes next?
**<u>Review</u>**
Now we will review what you have learned.

(Show students the IRD card (2.64). Students say the name of the letter, the key word, and the sound). If the students don't remember the information, the teacher says, "My turn.**OO**, moon, /oo/, Your turn" (Students respond).

(Teacher shows the Vowel Concept Card and asks.) What can you tell me about a vowel? (Students respond "Vowels are open and voiced. The vowels are a, e, i, o, u.). (If students are not able to respond, the teacher says.) "My turn. Vowels are open and voiced. The vowels are a, e, i o, u. Your turn" (Students respond.)

(Teacher shows the vowel pair syllables and asks.) What can you tell me about vowel pair syllables? (Students respond "A vowel pair syllable has two adjacent vowels.") (If the students are not able to respond, the teacher says.) "My turn." "A vowel pair syllable has two adjacent vowels.")

Good Job!

"What comes next?" The students will respond, "Oral Language and Reading Comprehension."

Day One Hundred Thirty Eight

**Check LLP**
**Reading Deck Activity**
Let's begin with a review of these cards from our reading deck.
Tell me the name of the letter, the key word, and the sound.

**New Concept Introduction**
Students take out you mirrors so that you can review a concept you
have already learned.

Listen and echo each word after me while you look in your
mirrors.
**frantic, rabbit, socket,**

How many vowels can you hear in each of these words?
That's right there are two vowels.
When you say a vowel, your mouth opens. A syllable is made with
one opening of the mouth. A syllable has one vowel sound.
How many syllables are there in the word frantic?
That's right there are two syllables.
How many syllables are there in the word RABBIT?
That's right there are two syllables.
When you pronounce the word "SOCKET" your mouth opens
twice. The word socket is made up of two syllables.
When you pronounce the word "FRANTIC" your mouth opens
twice. The word frantic is made up of two syllables.

Look at the word on the blackboard. (overhead)
When I place my finger under the vowels, there are two consonants
between the vowels. VOWEL, CONSONANT, CONSONANT,

VOWEL. The word is divided between the two consonants. We place the accent on the first syllable because most English words are accented on the first syllable.

The first syllable is closed. The vowel in a closed syllable is short. Code it with a breve. The second syllable is closed. We also code the short vowel with a breve.

What comes next?
## **Reading Practice**
Now we will apply what you have learned. You will divide the syllables between the two consonants.  Code each syllable and place the accent on the first syllable.

| | | |
|---|---|---|
| 1. bucket | hopper | tonsil |
| 2. suffix | locket | impact |
| 3. puppet | content | sandal |
| 4. popper | sandal | mantis |

What comes next?
## **Review**
Now we will review what you have learned.

(Teacher shows the VCCV pattern Concept Card) Students what can you tell me about a VCCV pattern? (Students respond "Words with the VCCV pattern usually divide between the consonants with an accent on the first syllable.") (If the students are not able to respond, the teacher says.) "My turn." "Words with the VCCV pattern usually divide between the consonants with an accent on the first syllable."

(Teacher shows the Closed Syllable Concept Card and asks.) What can you tell me about closed syllables? (Students respond "A closed syllable ends in at least one consonant. The vowel in a closed syllable is short; code it with a breve.") (If the students are

not able to respond, the teacher says.) "My turn." "A closed syllable ends in at least one consonant. The vowel in a closed syllable is short; code it with a breve."

(Teacher shows the Open Syllable Concept Card and asks.) What can you tell me about an open syllable? (Student responds "An open syllable ends in one vowel. The vowel in an open, accented syllable is long; code it with a macron.") (If the students are not able to respond, the teacher says.) "My turn" An open syllable ends in one vowel. The vowel in an open, accented syllable is long; code it with a macron.)

Good Job!

"What comes next?" The students will respond, "Oral Language and Reading Comprehension."

# Reading Practice 138
## VCCV

1.　　　bucket　　　hopper　　　tonsil

2.　　　suffix　　　locket　　　impact

3.　　　puppet　　　content　　　sandal

4.　　　popper　　　sandal　　　mantis

Day One Hundred Thirty Nine

Check LLP
**Reading Deck Activity**
Students each day our lesson will begin with a review of these cards from our reading deck. Each day you will tell me the name of the letter, the key word, and the sound.

"What comes next?"
**New Concept Introduction**
Students take out you mirrors so that you can review a new sound, a key word to unlock the sound and the letter or letters that represent that sound.

Listen and echo each word after me while you look in your mirrors.
Listen for the sound that is the same in all these words.
**Picnic, racket, basket**
What medial sound is the same?
Yes, the sound is sound is **/k/**

Look at the words on the blackboard. (overhead)
When I place my finger under the vowels, there are two consonants between the vowels. VOWEL, CONSONANT, CONSONANT, VOWEL. The word is divided between the two consonants. We place the accent on the first syllable because most English words are accented on the first syllable.

The first syllable is closed. The vowel in a closed syllable is short. Code it with a breve. The second syllable is closed. We also code the short vowel with a breve.

What comes next?

**Reading Practice**

Now we will apply what you have learned. Take out a sheet of paper. I will say words with the VCCV pattern. You will write each word. We will check the words that you have written. We will read the words you have written. The first word is: racket. The next word is: basket, trumpet, sandal

Now let's read the words.

racket, basket, trumpet, ruckus

Now let's check your work.

Good job reading and writing syllable division VCCV.

What comes next?

**Review**

Now we will review what you have learned.

(Teacher shows the VCCV pattern Concept Card) Students what can you tell me about a VCCV pattern? (Students respond "Words with the VCCV pattern usually divide between the consonants with an accent on the first syllable.") (If the students are not able to respond, the teacher says.) "My turn." "Words with the VCCV pattern usually divide between the consonants with an accent on the first syllable."

(Teacher shows the Closed Syllable Concept Card and asks.) What can you tell me about closed syllables? (Students respond "A closed syllable ends in at least one consonant. The vowel in a closed syllable is short; code it with a breve.") (If the students are not able to respond, the teacher says.) "My turn." "A closed syllable ends in at least one consonant. The vowel in a closed syllable is short; code it with a breve."

(Teacher shows the Open Syllable Concept Card and asks.) What can you tell me about an open syllable? (Student responds "An

open syllable ends in one vowel. The vowel in an open, accented syllable is long; code it with a macron.") (If the students are not able to respond, the teacher says.) "My turn" An open syllable ends in one vowel. The vowel in an open, accented syllable is long; code it with a macron.)

Good Job!

"What comes next?" The students will respond, "Oral Language and Reading Comprehension."

Day One Hundred Forty

**Check LLP**
**Reading Deck Activity**
Let's begin with a review of these cards from our reading deck.
Tell me the name of the letter, the key word, and the sound.

**New Concept Introduction**
Students take out you mirrors so that you can review a concept you
have already learned

Listen and echo each word after me while you look in your
mirrors.
**Yelled, seemed**

What do you hear in the final position of each of these words?
Yes, the /d/ sound
Look at the board.

yell + ed= yelled, seem + ed = seemed,

If you take off the -ed from each of these words, there is still a
base word. The suffix -ed with a final sound of /d/ means
happened in the past. Remember, a base word is a plain word with
nothing added to it -ed is a suffix that is added to a base word.
Since it begins with a consonant it is called a consonant suffix. We
will code the suffix -ed with a box.

Tell me the sounds that are at the end of these words,) yelled,
seemed)
Yes, the sound are /d/.

Say the sound again while looking in your mirror. Is the sound open or blocked?

Yes, it is blocked by the teeth.

Place your fingers on your vocal cords and say the sound one more time.

Is the sound voiced or unvoiced?

Yes, it is voiced.

When suffix –ed comes immediately after a voiced sound, it will say /d/.

Listen and echo each word after me while you look in your mirrors.

**Missed, helped, jumped**

What do you hear in the final position of each of these words?

Yes, the /t/ sound

Look at the board.

miss + ed= missed, help + ed = helped, jump + ed = jumped

If you take off the -ed from each of these words, there is still a base word. The suffix -ed with a final sound of /t/ means happened in the past. Remember, a base word is a plain word with nothing added to it -ed is a suffix that is added to a base word. Since it begins with a consonant it is called a consonant suffix. We will code the suffix -ed with a box.

Tell me the sound that is the same in all these words.

Yes, the sound is /t/.

Say the sound again while looking in your mirror. Is the sound open or blocked?

Yes, it is blocked

Place your fingers on your vocal cords and say the sound one more time.

Is the sound voiced or unvoiced?

Yes, it is unvoiced.

When suffix -ed comes after an unvoiced sound, it will say /t/.

What comes next?
## **Reading Practice**
Now we will apply what you have learned. Code suffix -ed with a box. Remember it will be pronounced as /d/ immediately after a voiced sound. It will be pronounced as /t/ immediately after a voiceless sound. We will code the first row together.

| | | |
|---|---|---|
| 1. filmed | banged | filled |
| 2. spilled | thrilled | willed |
| 3. spelled | drilled | billed |
| 4. smelled | yelled | dabbed |
| 5. skilled | filled | nabbed |

| | | |
|---|---|---|
| 1. jumped | kissed | stamped |
| 2. bumped | tricked | snacked |
| 3. camped | packed | dumped |
| 4. picked | stacked | blocked |
| 5. helped | kissed | missed |

What comes next?
## **Review**
Now we will review what you have learned.

(Teacher shows the Suffix Deck Card and asks.) What can you tell me about suffix -ed? (Students respond "Suffix -ed means happened in the past.) " (If the students are not able to respond, the teacher says.) "My turn. Suffix -ed means happened in the past.)

Good Job
"What comes next?" The students will respond, "Oral Language and Reading Comprehension." :

# Reading Practice 140

-ed = /d/

1. filmed      banged      filled

2. spilled      thrilled      willed

3. spelled      drilled      billed

4. smelled      yelled      dabbed

5. skilled      filled      nabbed

# Reading Practice 140-A

$\boxed{\text{-ed}}$ = /t/

1. jumped      kissed      stamped

2. bumped      tricked      snacked

3. camped      packed      dumped

4. picked      stacked      blocked

5. helped      kissed      missed

**Project 3**

**The Impact of the SIOP Model on Middle School Science and Language Learning**

**Year 1 Annual Report (8/1/05 - 7/31/06)**

**Deborah Short, Center for Applied Linguistics, Co-PI**
**Jana Echevarria, CSU Long Beach, Co-PI**

**Abstract**
        Most English language learners confront an educational landscape where they must study and be tested on grade-level curricula in a new language at the same time they are learning that language. This is not only difficult for the students themselves but also for their teachers. We intend to investigate this critical problem by focusing our research questions to determine which delivery model is the most effective delivery model for instruction, particularly in science.
        One approach that has shown promise is the research-validated Sheltered Instruction Observation Protocol (SIOP) Model (Echevarria, Short & Powers, 2006). The SIOP Model shares many features recommended for high quality instruction for all students. However, the SIOP Model adds key features for the academic success of ELLs, such as the inclusion of language objectives in every content lesson, the acquisition of content-related vocabulary, and the emphasis on academic literacy practice (Echevarria, Vogt, & Short, 2000, 2004). The SIOP Model offers a framework for organizing instruction with required features for each lesson so that teachers can accommodate the distinct second language development needs of ELLs.
        In our research, we investigate the impact of the SIOP Model on student academic achievement in science, a subject area with high language demands. We have developed and pilot-tested SIOP lesson plans and assessments that focus on the acquisition of science concepts and language development among English language learners in middle school. We will train science teachers in the SIOP Model so that they implement the lesson plans effectively. Then we will test student performance on the assessments and compare the results to those of control students.

**Theoretical and Conceptual Background of Study**
        The overall academic performance of ELLs in U.S. schools is problematic with a dramatic, lingering divide in achievement in many subject areas between Caucasian students and those from culturally and linguistically diverse groups (California Department of Education, 2004; Siegel, 2002; Snow & Biancarosa, 2004). Part of the reason for the achievement gap is that many teachers are underprepared to make content comprehensible to English language learners who are not proficient in the language of instruction (i.e., English). Until recently, they lacked a proven, effective model of instruction. In addition, ELLs are asked to demonstrate their content area knowledge on high stakes tests, particularly those required as part of the No Child Left Behind legislation, while they are still developing proficiency in English, which is usually the language of the tests. While ELLs have been tested in mathematics and reading to date, in

2007, tests in science will be added to the battery of assessments students must take. Our teachers need instructional interventions that can reduce the achievement gap between English language learners and native English-speaking students and we posit that the Sheltered Instruction Observation Protocol (SIOP) Model, which provides a framework for teachers to incorporate attention to second language development needs, will offer a successful approach to teaching science to ELLs.

The SIOP Model is a research-based model of sheltered instruction developed by researchers at the Center for Applied Linguistics (CAL) and California State University, Long Beach (CSULB) for the National Center for Research on Education, Diversity & Excellence (CREDE) (Echevarria, Vogt, & Short, 2000, 2004). It incorporates best practices for teaching academic English and provides teachers with a coherent, usable approach for improving the achievement of their students. The model comprises 30 items grouped into eight components essential for making content comprehensible for English learners—Preparation, Building Background, Comprehensible Input, Strategies, Interaction, Practice/Application, Lesson Delivery, and Review/Assessment. Teachers present curricular content concepts aligned to state standards through strategies and techniques that make academic content comprehensible to students. While doing so, teachers develop students' academic English language skills across the four domains— reading, writing, listening, and speaking.

The SIOP Model shares many features recommended for high quality instruction for all students, such as cooperative learning, strategies for reading comprehension, writers workshop, and differentiated instruction. However, the SIOP Model adds key features for the academic success of ELLs, such as the inclusion of language objectives in every content lesson, the development of background knowledge, the acquisition of content-related vocabulary, and the emphasis on academic literacy practice. The SIOP Model offers a framework for organizing instruction with required features for each lesson that accommodate the distinct second language development needs of ELLs. It allows for some variation in classroom implementation while at the same time provides teachers with specific lesson features that, when implemented consistently and to a high degree, lead to improved academic outcomes for English language learners (Echevarria, Short, & Powers, 2006).

## Research Issues

In the CREDE study, researchers worked with middle school teachers in four, large metropolitan school districts—two on the East Coast and two on the West Coast— to identify key practices for sheltered instruction and develop a professional development model to enable more teachers to use sheltered instruction effectively in their classes. The teachers taught mathematics, science, or social studies using the SIOP Model to ELLs. The students of middle school teachers using the SIOP Model outperformed comparable students on a standardized test of academic writing (Illinois Measure of Annual Growth in English). SIOP implementation was verified by in-class observations using the Sheltered Instruction Observation Protocol. (See Echevarria, Short, & Powers, 2006 for research results.)

The SIOP Model is currently being implemented in school districts and used in university teacher preparation programs in all 50 states around the U.S. Moreover, many resources have been developed by the researchers to help support the professional

development of teachers using the model. However, the implementation of the SIOP Model has outpaced the research on its features. While the preliminary research results were significant, the student outcomes were focused on academic literacy, in particular writing, and on attendance data. All core subject areas were combined in that study, so the effects on any one subject area could not be determined.

In this new research project, we are testing the effects of the SIOP Model on student academic success in one specific subject area with high language demands—science. In a series of controlled, randomized studies, we are investigating whether the SIOP Model has a significant impact on the acquisition of science concepts and scientific language development among English language learners in middle school at a time when they are beyond the initial age for literacy development. In order to do this study, we will provide professional development to teachers on the model, with a focus on identifying language and content objectives for each lesson, selecting appropriate techniques to ensure coverage of those objectives, and designing activities that promote science reading comprehension and student interaction. For one group of teachers, we will provide researcher-developed curriculum units with SIOP science lessons for them to implement for part of the academic year. We expect that students' vocabulary development and comprehension of scientific concepts will significantly increase in classes with SIOP trained teachers.

In the final 2 years of the Research Center, we will integrate what we have learned from our SIOP studies with findings from other Center studies on reading strategies, text modification, background building, and language development to enhance the SIOP Model. In a large scale, randomized study in Year 5 at new research sites, we plan to evaluate the effects of the integrated SIOP Model in the science and social studies content areas.

**Hypothesis**

We hypothesize that the students of teachers trained in the SIOP Model will outperform students of teachers not trained in the model on measures of Grade 7 science content and scientific language. In addition, teachers who receive training in the model plus project-developed SIOP science curriculum units will implement the model to a higher degree than teachers who receive training alone, and the students of teachers with training + SIOP science lessons will perform better than students of teachers with training alone.

**Research Questions**

1. What are the effects of the SIOP Model of sheltered instruction on academic language and concept comprehension among English language learners in middle school science classrooms?

2. What are the effects of an integrated SIOP Model of sheltered instruction (that incorporates findings from other Center studies on reading strategies, language development and text modification) on academic language and concept comprehension among English language learners in middle school science classrooms?

**Significance of Proposed Study for Research, Policy, or Practice**

Across the U.S., school districts are seeking research-based approaches with proven results to help ELLs develop academic language proficiency and understanding of science concepts. This study, over 5 years, will investigate the professional development and curriculum design of SIOP Model lessons and the subsequent effect on student achievement in multiple sites with diverse student populations. The Year 1 pilot was designed to develop and refine science curriculum lessons that incorporate the SIOP Model features and to field-test academic science language assessments. The results of the pilot study will be used in Years 2 and 3 as the research is scaled up to multiple sites across the U.S. It is anticipated that the data gathered from Years 1-3 will be combined with the research findings from other NRDCELL research studies and will ultimately coalesce into a successful school reform intervention that benefits English language learners and non-ELLs alike.

**Study Design: Sample Selection Criteria, Sample Size, Methods, and Data Analysis**

The student population will include seventh grade English language learners in Life Science classes. They will participate as part of their regular instructional day. The number of students and classes participating varies according to the research year. During the pilot in Year 1, approximately 120 students participated in two districts, Arlington, Virginia and Long Beach, California. In Year 2, it is anticipated that 150-200 students will participate in Long Beach, and in Year 3, 250-300 in a district yet to be determined. The number of participating students in Year 5 will be determined in later years.

Regarding the teacher participants, five teachers field-tested the SIOP science units and assessments in the Year 1 pilot study in the two districts. In Years 2 and 3, the teachers will be selected from randomly assigned schools as treatment or control participants. For Year 2, it is anticipated that 10 teachers will join the study (5 as treatment and 5 as control), and 15 teachers will join in Year 3 (10 as treatment and 5 as control). As with the students, the number of teachers for Year 5 will be determined in the future. In the Year 2 study, schools will be randomly assigned to treatment or control and teachers within schools will implement the assigned condition in all of their seventh grade science sections.

We are developing two types of materials for the research study: SIOP science curriculum units and scientific language assessments. For the pilot study, we created SIOP lessons for several seventh grade science units with corresponding assessments tied to state science and English language development standards. These lessons were taught by seventh grade science teachers in their classes. The teachers consulted on the lesson design and provided feedback once the lessons had been taught. These lessons will be revised based on teacher feedback and observation records. The revised lessons will be used in Years 2 and 3 as the study scales up.

We are also developing unit-specific scientific language assessments. Pre-and post assessments are being piloted in the study to ensure that the test items, instructions and format of the test are working. The items for these language assessments are informed by the World-class Instructional Design and Assessment (WIDA) English Language Proficiency Standards for English language learners, based on the TESOL Standards for English language learners. The test tasks are adapted from the test tasks used by Butler, et al. (2004) and Bailey, et al. (2005) from the National Center for

Research on Evaluation, Standards, and Student Testing (CRESST). Butler and Bailey developed a framework for developing tests for ELLs based on analyses of the academic language demands in science and other subject textbooks. The teachers in this project administer pre- and post-assessments of lesson-related scientific language and content at the start and close of each unit. The post assessments serve as the unit test the teachers would normally give.

Data collection for the pilot in Year 1 included observation notes made during delivery of the SIOP science lessons, teacher feedback on the lessons, and student performance on lesson tasks and assessments. In Years 2 and 3, SIOP protocol ratings of classroom observations and videotapes of classroom instruction will serve as additional data.

Data analysis in Year 1 includes qualitative review of the feedback and observation notes to determine necessary revisions to the SIOP lessons. Analysis of student performance on the assessments, including an item-analysis examination, will be used to revise the assessments after Year 1. Student knowledge growth will be determined by comparative analyses of their pre- and post-test scores. Differential analysis of each test item will help determine areas of weakness and strength among the students. Test items from student assessments will be combined with teacher observation scores on the SIOP and field notes from the observations to identify the relationship between what is taught, how it is taught, and how students perform on the test. In Year 2, the analyses will include a comparison of the gains achieved by the treatment and control groups in the pre and post administrations of the content and language assessments. We will also determine whether students' gains are larger for certain science units. The statistical model is multi-level repeated measures design with students nested within class, class within teacher, and teacher within school. Treatment effects are measured at the school-level, but with repeated measures at the teacher level (multiple sections per teacher), and the measure of learning is post-test performance adjusted for pre-test performance at the student level. In order to minimize the chances for unhappy randomization at the school-level given the small number of units to be assigned, we grouped the schools based on the number of ELLs and randomly assigned them to conditions within groups in accordance with recommendations from Murray (1998) (see below for additional details).

**Principal Dependent, Independent, and Control measures**

During the pilot phase of Year 1, we did not have dependent, independent, or control measures. We field tested a lesson design template, curriculum units, and an approach to measuring the language of science. We sought to determine, through pre- and post-assessment, the growth in students' science content and language skills after receiving 2-3 weeks of instruction by teachers using lessons designed according to the SIOP Model.

In Year 2, the independent variables will be the staff development for the treatment teachers and the SIOP science lesson plans. In addition, teachers who are determined to be low implementers of the SIOP based on the results of their observation ratings will receive coaching from the researchers to enhance their implementation. The dependent variable will be the curriculum objectives for Grade 7 science and SIOP protocol rating scale.

The schools participating in Year 2 will be randomly selected as treatment or control sites and then teachers will be assigned. In Year 2, we will have two conditions: Treatment teachers receive professional development in the SIOP Model plus the SIOP science units, and Control teachers provide instruction on the same units in their usual way. In Year 3, we will have three conditions: Treatment A teachers receive professional development in the SIOP Model plus the SIOP science units, Treatment B teachers receive professional development in the SIOP Model without the SIOP science units, and Control teachers instruct the same units in their usual way.

## Findings and Accomplishments Since the Last Performance Report

### School Recruitment

On the east coast, in Fall 2005, we contacted several school districts in the metropolitan Washington, DC area to determine their middle school program models for English language learners, number of ELLs they serve in Grade 7, and their interest in participating in the pilot stage of this study. The contacted districts included Arlington Public Schools, Fairfax County Public Schools, Prince William County Public Schools, and the City of Manassas Public Schools in Virginia, and Montgomery County Public Schools, in Maryland. After several discussions with ESL and science coordinators at these districts, we pursued a collaborative research relationship with Arlington Public Schools (APS) which provides the High Intensity Language Training (HILT) program model for their students and which was the site of the original SIOP Model research under the Center for Research on Education, Diversity & Excellence. We submitted a research application to APS's Research and Evaluation office for consideration by their research committee in January 2006. We also met with the ESOL Science Resource specialist, the ESOL secondary specialist, and the head of the ESOL Program for the district. Our application was passed on to the Board of Education and approval was granted in late March 2006.

The ESOL central office staff identified teachers and schools for the pilot and we formally invited their participation. After approaching nine teachers, four teachers from two middle schools agreed to join the study. The teachers received 3 hours of training in the SIOP Model, an overview of the SIOP science lesson plans, and a discussion of the science language assessments. The teachers received the lessons and associated teaching materials (e.g., student handouts). The language and content assessments were provided according to the lesson implementation schedule. Teachers received the pre-assessments at the start of each unit and the post assessments at the end.

A similar process occurred on the west coast. Several California districts were contacted in Fall 2005 for possible participation in the study. Given the time frame, it was also important to identify the district for the Year 2 research that served a large population of ELLs. The districts contacted included Garden Grove Unified School District, ABC Unified School District and Long Beach Unified School District. Los Angeles Unified was also considered but not pursued because they were already committed to another SIOP grant proposal. Long Beach Unified School District seemed the best choice given the size of the student and teacher population; the large number of middle schools with ELLs allowed for 5 schools to be randomly assigned to each condition. After several meetings with district personnel (i.e., the assistant

superintendent, district ELL coordinator, science coordinator, and middle school coordinator), we received permission from Long Beach Unified School District (LBUSD) to participate in the pilot study and three Grade 7 science teachers were identified to support the effort. Researchers held a meeting at the pilot school site with the principal and science teachers to prepare for the pilot study. In addition, LBUSD gave approval to conduct the Year 2 study in 10 middle schools. The researchers worked with the district ELL coordinator to determine the number of ELLs at each school site. After some schools were eliminated because of year-round status or special programs, the remaining sites were classified as high, medium or low relative to the number of ELLs in the student population. Sites were randomly assigned to treatment or control, beginning with the high and medium sites, until there were 5 schools in each condition.

At the west coast site, in mid March, we conducted a 3-hour training for the science teachers at the pilot school site. This staff development session included an overview of the SIOP Model as well as a session for critiquing SIOP lesson plans. At that point, two teachers informed the researchers they were teaching health rather than life science in the spring and could not participate in the pilot. One teacher did continue with the study. The teacher was provided with a binder of all lessons from the cell division and genetics/heredity units and associated materials for teaching the lessons.

**SIOP Science Lesson Plans**

We developed a unit design and lesson plan template for the pilot SIOP Science lessons that aligned with the Grade 7 life science standards and the middle school ELD standards for Virginia and California. After reviewing the pacing guides and speaking with administrators from both districts, we selected a unit on genetics and heredity for the pilot because both districts would teach topics from this unit in the fourth quarter of the 2005-06 school year when we would conduct the research. We then drafted specific lessons for this unit that corresponded to California's and Virginia's content standards for genetics and investigation and experimentation. Additionally, the lessons supported specific skills and tasks outlined in the curriculum frameworks for APS and LBUSD. Most of the same lessons will be taught at both sites, but some will be different because the scope and sequence of science instruction varies somewhat between the two school districts. We intended to have teachers work with us to design the SIOP science units, but the delay in district approvals and teacher selection required that we write the lessons and then have teachers review them. We wrote lessons on cell division and genetics and heredity to start the study. By the time the pilot started in the east coast district, however, three of the four teachers had taught these topics. Therefore, an additional unit on biomes was developed. The LBUSD teacher piloted the cell division and genetics lessons. All four APS teachers piloted the biomes lessons, and one piloted the genetics and heredity unit as well. A sample lesson plan is attached in Appendix P3-A.

**Science Language Assessments**

In preparation for developing pre-and post- assessments to determine the effectiveness of the SIOP intervention in our pilot study, the project assessment specialist reviewed the literature to investigate how other researchers have defined and tested the construct of academic language in science. She examined the TESOL PreK-12 standards for English language learners and the national science education standards to guide the

test development process and also reviewed available science tests at the national, state, and school district levels and researcher-developed tests that assessed academic language in science, to obtain ideas for possible assessment format and content. To assist in the test design, the project acquired resources for test and lesson plan development, such as a free online software that analyzes the lexile level of reading passages and a vocabulary database that provides the grade and difficulty levels of words.

In collaboration with the project PIs, the assessment specialist defined the construct of academic language in the context of the project and developed test specifications for the pre- and post- tests. Each SIOP science unit would have a corresponding science language assessment. Test passages and questions were drafted to align to the language skills associated with cell division, genetics/heredity, and biome knowledge. These sample items involved reading and writing tasks, using scientific language. A scoring rubric, with descriptions of the quality and quantity of vocabulary and syntactic complexity required for each score, has been developed for the essay writing portion of the test. Sample responses for each numeric score on the rubric have also been written for each essay question. The pilot teachers also reviewed these items. After an initial item analysis of the genetics and heredity language pre-assessments revealed the students were correctly answering too many of the vocabulary and reading items, the biome assessment was modified to include items that were more appropriate to the age and English proficiency level of the students. A sample science language assessment is attached in Appendix P3-A.

For the content assessments, we relied on LBUSD's end of course exam which meets the California state testing requirement for science knowledge for the west coast students. This 42 item multiple choice test, revised slightly each year, is based on the California science standards and is given to all students in the Long Beach district at the conclusion of life science. We modified LBUSD's end of course test for the east coast so that it only included test items relevant to the topics covered in our SIOP science. We also included questions from the chapter tests associated with the textbook *Science Explorer* series which our assessment specialist reviewed for lexile levels.

## Year 1 Pilot Results

The pilot study took place from late April through early June. We communicated regularly with the teachers and periodically met with them at the school sites. On the west coast, the lessons and assessments from three units—photosynthesis and respiration, cell division and genetics—were pilot tested at one middle school in three different Grade 7 science classes, and on the east coast, 4 teachers at two schools participated using the genetics/heredity and biomes curriculum units. For data collection purposes, each teacher was observed during the pilot (three times on the east coast, twice on the west coast), and researchers recorded field notes about the lesson delivery and the student participation and performance on lesson tasks.

As part of the study data collection, each teacher (in both districts) was given a feedback form to record information after each lesson. Teachers were asked to comment on what went well during the lesson, any challenges they encountered, and changes they made to the lesson and why. The teachers were encouraged to offer suggestions for alternative activities. In addition, as they administered the assessments, the teachers recorded information about student reaction, time spent on the assessments, and questions

posed. One teacher's feedback indicated that the lessons were engaging and students enjoyed many of the hands-on activities that provided practice with the lesson's concepts. She reported, "Some students' ability to take notes and summarize has improved and is evident in their work." However, generally lessons were too long so students were unable to complete all the activities in one period. Other teachers reported that they enjoyed the vocabulary building and review activities built into the lessons, but also acknowledged not doing as many as they would have liked due to a lack of time.

In LBUSD, 102 students participated in the pilot study. Of those students, 38 were classified as ELL or had been ELL but were redesignated as fluent. Their proficiency level breakdown was the following, based on California's five levels: 33 students were redesignated; 1 student was advanced, and 4 were early advanced students. Forty-three APS students participated: 28 were at the intermediate level, 9 were at the early advanced level, and 1 was an advanced level student. Also 5 former ELLs who have monitored status were in the classes. The beginning level APS students do not use the Grade 7 science curriculum and so were excluded. We collected and scored the student pre- and post assessments of scientific language and content knowledge on the following unit topics: genetics/heredity and interactions among living things/biomes.

Much of the data gathered from the pilot was qualitative. Data were collected from classroom observations, written teacher feedback on the lessons, teacher interviews, and pre- and post-assessments to measure student content and language achievement. Each teacher was observed two or three times and notes were recorded on general information about the class, such as number and gender of students, and classroom arrangement, and information specific to the lesson plan. Additionally, notes were made on the posting of content and language objectives, key vocabulary words, and other features in the room that supported science language and literacy development. During the observations, we indicated each section of the lesson that the teacher addressed, and noted any modifications and how long it took the teacher to cover the section.

Our observations and the teacher feedback confirmed that the lessons need to be modified in scope for subsequent years of the study. For example, the lessons will be rewritten to instruct teachers to state the objectives explicitly at the beginning and end of class. Because many of the lessons took longer than anticipated, the revisions will also shorten the lesson plans. Classroom observations also informed us of areas where teachers needed more guidance. For example, some teachers only presented and reviewed information orally. Lessons will be revised to direct teachers to use more sheltered instruction practices, such as recording student responses during brainstorming activities, partnering students for more interaction, and completing the note-tasking templates.

Classroom observations also revealed that there was a high degree of variance with regard to adherence to the lesson plan and SIOP-based instruction and activities. Of the four teachers on the east coast, two were familiar with the SIOP Model and were more consistent in following the lesson plan. The participating teachers who had had no exposure to the SIOP Model prior to the pilot workshop were less consistent in following the plans. It was also apparent that the teachers less familiar with the SIOP Model avoided, or had difficulty with, activities in the lessons that emphasized building background, language development, and interaction. For example, less experienced SIOP teachers instructed students to use the book glossary to define new words or ignored

activities in the lessons designed to emphasize and expand the students' use of scientific language.

In contrast, teachers with more familiarity in the SIOP Model spent more time building background and emphasizing vocabulary than expected according to the lesson plans. In some instances, the experienced SIOP teachers modified the lessons effectively so students would be more successful. For example, these teachers displayed and added on to a list of the new vocabulary so students would have a resource to consult during the unit. These teachers overall followed the lesson plans in terms of the activities designed to promote science language development; they explicitly referred to the key vocabulary throughout the lesson and encouraged the students to replace general vocabulary terms with more academic ones. Our conclusion from this finding is that the teachers need significantly more staff development on the SIOP Model prior to implementing the lessons.

We also piloted the assessments and rubrics for each unit of lessons. Assessments were scored by one rater using the rubric created by the assessment specialist. We uncovered a major difficulty with our west coast student data which rendered our analyses for those students unfortunately invalid. The pilot teacher admitted that she coached the students during both the pre- and post-assessment administrations in an effort to make them feel more confident in their performance. As a result, we do not believe we have an accurate picture of their performance and have not included their scores in the discussion here.

Initial analysis of data from the genetics/heredity and biome units on the east coast indicates that ELLs exhibited more improvement on the content assessments than on the language assessments (see Table 1). Twelve students were present for both the pre- and post-test administrations. The maximum score varied by assessment. The genetics/heredity language and content assessments were worth 16 points. The biome language assessment was worth 18 points and the content assessment was worth 20.

**Table 1: APS student means on pre and post language and content assessments**

|  | **Language pre-assessment** | **Language post-assessment** | **Content pre-assessment** | **Content post-assessment** |
|---|---|---|---|---|
| Genetics/Heredity | **6.0** of 16 pts | **7.0** of 16 pts | **1.6** of 16 pts | **6.9** of 16 pts |
| Biomes | **8.9** of 18 pts | **10.1** of 18 pts | **4.7** of 20 pts | **9.1** of 20 pts |

N=12

The scores on the language assessment reveal minimal improvement between pre- and post-test administration; however, as shown in Tables 2 and 3, writing was one section where students showed some improvement.

**Table 2: Breakdown of APS student scores on test item V (essay writing) on genetics language pre and post-assessment**

| Writing score | Pre-assessment scores | Post-assessment scores |
| --- | --- | --- |
| 0 | 7 | 4 |
| 1 | 4 | 6 |
| 2 | 1 | 2 |
| 3 | 0 | 0 |

N=12

**Table 3: Breakdown of APS student scores on test item V (essay writing) on biomes pre and post-assessment**

| Writing score | Pre-assessment scores | Post-assessment scores |
| --- | --- | --- |
| 0 | 4 | 4 |
| 1 | 7 | 3 |
| 2 | 1 | 5 |
| 3 | 0 | 0 |

**N=12**

We are concerned that the limited time frame in which a unit is taught, approximately 3 weeks, may be too brief for measurable language acquisition to occur. We realized that the directions for the writing prompt item were not explicit enough for the students and will adjust that in the revision process. The writing rubric and benchmark papers are also being revised. The existing rubric is too general to distinguish the features of academic science writing that the prompts were designed to elicit. We are looking into the possibility of using Latent Semantic Analysis to score the writing assessments during the Year 2 study and will be piloting its use on the current writing samples over the summer. Based on that pilot we will make a decision toward the end of summer on the scoring of the writing assessments. Benchmark papers for each writing score will be reviewed as well. Further, for Year 2, the pre- and post-assessments will have items that are similar so that they can be linked, but also items that are different to ensure that a wide variety of material on each unit would be covered. For the reading comprehension questions, we will also develop items that are more independent of each other to obtain more information about the goodness of fit of each item.

The teachers also reported a concern about the amount of assessment we required. They found that two pre-tests, one for language and one for content, along with two post-tests were difficult to accomplish in one class period, yet due to tight district pacing guides, they were unable to devote additional days to assessment.

**Products**

We have attached a sample lesson plan and sample language assessment (Appendix P3-A) for the biome unit to this report. These are the versions used during the pilot study and will be revised in Summer 2006.

**Update Since the Last Performance Report**

A major goal was to secure a study location for the Year 2 intervention on the west coast and identify the treatment and control teachers. Much effort was expended in Spring 2006 on the west coast to accomplish this. As noted earlier, LBUSD agreed to be the district site for the Year 2 study. In February, after district approval was received, the 10 identified schools were categorized by ELL population. Sites were classified as high, medium or low relative to the number of ELLs in the student population. Sites were randomly assigned to treatment or control, beginning with the high and medium sites, until there were 5 schools in each condition.

The next step was to recruit teachers for Year 2. The west coast researchers emailed all project principals with introductions and a written overview of the project at the end of March. The memo requested a meeting with the principal and 7th grade science teachers in the subsequent 2 weeks. One principal responded and asked if the teachers will be informed of the benefits of the project. None of the other principals responded. In early May, the researchers succeeded in getting appointments with two of the remaining principals. They received a memo regarding the timeline of the project and a flyer announcing the teacher orientation meeting. For the other schools, the memo and flyers were left for the principal in the main offices. Subsequent emails and phone calls to the teachers were sent as reminders of a study orientation meeting scheduled for mid May.

The orientation meeting was attended by Jana Echevarria, Cara Richards, and two SIOP coaches, and one teacher from 4 of the 5 schools. The study's benefits and commitments were explained. Several teachers indicated that they may not be teaching 7th grade science in the fall. Given the low turnout of teachers at the meeting and concern about the teacher subject size in Fall 2006, one of the researchers also consulted with the principal of the pilot school site for guidance on recruiting more teachers. The principal informed her that in urban school settings, most principals do not schedule teachers for specific courses until the school year begins.

**Next Steps**

In July, researchers will revise the SIOP curriculum units and language assessments in collaboration with two teachers from the Long Beach district. Additional lessons to match the syllabus of LBUSD's Grade 7 science course will be written as well. For Year 2, a total of 8 weeks of lessons across three curriculum units will be prepared. In addition, to assist the Year 2 teachers, the researchers will prepare a calendar that shows the dates when assessments need be administered as well as the sequence of lesson instruction. The intention is to structure the units tightly so that all teachers will adhere to a similar instructional sequence.

Beginning in August, we will contact the project treatment and control teachers. A meeting with the control teachers will provide them with an overview of the project and their role in administering the pre- and post-test assessments with each unit. The project teachers will participate in a 3-day SIOP Institute wherein they will receive intensive training in the SIOP Model and will review the binder of lessons they will be teaching during the intervention. In addition, teachers will be given the calendar that specifies dates that the assessments are to be administered and a pacing guide for the lessons.

Once the Year 2 study begins, teachers will be observed and rated using the SIOP protocol to document fidelity to the SIOP Model. Each project teacher will be observed

and their lessons will be rated twice (pre-, post), one of which will be videotaped. Those teachers who do not meet a minimum level of implementation will receive coaching on more effective implementation of the SIOP Model. The coaching will be provided by research staff and will involve:

- Pre-observation discussion with each teacher emphasizing the fidelity checklist elements
- Possible viewing of the lesson videotapes.
- Observation in class
- Post-observation debriefing and suggestions

Each control teacher will be observed and the lessons will be rated twice (pre-, post) by observation only.

**Challenges**

1. Because we discovered that the pilot teacher on the west coast assisted students with the pre- and post- tests, the researchers will provide an explicit script for Year 2 teachers that will simulate the procedures of standardized testing to ensure uncontaminated administration.
2. At the initial teacher orientation, not all schools were represented because, given the transience of teachers and students in urban schools, few schools are certain of their 7th grade science teacher staffing for Fall 2006. We will work with school and district administration to ascertain the names of the teachers by mid-August in time for the SIOP training.
3. Teachers tended to modify the SIOP lessons to suit their own style. This is to be expected to some extent but to ensure that the essential elements of the questions of the study were addressed, such as language objectives and vocabulary development, we have developed a Fidelity Checklist. This checklist will function as a reminder to the teachers that for each lesson they need to: Write objectives on board; State language objectives; State content objectives; Introduce vocabulary, write words and keep posted; Review vocabulary at end of the lesson; Review each language objective and ask if it was met; and Review each content objective and ask if it was met.

**Other Activities of Note**

We had two chapters published in the National Science Teachers Association (NSTA) book, *Science for English Language Learners:*

Echevarria, J., & Coburn, A. (2005). Designing lessons: Inquiry approach to science using the SIOP model  In A. Fathman & D. Crowther (Eds.), *English through science: A guide for developing skills in English and science, grades K-8* (pp. 95-108). Arlington, VA: National Science Teachers Association.

Short, D., & Their, M. (2005). Teaching and learning English and science. In A. Fathman & D. Crowther (Eds.), *English through science: A guide for developing skills in English and science, grades K-8* (pp.199-219). Arlington, VA: National Science Teachers Association.

An article for secondary school principals was published by the National Association for Secondary School Principals:

Echevarria, J. (2006). Helping English language learners succeed. *Principal Leadership*, *6* (5), 16-21. Reston, VA: National Association for Secondary School Principals.

We have submitted proposals to present results of the pilot study at the October 2005 Washington Area Teachers of English to Speakers of Other Languages regional conference, the November NSTA regional conference on science and English language learners, and the March 2006 national Teachers of English to Speakers of Other Languages conference.

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**Attachment A**

**National Research and Development Center for English Language Learners**

**Project 3**

**Appendix P3-A**

Part A – SIOP Lesson Plan for Biomes
Part B – Sample Science Language Assessment

**SIOP SCIENCE LESSON PLAN**

**SUBJECT:  Life Science**
**UNIT FOCUS:  Biome**

**Lesson #  7**                                    **Length of lesson 1 day**

**STANDARD(S):** Virginia Standards of Learning. Life Science **10)** The students will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem.

**LESSON TOPIC:   Tundra Biomes**

**OBJECTIVES:** *write on board*
  **Language** - Students will

- Define and visually represent new vocabulary
- Use new vocabulary in original sentences
- Read and take notes on main ideas
- Describe the tundra and the adaptations of its organisms orally and in writing
- Compare and contrast the characteristics of different biomes using transitional phrases

  **Content -** Students will

- Identify the characteristics of tundra biomes
- Analyze an organism's ability to adapt to its environment

**KEY VOCABULARY**: tundra, permafrost, dwarf, in contrast, on the contrary, by comparison, conversely, lichen

**MATERIALS:** biome summary template, lesson 7 T-chart, lesson 7 mix and match cards, index cards, markers, poster or chart paper, world map
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
- -
**MOTIVATION**
**Read and explain the content and language objectives of this lesson to the students.

**Warm Up - Review key concepts of previous lesson** (10 minutes)
- Mix and Match
  - Pass out mix and match cards to pairs of students
  - Tell the students that the word on their card is either a biome or an organism in a particular biome. Tell the students they need to find their match (e.g., one card will say zebra and the matching card will say grassland)
  - Pre-teach the language structures you want the students to use (e.g., "I have gila monster, what do you have?", "Ok, can we trade?" etc…) for the mixing part. Demonstrate the card exchange process for the students.

  o Students walk around and "mix" their cards while trying to find a match.
  o Once the matches are complete, ask the students to sit down as a group and write a sentence(s) on the Warm-Up sheet explaining how this animal is well adapted to survive in its biome.
  o Groups share answers with the class when everyone finishes.

**Building Background** (3 minutes)
- Show the students a world map and direct their attention to the area of the Arctic Circle. Ask the students to brainstorm some ideas they have about this area including climate and types of organisms that live there. Tell the students that this area is in the tundra biome and we are going to learn more about it today.

**PRESENTATION (**15 minutes**)**
- Students skim Tundra Biomes and Mountains and Ice section to self-select any words they do not know but think will be important in understanding the passage. Students read and take notes on the T-chart in pairs. Go over the notes as a class to check and confirm. Record for all the students to see.
- Make vocabulary cards for *tundra, permafrost, dwarf, lichen*

**PRACTICE/APPLICATION** (10 minutes)
- Students compare and contrast the tundra with another biome on the biome summary template. Before students begin writing,  pre-tech the grammar forms and phrases they need to use for their comparison statements, include some transition phrases like *in contrast, on the contrary, by comparison, conversely*
- Ask some students to share their writing with the class.

**REVIEW/ASSESSMENT** (8 minutes)
- Carousel Review
  1. List the biomes on chart paper on post around the room (tropical rain forest, temperate rain forest, desert, tundra, grassland, deciduous forest and boreal forest).
  2. Put the students into groups and assign each one a poster and a marker. Ask the students write some information that they know about each biome on the chart paper. If the groups find a piece of information on the chart paper that they think is wrong or they have a question about, tell the students to write a question mark next to it.
  3. Give the groups about 60 to 90 seconds at each poster and then tell the students to move clockwise and repeat the activity.
  4. When all groups have visited each poster, debrief the class on the activity and answer any questions.
- Review objectives.

# Tundra Biomes

| | |
|---|---|
| 1. What is the climate in the tundra? | 1. |
| 2. What kinds of plants live in the tundra? | 2. |
| 3. When do most plants grow? Why is this the best time? | 3. |
| 4. What kinds of animals live in the tundra? | 4. |
| 5. How have birds adapted to living in the tundra? | 5. |
| 6. How have mammals adapted to living in the tundra? | 6. |
| 7. What are some areas on Earth that cannot be classified as part of one biome? | 7. |
| 8. What are some organisms that have adapted to living on ice? | 8. |

# Tundra Biomes -  Answer key

1. What is climate in the tundra?

1. Cold and dry

2. What kinds of plants live in the tundra?

2. Mosses, grasses, shrubs, and small trees like willows

3. When do most plants grow? Why is this the best time?

3. During the summer because the days are long with lots of sunshine and warmer temperatures

4. What kinds of animals live in the tundra?

4. Many insects, birds, caribou, foxes, wolves, and hares

5. How have birds adapted to living in the tundra?

5. When winter comes they migrate south

6. How have mammals adapted to living in the tundra?

6.  Some have thick fur coats. Some animals scrape snow to find lichens and animals like wolves follow herds of caribou to prey on the weak ones.

7. What are some areas on Earth that cannot be classified as part of one biome?

7. Mountain ranges and places with a lot of ice

8. What are some organisms that have adapted to living on ice?

8. Penguins, polar bears, and seals

9.

Lesson 7 Biomes Mix and Match
Directions to teacher: Print onto labels and affix one per index card.

| | |
|---|---|
| **tropical rain forest** | **tarantula** |
| **temperate rain forest** | **redwoods** |
| **desert** | **saguaro cacti** |
| **grassland** | **bison** |
| **deciduous forest** | **chipmunks** |
| **boreal forest** | **firs** |

Lesson 7 Biomes Mix and Match
Directions to teacher: Print onto labels and affix one per index card.

| | |
|---|---|
| **tropical rain forest** | **birds, like toucans** |
| **desert** | **gila monster** |
| **grassland** | **small trees** |
| **deciduous forest** | **black bears** |
| **boreal forest** | **finches** |

# Summary Template

Introductory paragraph:

Rain Forest Biomes:

Desert Biomes:

Grassland Biomes:

Deciduous Forest Biomes:

Boreal Forest Biomes:

# Summary Template

Tundra Biomes:




Freshwater Biomes:




Marine Biomes:

**Biomes Language Assessment**

**Read the following passage and then answer the questions.**

An ecosystem is a community of different species living together and the abiotic elements that affect them. A biome is a group of ecosystems with similar climates and organisms.  The location, temperature, and rainfall define an area's biomes. On land, some of the most common biomes are tropical rain forests, deserts, grasslands, deciduous forests, boreal forests, and tundras.

Tropical rain forests are found in areas near the equator. Deserts can be found in dry areas such as the Southwestern United States. Grasslands can be found in the Midwestern United States and Africa. Boreal forests are found in subarctic areas such as Siberia and North Canada. Deciduous forests are found in temperate areas such as the Northeastern United States. Tundras can be found in arctic or subarctic areas such as Alaska and the Antarctica.

Tropical rain forests receive more than 300 cm of rain each year. Most grasslands receive 25-75 cm of rain per year, but grasslands located near the equator receive as much as 120 cm per year. Deciduous forests receive at least 50 cm of rain per year. Boreal forests receive little rain throughout the year, about 20-75 cm annually. Tundras receive very little rain, only about 15–25 cm each year.

Tropical rainforests are warm and humid. Grasslands are warm to hot. Deserts are hot and dry. Deciduous forests are temperate. Boreal forests are colder than deciduous ones. Tundras are extremely cold and dry.

Tropical rainforests have tall and medium-sized trees and vines, and plants that grow well in the shade. Desert plants include plants that survive with very little water and plants that store water in their leaves, roots, and stems. Plants in grasslands are mostly grass and non-woody plants.  Deciduous forests include mostly deciduous trees that shed their leaves and grow new ones each year. Most trees in boreal forests are coniferous. They produce seeds in cones and have leaves shaped like needles. Plants in tundras include mosses, grasses, shrubs, and dwarf forms of a few trees.

I. The area around the Amazon River in South America  receives more than 400 cm of rain every year. This area must be a _____.

    a)  deciduous forest
    b)  grassland near the equator
    c)  tundra
    d)  tropical rain forest

II. Complete each sentence with one of the words in the list. Each word can only be used once.

ecosystem              biome                  abiotic                  community

1. _____ factors are the nonliving parts of an ecosystem.
2. A/an _____ contains different species living together.

3. The community and abiotic factors together form a/an _____.

4. A/an _____ is a group of ecosystems with similar climates and organisms.

III. Match the plants and their biomes. Write the letter of the biome next to the plant or plants that live in it.

A. desert
B. deciduous forest
C. boreal forest
D. tropical rain forest

___ 1) Maple trees shed their leaves during autumn.
___ 2) Many of the trees have leaves with a "drip tip" that enables rain drops to fall off quickly.
___ 3) Pine trees have needle-shaped leaves.
___ 4) The saguaro cactus stores water in its body.

IV. Part of northern Senegal is changing from grassland to desert because of a sudden population growth of humans, overgrazing by cattle, firewood gathering, and severe droughts. Scientists call this process "desertification".  Predict what will happen to the organisms of northern Senegal because of desertification. Write a short explanation.

V. Choose two biomes to compare. Using your own words, compare and contrast the two biomes in terms of their rainfall, temperature, and types of plants. Write as much as you can. Use scientific terms.