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Focus on Middle and High School Issues*

Ecobehavioral Assessment of Exceptional Culturally and Linguistically Diverse Students: Evaluating Effective Bilingual Special Education Programs

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Introduction

The bilingual exceptional student has created added pressure for educators and researchers to develop effective instructional strategies and for administrators and researchers to develop evaluation strategies that facilitate statutory compliance, but also make instructional sense. In the field of bilingual education the issues of the best type of services, coupled with cultural pluralism, heterogeneous populations, exit-entry assessments, and the equal protection of the law, are often in conflict with intervention strategies, confounding the issue of what an ideal bilingual education program should be or accomplish. No one specific criterion is sufficient to measure and describe the variety of bilingual programs available, nor has any clearly defined variable emerged against which to evaluate the general adequacy or effectiveness of bilingual education (Amber and Dew, 1983; Fradd and Hallman, 1983; Garcia, 1991; Hakuta, 1985; O'Malley, 1978).

The merging of the fields of bilingual education and special education into bilingual special education has presented even more methodological and assessment challenges and more demanding complications to teachers and program evaluators. Students in bilingual special education not only have limited English proficiency (LEP), they also experience specific learning problems and handicapping conditions that interfere with the acquisition of English and with retention of skills and content material (Baca and Cervantes, 1984; Tymitz, 1983). The issues of referral, nondiscriminatory assessment, categorization and classification procedures, individualized education programming, program conferences, mainstreaming, due process, parent involvement, staff training, placement in less restrictive environments, and coordination of services, all add to the difficulty of assessing program impact and efficacy accurately (Baca and Bransford, 1982; Hakuta, 1985; Ortiz and Yates, 1983).

The science of bilingual special education service delivery can only move forward when successful programs can be replicated, and this can only happen when the independent variable, the bilingual special education intervention, has been clearly delineated, assessed, and empirically examined. Bilingual special education researchers, in order to establish the purview necessary for research, education development, and evaluation agendas for this growing field, must address the critical questions of: (a) What is the state-of-the-art in bilingual special education in terms of essential features of effective intervention programs and program evaluation? (b) Which service delivery programs [e.g., full bilingualism, English immersion special education programs, or mainstream with English as a second language (ESL)] are most effective with different categories of bilingual exceptional children? (c) How do bilingual special education intervention programs work? and (d) How can we practically effect long-term gains cognitively, linguistically, and

educationally through these interventions? Answers to these questions require more than a traditional outcome-only approach to assessment. They require the use of evaluation strategies that are responsive to the complexities of individual children, individual programs, and individual contexts.

Ecobehavioral Assessment: A Technology for Measuring Classroom Processes

During the last decade the ecobehavioral assessment approach has received growing attention as a sophisticated and applicable methodology in the analysis of education programs. The ecobehavioral approach to assessment emerged from a combination of three different theoretical fields: *ecological psychology* and its concerns with assessment of aspects of the environment within strategies for observational measurements (e.g., Barker and Wright, 1968; Brofenbrenner, 1979); the designs of *applied behavior analysis* (e.g., Bear, Wolf, and Risley, 1987; Bijou, Peterson, and Ault, 1968; Rogers-Warren and Warren, 1977); and the *process-product research* in education (e.g., Brophy and Good, 1986; Dunkin and Biddle, 1974). It is defined as a means of assessing program variables through systematic observation, and measuring the moment-to-moment effects of an array of situational variables on student behavior. In ecobehavioral assessment, the momentary interactions between program variables (ecological stimuli) and student behaviors are the units of analysis for predicting or otherwise investigating program outcomes such as developmental gain or long-term achievement (Carta and Greenwood, 1985, p. 92).

Ecobehavioral assessments have been developed in response to the growing demand in the education fields for improved methods of evaluating and developing effective instructional practices that focus on the series of ecological events (e.g., instructional activity, materials, grouping, teacher behaviors, and so on) temporarily related to students' behavior. Thus, the ecobehavioral approach goes beyond the input (independent variable–intervention); output (dependent variable–outcome measure) strategy of assessment by providing for the assessment of ongoing, moment-to-moment processes that affect students. Kamps, Leonard, and Greenwood (1991) described the definite advantage of an ecobehavioral approach to the assessment of classroom practices in that it allows for the direct examination of quantified ecological and behavioral variables either individually or conditionally (i.e., in terms of the effect of one on another).

In the past few years, researchers have advanced the use of ecobehavioral analysis in evaluating the effectiveness of instruction and interventions in a variety of education settings: in *regular education* (Greenwood, Delquadri, and Hall, 1984; Greenwood, Schulte, Kohler, Dinwiddie, and Carta, 1986); in *special education* (Greenwood, Carta, Kamps, and Arreaga-Mayer, 1990; Thurlow, Ysseldyke, Graden, and Algozzine, 1984; Ysseldyke, Thurlow, Mecklenburg, Graden, and Algozzine, 1984); and in *early childhood education* (Carta, Greenwood, and Robinson, 1987). Work in ecobehavioral methodology at the Juniper Gardens Children's Project has resulted in development of several comprehensive observation systems (Carta, Greenwood, and Atwater, 1985; Greenwood, Carta, Kamps, and Arreaga-Mayer, 1990; Greenwood, Delquadri, et al., 1985, 1986; Stanley and Greenwood, 1983). This technology has taken on greater applied significance in the evaluation of instructional interventions by demonstrating that an ecobehavioral approach can ascertain the specific elements of programmatic success in a variety of service delivery models for monolingual students. However, although the ecobehavioral approach equips researchers and educators with a more precise and systematic means of ensuring program effectiveness, fidelity, and replication, this approach has yet to be applied to bilingual special education programs (Arreaga-Mayer, Carta, and Tapia, in press). Once researchers, program developers, administrators, and teachers in bilingual intervention programs have a knowledge base concerning the variables that are responsible for the success of bilingual

special education programs, they can be more likely to replicate and expand upon these successes.

The Ecobehavioral System for the Contextual Recording of Interactional Bilingual Environments: ESCRIBE

The ESCRIBE code represents a new approach to the evaluation of programs serving culturally and linguistically diverse learners (CLDL) in mainstream and special education settings (Arreaga-Mayer, Carta, and Tapia, 1992). It was developed based on the documented need to describe in quantifiable terms those aspects of mainstream or special education intervention programs that make a difference in CLDL's academic and linguistic development. This code is an endeavor at quantifying the complex array of variables that differentiate one program from another. It identifies those variables that interact to affect program outcomes on moment-to-moment bases.

ESCRIBE assesses four major categories of variables: stationary variables, instructional environment variables, teacher variables, and student variables. These four categories are further divided into 17 subcategories (see Table 1) and each subcategory comprised of separate event codes (see Table 2).

Table 1
Summary of ESCRIBE Categories and Subcategories

Ecobehavioral Variables

Stationary Variables	Instruction Environment Variables	Teacher Variables	Student Variables
· Setting	· Activity	· Teacher Definition	· Language Initiating/ Responding
· Instructional Model	· Materials	· Teacher Focus	· Oral Responses
· Number of Adults	· Language Materials	· Language-Instruction	· Language-Student
· Number of Students	· Instructional Grouping	· Corrections/ Affirmations	· Student Activity-Related Responses
·	·	· Teacher Behavior	·

Table 2

ESCRIBE Categories Description Codes and Examples

Categories	Number of Codes	Description	Examples of Codes
Ecological			
Setting	11	Service delivery setting	Regular Class, Resource Room, Therapy Room, Library, Computer Lab
Instructional model	7	Instructional delivery model	Native Language Instruction, Full Bilingualism, English Immersion
Activity	17	Subject of instruction	Reading, Math, Language, Spelling
Materials	8	Curriculum materials	Books, Worksheets, Manipulatives
Language of materials	5	Language of curriculum materials used	English, Non-English, Mixed, No Language
Instructional grouping	5	Instructional patterns	Whole-Class Instruction, Small Group Instruction, One-to-One Instruction, Independent Work
Teacher			
Teacher definition	8	Person teaching target student	Regular, Special, or Language Education Teachers, Aides, Peers
Teacher focus	4	To whom teacher behavior is directed	Target Student Only, Target Student and Others, None
Teacher language	5	Oral or written language used	English, Non-English, Mixed, No Language
Teacher corrections/affirmations	3	Quality of teacher's statements	Corrections, Affirmations, Neither
Teacher behavior	12	Teacher's behavior relative to target student	Question, Command, or Talk Academic, Talk Nonacademic, Nonverbal Prompt
Student			

Language initiating/responding	3	Classifies students' oral or written descriptions	Self-Initiated, Response to Teacher Behavior, Neither
Oral responses	5	Description of verbal behavior as it relates to academic activity	Talk Academic, Talk Management, Talk Social
Student language	5	Description of oral or written language used by student	English, Non-English, Mixed, No Language
Activity related behavior	11	Behavior or responses made directly to an academic activity	Writing, Reading Aloud, Talking

The ESCRIBE code focuses on an individual target student as the unit of observation and analysis. It is data intensive in sampling the behavior, language, and ecology of each targeted student. This intensive sampling enables the recorder to generate sufficiently dense frequencies of events to provide adequate analyses of ecological and/or teacher variables that influence specific student language and/or behavior. Recording of all ecobehavioral variables (i.e., instructional environment, teacher and student variables) is based on a 15-second momentary-time sampling system in order to produce reliable records. Observers use a laptop computer that provides them with auditory cues every 15 seconds to observe a target student, then record a specific category of variables. More specifically, the program will cycle through one 15-second interval to collect the instructional environment codes, followed by six sequences of two 15-second intervals to collect the teacher and student codes alternatively. Using this ecobehavioral observation system, a single observer can track a single student during an entire school day or for shorter periods of time that are of interest to the researcher or evaluator. ESCRIBE is most applicable to settings that serve CLDL (e.g., bilingual or LEP) in special education or in mainstream education programs.

The ESCRIBE code allocates for the recording of the following:

1. the variety of regular and special education service delivery settings in which instruction is delivered;
2. the type of instructional model used;
3. the range of teacher-to-student ratios that occurs;
4. the actual activity engaged in by the target student;
5. the materials the student is using during instruction and the language of the material;
6. the size of the instructional grouping in which the target student receives instruction;
7. the variety of teaching persons who deliver instruction to the target student;

8. the behavior of teaching persons as well as the persons to whom that behavior is directed;
9. the languages used for and during instruction;
10. the corrective/affirmative characteristics of the discourse;
11. the concurrent recording of academic and verbal interaction behaviors of the target student;
12. the languages used by the target student; and
13. the initiating and responding characteristics of the student's language.

Analysis of Ecobehavioral Processes

Ecobehavioral analysis can be used to describe observations of specific variables in which the frequency of each coded event can be totaled and expressed in terms of the grand total of all the coded events, as a percentage score, or as an unconditional proportion. These “molar” descriptions are proportions or session estimates of the relative rates of occurrence of each coded classroom event. This type of analysis will allow independent summary statements about the classroom ecology, such as the percentage of the day spent in specific activities or using a specific language. Similar descriptions can be made about the proportion of the day that the teacher or the student engaged in various behaviors or languages.

In addition, classroom events that occur contiguously (co-occurring in the same time interval or those that follow each other in subsequent intervals) can be combined to form conditional proportion scores (conditional probabilities). Summaries of these jointly occurring events can then be combined to form “molecular” descriptions, the conditional relationship between ecology and behavioral events. These molecular descriptions are conditional probability statements regarding the likelihood of two or more events (ecological and behavioral) occurring simultaneously in close sequential time intervals. These data provide information about the effects of specific instructional environment variables on teacher and student variables. Thus, one may compute the conditional probabilities of various combinations of variables on the code of theoretical interest. These computations will make possible the following types of statements:

- (a) Given a specific type of activity or material (such as language arts or non-English computer program) in what type of behavior or language was the student most likely engaged?;
- (b) Given a specific classroom structure of grouping (such as one-on-one arrangement), in what type of behavior or language was the teacher most likely engaged?; and
- (c) Given a specific service delivery model (such as regular classroom) or instructional model (such as full bilingualism), in what type of oral response behaviors or languages was the student most likely engaged?

In ecobehavioral analysis, the classroom processes defined using molar and molecular descriptions achieve added significance when they are related to product measures (i.e., language or achievement gains), that is, product-process analyses of achievement gains. This type of analysis may be conducted by correlating individual variables percentage occurrence scores with outcome measures such as tested levels of criterion-referenced or standardized achievement. Analyses of this sort will allow for responses to questions such as, "Do students with high rates of oral responding also exhibit high rates of change on achievement or language dominance tests?" This type of analysis enables the determination of those program aspects (i.e.,

instructional environment components, teacher behaviors/languages, or student behaviors/languages) that are most related to academic and linguistic gains.

Pilot Study

During the 1991-92 school year we conducted a pilot study in which the ESCRIBE code was used to assess the classroom instruction provided for students with limited English proficiency (LEP) that were identified as receiving special education services or at risk for developmental disabilities. This study provided a rich quantitative description of potentially influential programmatic and linguistic variables and their subsequent behavioral effects.

For this pilot study, data were collected on 111 variables across 36 students within four elementary level school settings and 26 different classrooms. The instructional models represented in the sample included, English immersion, full bilingualism, special education, bilingual special education, and English as a second language (ESL). The subjects (N = 36) were observed for six full school days each, with the exception of one student who moved out of the country (three observations), for a total of 213 days and 1,491 hours. When the various combinations of variables and the different levels of analysis previously discussed were studied, the array of results available for interpretation was enormous. For the purpose of this paper, we have chosen to focus on the results that illustrate the types of analyses available through the ecobehavioral approach to assessment.

Results

Molar Descriptions

The first analyses were based on the combined data set, including all 213 days of observations across the four schools and 26 classrooms. These data allowed global descriptions to be made regarding ecobehavioral events on a typical classroom day for this population based on our sample of 36 students. The first analyses addressed the question of time devoted to instructional activities. The data in Figure 1 show that the most frequently occurring activity was Math at 20 percent. The next more frequent occurring activities were Reading at 18 percent, Language Arts at 16 percent, Social Studies and Science at 7 percent, spelling and transition at 5 percent, and all other activities occurring less than 5 percent of the time. These data portray an emphasis on academic skills with these students.

Figure 1
Average Occurrence of Activities

[image not included]

Second, the data in Figure 2 addressed the question of typical teacher behavior. The most frequently occurring teacher behavior was Talk Academic at 28 percent. Teacher Attention (i.e., looking at student/students or at the students' instructional or play materials) occurred 19 percent of the time and "No Response" (i.e., no attending to student/students or their materials) occurred 15 percent of the time. Use of Command Academic, Question Academic and Talk Nonacademic behaviors occurred with similar frequency (8 to 9 percent). These data revealed that the Teacher Attention and No Response behaviors, both deriving

less active academic and linguistic engagement from students, were most predominant in a typical school day than the use of Question and Command Academic behaviors, both identified as highly academic and language engaging behaviors (see Figure 2).

Figure 2
Average Occurrence of Teacher Behaviors

[image not included]

A third analysis addressed the Language of Instruction. Figure 3 shows that English was the most frequently used Language of Instruction at 58 percent. Non-English (i.e., Spanish) was used only 5 percent of the time and No Language (i.e., no verbal or written language) was coded at a frequency of 37 percent of the instructional time. These data depict an emphasis on the use of English or No Language (i.e., verbal or written) for the instruction of exceptional and developmentally at-risk LEP students.

Figure 3
Average Occurrence of Language of Instruction

[image not included]

The fourth level of analyses addressed the question of Student Responses. Figure 4 reports on the Student Language Related Behaviors. The data revealed that the most frequently coded behaviors were the students' use of No Language and No Talk, both at 92 percent. The students used the English Language 8 percent of the time and Non-English (i.e., Spanish) only 1 percent of the time. The students were engaged in Academic Talk only 5 percent of the time, the highest frequency of Oral Responses coded, followed by 2 percent of the time engaged in Other Talk (i.e., social). The students spent 76 percent of the day neither initiating nor responding to language (verbal or written), 21 percent Responding to Language initiated by another adult, peer or instructional material and only 4 percent Initiating Language. These data are extremely informative as to the quality of linguistic opportunities that exceptional or developmentally at-risk LEP students receive during a typical academic day. If LEP students are to increase their use and fluency of the English language and/or to maintain their native language, the frequency and quality of students' language behaviors need to change.

Figure 14
Average Occurrence of Student Language Response

[image not included]

Figure 5 addresses the occurrence of Student Activity Related Behaviors. The data indicate that the most frequently coded behavior was Attending (i.e., looking at a teacher who was instructing or discussing, at a peer involved in an interaction with the target, or at some instructional material), occurring in 38 percent of all intervals. The total "active engagement" of students in Academic Behaviors (44 percent) was slightly less than one-half of the school day, although the "active engagement" of students in Oral Language Responses occurred only 7 percent of the total school day.

Figure 5

Average Occurrence of Student Behavior

[image not included]

Schools Comparisons

Although the previous data presented an overall picture of the typical day for exceptional and at-risk LEP students, the analyses that follow sampled another molar comparison capability of the ESCRIBE code, schools comparisons. These analyses can refine global data by examining effects within and across specific schools and instructional or service delivery models. For the purpose of this paper school comparisons based on the category of "Student Activity Related Responses" (representing 11 out of 111 total codes) will be illustrated. Schools 1 and 3 were traditional English immersion schools with pull-out special education, bilingual special education, and ESL services. School 2 was a math, science, and language magnet school with special services provided through Instructional Labs, special education, bilingual special education, and ESL services. School 4 was a Spanish language magnet school providing full bilingual instruction, special education, bilingual special education, language labs, and ESL services.

The individual schools analyses can provide an in-depth look into variables affecting academic and linguistic achievement and provide descriptive analyses of school events. For example, regardless of the type of instructional models represented in all the schools (see Table 3), slight variations occurred in the frequency of total "active engagement" in Academic Responding (range, 40 to 50 percent) and Oral Responding (range, 6 to 8 percent). The largest discrepancy sampled by this category occurred in the Noncompliance sub-category that averaged 7 percent overall and ranged from 4 percent to 15 percent across schools.

Table 3
Schools Comparison Summary from ESCRIBE Observations: Percent Occurrences

Schools

ESCRIBE Codes	1 (B)	2 (M)	3 (S)	4 (N)
Student Activity-Related Response				
Writing	10	12	12	9
Reading Aloud	1	1	1	1
Reading Silently	7	10	12	7
Talk	6	5	5	6
Other Academic	16	18	19	16
Exercise	-	-	1	1
Nonacademic Response	7	10	8	11
Noncompliance Response	15	6	4	6
Student Attention	36	37	37	41

None	2	1	1	1
Can't Tell	-	-	-	-
Academic Responding Composite	40	45	50	40
Oral Responding Composite	7	6	7	8

- = 0 or less than 1 percent

Table 4 delineates similar molar analyses as those on the previous section (school comparisons) based on the ESL instructional model for each of the four schools represented in Table 3. Exceptional and at-risk LEP students receiving ESL instruction spent the largest percentage of their instructional time "attending" (i.e., looking at a teacher who was instructing or discussing, at a peer involved in an interaction with the target, or at some instructional material), with a mean of 46 percent (range, 32 to 58 percent), a behavior that does not require active academic or language engagement from the student. The highest percentage of "Attending" behavior occurred for those students in School 4, the full bilingualism Spanish magnet school and the lowest percentage was for students in School 3, a traditional English immersion school. In contrast, active Academic Responding averaged 43 percent (range, 31 to 59 percent), with School 4 students scoring the lowest percentage response at 31 percent and School 3 students scoring the highest percentage at 59 percent. Oral Responding Composite scores, the percentage of time that students engaged in verbal behaviors, resulted in an average of 10 percent occurrence with a range of nine to 11 percent. In summary, the learning profile for students participating in ESL programs at these four schools confirmed that these LEP students spent an average of 89.7 percent of their instructional time not engaged in oral language behaviors (oral responses category) and in the average only 43 percent of their instructional time engaged in active academic responding behaviors (i.e., writing, talking, reading, or manipulating academic materials). As the bilingual literature and the special education research has demonstrated, exceptional LEP students learn best by active participation, hands-on task activities, and continuous opportunity to use oral language skills (Baca and Cervantes, 1984; Garcia, 1991). The data analyses from this pilot study illustrated the opposite instructional and oral language opportunities occurring in these four classrooms.

Table 4
ESL Comparisons: Percent Occurrences

Schools

ESCRIBE Codes	1 (B)	2 (M)	3 (S)	4 (W)
Student Activity				
Writing	13	11	15	11
Reading Aloud	1	1	1	3
Reading Silently	2	4	8	4
Talk	8	10	8	7
Other Academic	16	16	27	7
Exercise	0	0	0	0

Nonacademic Response	5	5	5	4
Noncompliance Response	9	4	5	6
Attending	46	49	32	58
None	0	0	0	0
Can't Tell	0	0	0	0
Oral Responses				
Talk Academic	7	10	8	8
Talk Other	3	1	2	1
Talk Management	0	0	0	0
No Talk	90	89	90	90
Academic Responding Composite	40	42	59	31
Oral Responding Composite	10	11	10	9

Schools and instructional model comparisons such as these help refine our research hypotheses concerning the problem of low student engagement and the configuration of the school or classroom environment in terms of ecological and teacher behavior as they affect student academic and language responses. Analyses as those illustrated on Tables 3 and 4 can provide the effectiveness answers to questions such as: Are all ESL programs alike? and Can we modify these programs, based on ecobehavioral assessment, to provide the skills necessary to effect language and academic gains for exceptional LEP students?

Comparisons Within Classrooms

The next analyses addressed the question of student variation within a classroom in response to the instructional programs. The data for three target students in Classroom 9 (School 4: full bilingualism instructional model) are presented in Table 5 with regard to Teacher Behavior and Language of Instruction. All students were identified at risk for exceptionality and all participated in full bilingualism, language labs and ESL instructional programs. Each student was observed for six days. Although many similarities were noted, other interesting differences existed between these students served in the same learning environments.

The most frequently occurring teacher behavior for Sancho and Angel was Talk Academic (22 percent, 30 percent). Herman's highest frequency of Teacher Behavior was in the No Response sub-category (i.e., no teacher attention or interaction) at 23 percent, yet Talk Academic also occurred at a fairly high level for this student (21 percent). All three students received similar frequency occurrence of Teacher Attention behavior.

The most frequently occurring Language of Instruction for Sancho and Angel was English (47 percent, 46 percent), although Herman received only 37 percent. Herman received the highest frequency of occurrence in No Language (i.e., no verbal or written language) at 46 percent, yet Sancho and Angel also received fairly high levels of No Language teacher behavior (40 percent, 32 percent). The use of Non-English (i.e., Spanish) for instruction however, varied widely across subjects at 17 percent, 12 percent, and 21 percent respectively (see Table 5).

Table 5
Comparison of Students in Classroom 9 Across Teacher Behavior and Language of Instruction: Percent Occurrences

Students

Category	Herman	Sancho	Angel
Teacher Behavior			
Question Academic	8	8	11
Command Academic	9	11	10
Talk Academic	21	22	30
Talk Nonacademic	9	9	10
Nonverbal Prompt	7	5	3
Teacher Attention	17	19	18
Praise/Approval	1	2	1
Disapproval	3	4	2
Read Aloud	2	3	2
Sing	0	1	1
No Response	23	16	12
Language of Instruction			
English	37	47	46
Non-English	17	12	21
Mixed	0	0	0
No Language	46	40	32
Can't Tell	0	1	1

These results demonstrated that teacher behaviors and the languages used for instruction can show both consistency in their structure but can also depict student differences in magnitude of specific variables.

Descriptions of Individual Students Daily Variations

The two panels in Figure 6 illustrate the relative magnitude of one student's percentage scores for two sub-categories of Student Activity Responses (upper panel) and Total Academic and Oral Responding (lower panel) while receiving services in a Special Education resource classroom. These data depict daily variations, and the relative range in magnitudes within subcategory codes.

Figure 6

Range of Occurrences Across Days for One Student in Resource Room: Special Education

[image not included]

The upper panel illustrates the daily differences in the student responses of Talk and Reading Aloud during special education resource room services. Talk was the most frequently occurring activity response and ranged from 14 percent to 39 percent (average of 24 percent) over the five days sampled. Reading Aloud occurred less frequently than Talk and ranged from zero to 52 percent (average of 19 percent). The behaviors exhibited great variability with alternating days of higher frequency, with the exception of Day 1 where both behaviors occurred at the same frequency (28 percent).

The lower panel depicts the overall variations of the composite scores for Academic and Oral Responding (active engagement scores). Academic Responding averaged 76 percent over the five days sampled (range, 67 to 89 percent), and Oral Responding averaged 43 percent (range, 23 to 33 percent). The student's overall active engagement while participating in special education services was higher for Academic and Oral Responding than his overall typical day with Academic Responding at 45 percent (range, 31 to 57 percent) and Oral Responding at 12 percent (range, 8 to 17 percent).

Summary of Molar Analyses

These analyses are useful in providing general descriptions about the structure of time spent within different ecological variables (e.g., different instructional models, activities, materials, language usage, grouping configurations, and service delivery models), and within various teacher and student behaviors. Molar analyses, as illustrated in the previously discussed data can be useful in making comparisons across settings, students, and days for individual students. Collectively, these particular data confirm an important point, that bilingual intervention is not a unitary variable that is either present or not present, but rather a multitude of variables of different strength.

Molecular Descriptions

Molecular analyses were conducted to determine the influences of ecological or teacher behavior variables on students' behavior or language usage from a temporal correlational and causal perspective. Table 6 presents one such analysis based upon the consolidation of six full days of observation for one student. This student's teachers were concerned about the frequency and quality of his oral language usage during the school day.

Table 6
Conditional Probability Analysis:
Oral Responses <-----> Setting + Talk

Number of Strings with Conditional Probability Equal to or Greater than 0.05 = 5

	RC	SP	RR	LY	THR
	T	T	T	T	T

TA	0.514	0.943	0.870	0.636	1.000
TM	0.143	--	--	0.091	--
TO	0.329	0.029	0.130	0.273	--
NT	0.014	0.029	--	--	--

TA = Talk Academic, TM = Talk Management, TO = Talk Other, NT = No Talk, RC - Regular Classroom (full bilingualism), SP = Special Education, RR = Resource Room-ESL, LY = Library, THR = Therapy-bilingual special education, T = Talk.

The molecular descriptions based on the conditional probability analysis of the student's Oral Responses by Instructional Setting revealed important temporal correlations. The target student spent the highest percentage of time engaged in Talk Academic while participating in special education. During bilingual special education, the student spent 100 percent of his "Talk Behavior" engaged in Talk Academic, and 94 percent while in regular/English only special education. The student spent 87 percent of his "Talk Behavior" in Talk Academic during ESL services, 63 percent during Library, and 51 percent during regular classroom services. In contrast, the student spent the highest percent of time engaged in Talk Other (i.e., social) while in the regular classroom and the lowest while receiving special education services. These differences suggest the need to examine additional ecological factors across these settings in order to further isolate the elements or techniques accelerating oral language usage in the special education settings.

A second sample of molecular analysis addressed the causal relationship between active engagement in academic/language use behaviors (Academic Responding/Oral Responding) and instructional grouping (whole class versus small group). As presented in Figure 7, the highest frequency of Active Academic Responding occurred during the Small Group instructional format, however, the frequency of Oral Responding did not demonstrate similar causal effects. Small Group Instruction provided a significant ecological change resulting in a higher active engagement level of students' activity-related behaviors but in itself was not a causal factor for increased language usage.

Figure 7

Comparison of Academic and Oral Responding as a Function of Instructional Grouping

[image not included]

Table 7 presents a descriptive as well as quantitative analysis of the academic and oral responses during the two instructional grouping arrangements, for the same student presented in Figure 7. Small group arrangement provided the student with higher percentage opportunity for active academic responding in Writing (18 percent), Reading Silently (14 percent), Talk (9 percent), and Other Academic activities (6 percent). In addition while participating in small group, the passive "Attending" behavior decreased to 34 percent as compared to 83 percent in whole class grouping. Overall, small group instruction allowed this student to increase her academic engaged time from 15 percent (whole class) to 47 percent (small group) and her oral responding from 7 percent (whole class) to 10 percent (small group).

Table 7

ESCRIBE Output Validation of Intervention Changes: Percent Occurrence

Student Variables	Whole Class	Small Group
Activity-Related Responses		
Writing	3	18
Reading Aloud	1	0
Reading Silent	0	14
Talk	6	9
Other Academic	5	6
Nonacademic	1	8
Noncompliance	1	11
Attention	83	34
None	0	0
Academic Responding	15	47
Oral Responding	7	10

In summation, these analyses demonstrated the use of an ecobehavioral assessment approach to determine the impact of ecological and teacher variables on student behaviors and language usage. Molecular analyses such as this provide critical direction in the development of interventions and in evaluating effects across a broad array of variables. These scores, paired with student outcome measures, can provide a detailed picture of classroom processes that are highly related to academic and linguistic programmatic success.

Discussion

The data gathered with the ESCRIBE code will provide three types of descriptions of classrooms serving CLDL, namely; molar, molecular, and process-product analyses. These three types of descriptions can be used in several ways to evaluate intervention programs for CLDL in mainstream and special education settings, as follows:

1. they can provide the basis for the definition of program variables across different types of instructional models in a quantifiable manner;
2. molar and molecular descriptions can be used to evaluate the fidelity of program replications;
3. molar and molecular descriptions can provide a means for documenting specific changes and variations in programs. Similarly, occurrences of student behavior/language use within the curriculum variations can be monitored;
4. process-product analyses using molar descriptions of student behaviors can be used to determine the specific classroom behaviors that are most related to language and academic gains. This type of information will assist program developers in selecting behaviors that will be the focus of the intervention program; and
5. the molecular descriptions of ecobehavioral interactions can be used for prescriptive teaching, that is, to

make determinations on the specific combinations of ecological and teacher variables that are most related to the classroom skills and that are critical to the acquisition and maintenance of language and academic gains.

In conclusion, this type of evaluation would enable us to design, deliver, and support the most effective education programs for mainstream and special education CLDL.

Summary

This paper described a powerful methodological improvement for use in the next generation of bilingual and bilingual special education efficacy studies, an approach for generating the data necessary to support instructional or accountability research in bilingual special education programs. The ecobehavioral approach will expand the focus of assessment to account for both the independent and dependent variables to explain student outcomes. This type of evaluation would enable us to design, deliver, and support the most effective education programs for this unique and diverse population.

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