CREATE
Center for Research on the Educational Achievement and Teaching of English Language Learners

Linking Science and Academic English: Teacher Development and Student Achievement

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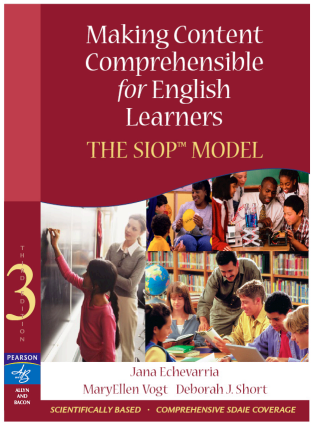
The SIOP Model

(Echevarria, Vogt, & Short, 2008)



- Preparation
- Building Background
- Comprehensible Input
- Strategies
- Interaction
- Practice & Application
- Lesson Delivery
- Review & Assessment

The SIOP Model

(Echevarria, Vogt, & Short, 2008)

- **Lesson Preparation – language and content objectives**
- **Building Background – vocabulary development, student connections**
- **Comprehensible Input – ESL techniques**
- **Strategies – metacognitive and cognitive strategies**

The SIOP Model

(Echevarria, Vogt, & Short, 2008)

- **Interaction – oral language**
- **Practice & Application – practice and apply all 4 language skills**
- **Lesson Delivery – meet language and content objectives**
- **Review & Assessment – review vocabulary and concepts**

Sheltered Instruction Observation Protocol (SIOP)

- Tool for teacher observation and feedback
- Rubric (5 point scale) to rate teaching practice on 30 features of sheltered instruction, as developed by teachers and researchers
- A guide for lesson planning and delivery

Original SIOP Development Study Research Findings (1996-2001)

- After several years of field-testing the SIOP, a validity and reliability study of the instrument was conducted. Findings indicated the SIOP is a highly reliable and valid measure of sheltered instruction (Guarino, et al., 2001).
- 1998-99: Using a prompt requiring *expository* writing, ELLs in classes with SIOP-trained teachers outperformed and made greater overall gains than ELLs in classes with non-SIOP-trained sheltered teachers on a version of the IMAGE writing test.

NJ SIOP Research Study Findings (2004-2006)

- Teachers reached high levels of SIOP implementation after 1-2 years (1 year with more support). Sustained, supported professional development works.
- Students with SIOP-trained teachers outperformed nonSIOP students on IPT tests to statistically significant levels, on average, within district in 1 year, across districts in 2 years.
- Although sample numbers were small, students with SIOP-trained teachers had, on average, statistically higher mean scores on more state content tests than the comparison group in the other district.
- Study showed that SIOP Model instruction led to improved oral, reading, and writing performance in English.

CREATE Study:

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

Research Questions

- What are the effects of the SIOP Model of sheltered instruction on academic language and concept comprehension among English Learners (ELs) in middle school science classrooms?
- What impact does teacher implementation have on student outcomes?

Overview

- Year 1: Pilot study designed to
  1) develop and refine science curriculum lessons that incorporate the SIOP Model features, and
  2) field-test academic science language assessments.
- Year 2: Randomized study

  8 California schools participated as Treatment or Control sites. Treatment teachers received SIOP training, SIOP lessons, and coaching.

- Year 4: 11 schools in Maryland participate as Treatment 1, Treatment 2, or Control sites.
  - Treatment 1 teachers will receive SIOP training, SIOP lessons, and coaching.
  - Treatment 2 teachers will receive SIOP training and coaching.
  - Control teachers conduct business as usual with data collection.
- Year 5: Data gathered from Years 1-4 will be combined with the research findings from other CREATE research studies and will tested as a school reform intervention for ELs.

Year 1: Pilot Study

- Approximately 120 students participated in two districts, Arlington, Virginia and Long Beach, California.
- Pilot tested two types of materials:
  - SIOP science curriculum units (state science and ELD standards)
  - Scientific language assessments
- The teachers consulted on the lesson design and provided feedback once the lessons had been taught.

Developing SIOP Science Units

- Aligned to state science, English language arts, and English language development standards
- Based upon district's textbook and other curriculum materials
- Included language and literacy skills necessary for ELs achievement in science
- Followed district's pacing guide
- Developed in tandem with a teacher consultant and reviewed by science teachers

SIOP Science Lesson Plan Format

- Standards
- Lesson Topic
- Objectives: Content and Language
- Key Vocabulary
- Motivation (Review of previous material and/or building ba
- Presentation
- Practice/Application
- Review/Assessment

Year 2: California Study

- Experimental Design
- 8 Middle Schools – Random assignment
  - 5 SIOP
  - 3 comparison
- 7th grade science classes
- SIOP teachers received 2 _ day training and lesson plans for 4 units on Cells and Heredity
- Teachers were provided coaching
- Students were administered pre and post science language assessments

Year 2 Schools

- 8 schools in large urban school district in Southern California
- 7 middle schools (6-8); 1 school K-8
- Balance of schools with high level EL and FEP students (30% EL, 30-50% FEP) and mid-level (15% EL, 30%-40% FEP)
- Schools all low SES or working class neighborhoods

Student Participants

Category	SIOP	%	Control	%	Totals	%
EL	105	16.2	112	30.1	217	21.3
FEP (3years or less)	212	32.7	121	32.5	333	32.6
FEP (3 years plus)	89	13.7	20	8.1	119	11.7
EO	243	37.4	109	29.3	352	34.5
Total	**649**		**372**		**1021**	

Teacher Participants

- SIOP
  - 1 male, 7 female
  - 1 African American, 1 Latina, 6 Caucasian
- Control
  - 1 male, 3 female
  - 1 Latino, 1 Asian American, 2 Caucasian

Teacher Participants

	Credential Area	Years of teaching Experience	EL Certificate
SIOP			
1	Science	15+	Yes
2	Science	11-15	Yes
3	Science	11-15	Yes
4	Science	11-15	Yes
5	Science	6-10	Yes
6	Science	6-10	Yes
7	Intern Science	3-5	No
8	Health	<1yr	No
Control			
1	Science	11-15	Yes

Professional Development

- 2 1/2 days of SIOP training

- Coaching
  - -Observations
  - -Scoring and debriefing

2 _ Day SIOP Workshop

- Second Language Acquisition
- Presented each component of the SIOP in turn with activities for each component
- Showed video clips of sample lessons
- Study Implementation
  - Reviewed research assessments: administration and timeline
  - Reviewed SIOP science lessons
  - Discussed lesson plan checklist and teacher notes page

Teacher Notes Checklist

Component	Completed	Not completed
1. Write objectives on board-both content and language		
2. State language objectives		
3. State content objectives		
4. Introduce vocabulary, write words and keep posted		
5. Highlight vocabulary throughout the lesson		
6. Review vocabulary at end of the lesson		
7. Review each language objective and ask if it was met		
8. Review each content objective and ask if it was met		

SIOP Coaching

- Coaching took place during "intervention"
- Pre-conference
- Observation - 5 times over 8 weeks
  - A few teachers were visited 6 times because they needed more support
- Debriefing with written feedback
- Coaches reviewed teacher notes

SIOP Protocol Ratings

SIOP teachers

- Each observed lesson was rated and used with coaching session

Control teachers

- One lesson was observed and rated in the middle of the 8 weeks

Unit Timeline

Example: Cell Structure and Function

- Pretest
- Lessons - 8 lessons covered in 11 days, most lessons lasted 1 day, but some were 2 or 3 days long
- Post test

*Pretest photosynthesis and respiration

Assessment: Objective Questions and Essays

Objective Questions:

- Students read passage and answer selected response items (m/c, fill-in, sequencing) related to the topic
- Often an illustration accompanies the passage to aid the student
- Measure of concept understanding

Essays

- Measure of academic language
- Scored using the IMAGE Writing Summary Rubric. Writing Subtests:
  - Language production
  - Focus
  - Support/elaboration
  - Organization
  - Mechanics

Essay Scoring

- Three trained graduate students who had been teachers or worked with ELs in classroom
- Each day raters were calibrated on 2-3 essays
- Reliability was analyzed across all three raters on 20% of the essays. There was reliability among raters.

MEANS AND SD FOR NON-ESSAY TESTS AT PRE-TEST AND POST-TEST

	CONTROL				SIOP			
	PRE-TEST		POST-TEST		PRE-TEST		POST-TEST	
SCALE	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
CELL DIVISION	2.68	1.37	**2.67**	1.41	2.57	1.45	**2.86**	1.43
CELL STRUCTURE	5.22	3.01	**7.28**	2.92	6.26	3.14	**7.53**	3.04
GENETICS	5.83	3.64	**8.29**	3.79	5.45	3.34	**8.14**	3.96
PHOTOSYNTHESIS	3.08	1.64	**3.79**	1.67	3.24	1.76	**4.08**	1.69
COMBINED	15.48	7.31	19.36	8.60	15.86	7.81	20.83	8.72

MEANS AND SD FOR ESSAY MEASURES AT PRE-TEST AND POST-TEST

	CONTROL				SIOP			
	PRE-TEST		POST-TEST		PRE-TEST		POST-TEST	
SCALE	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
CELL DIVISION	12.22	3.20	**12.83**	3.67	12.99	3.14	**13.87**	3.87
CELL STRUCTURE	18.31	8.50	**24.63**	7.93	22.02	9.34	**26.56**	9.62
GENETICS	19.16	7.19	**24.88**	8.44	18.21	7.52	**26.91**	9.06
PHOTOSYN-THESIS	14.21	3.47	**14.44**	3.61	14.11	3.51	**15.33**	3.41
COMBINED	41.77	20.89	56.41	24.62	43.78	24.72	61.21	29.63

SIOP Observation-Sample Section

LESSON PREPARATION

	4	3	2	1	0
1.	**Content objectives** clearly defined, displayed, and reviewed with students		**Content objectives** for students implied		No clearly defined **content objectives** for students

Comments:

	4	3	2	1	0
2.	**Language objectives** clearly defined, displayed, and reviewed with students		**Language objectives** for students implied		No clearly defined **language objectives** for students

Comments:

	4	3	2	1	0
3.	**Content concepts** appropriate for age and educational background level of students		**Content concepts** somewhat appropriate for age and educational background level of students		**Content concepts** inappropriate for age and educational background level of students

Comments:

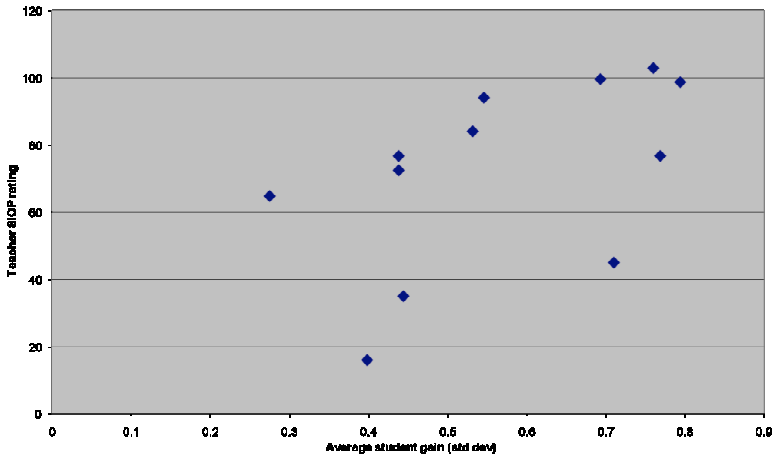
Teacher growth with coaching

- "High Implementers" (total score over 80%)
  - Consistently high scores in all components: particularly higher in lesson preparation, interaction and review
- "Low implementers"
  - Made the most growth over the time in lesson preparation but never got to the same level
  - Were inconsistent in the other components, moving up and down across observations

Effects of Teacher Implementation

- The higher the teacher rating on the SIOP protocol, the better the students performed
- This was true for all subgroups: English Learners, Fluent English Proficient, English Only, and students with disabilities
- This is true of both SIOP and control teachers

Relationship: average teacher performance and student outcomes



Year 4 Study Modifications

- We have developed new SIOP Science lessons for second quarter units on Chemical Interactions.
- We have developed new science language assessments to accompany these units.

Year 4 Study Modifications

- We offer extended professional development on the SIOP Model before the lesson intervention and data collection
  - teachers in both treatment groups have first quarter (Q1) to practice the SIOP Model and receive coaching
  - the intervention/data collection takes place in Q2 of the school year

Year 4 Study Modifications

We are testing two strong pd options
- Treatment 1 and 2 had joint summer training (3 days) plus a follow up in September (1 day)
- Treatment 1 uses SIOP Science lessons in Q1 and Q2
- Treatment 2 uses some SIOP Science lessons in Q1 but with a gradual release, so they develop own lessons for Q2.
- Treatments 1 & 2 have coaching in both quarters.

Year 4: SIOP Science Interventions

Treatment 1	Treatment 2	Control
SIOP prof. development + Coaching + Science Units for Q1 & Q2	SIOP prof. development + Coaching + Some science lessons for Q1	Regular instruction

Conclusions

- Teacher implementation of the components matters
- It appears that teachers need more than 10 weeks to learn the model