# Combining Ecobehavioral Assessment, Functional Assessment, and Response to Intervention to Promote More Effective Classroom Instruction

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# Combining Ecobehavioral Assessment, Functional Assessment, and Response to Intervention to Promote More Effective Classroom Instruction

**Silvana M. R. Watson,[1] Robert A. Gable,[1] and Charles R. Greenwood[2]**

## Abstract

In this article, the authors discuss ways ecobehavioral assessment (EBA) has contributed to greater understanding of students' response to instructional intervention and its relationship to academic learning and achievement. EBA represents a proven effective way to conduct a contextual analysis of the instructional environments, teacher and student interactions, student engagement, and specific teaching practices that promote learning. It mirrors much of the current thinking regarding functional assessment of academic behavior and response to intervention (RTI). With EBA, school personnel are able to examine various aspects of the classroom environment and instruction to determine how best to increase students' positive response to instruction and, in turn, improve academic achievement. The authors argue that incorporating elements of EBA into the RTI model yields a more complete picture by allowing observers to identify the ecological and educational factors that promote or inhibit student academic gains. That knowledge can easily be incorporated into multitiered prevention and intervention programs in schools.

## Keywords

assessment, ecobehavioral assessment, functional assessment, response to intervention

Recent changes in the law, the Individuals with Disabilities Education Improvement Act of 2004 reauthorization, and the 2006 published regulations to implement the law highlight the significance of prevention and intervention in serving children at risk (Yell & Drasgow, 2007). Emphasis is on early identification. Schools are given a framework for early structured steps for prevention and the choice of an alternative identification process—response to intervention (RTI)—a process that holds real promise for circumventing longstanding and flawed traditional practices. Moving away from past practice and adopting a different approach, RTI focuses on prevention and early intervention and is designed to provide students effective research-based instruction by means of a multitier approach. The intensity of the intervention is determined according to the complexity of the presenting problem (Fuchs, Mock, Morgan, & Young, 2003; Gresham, 2004). Among the defining characteristics of RTI is the careful monitoring of student RTI (Burns, Dean, & Klar, 2004; Shinn, 2007), fidelity of treatment (Shinn, 2007), functional assessment of variables that influence student behavior (e.g., task difficulty; Hendrickson, Gable, Novak, & Peck, 1996), and ensuring that students have a quality classroom environment within which to receive instruction (Burns, Jacob, & Wagner, 2008; Soukup, Wehmeyer, Bashinski, & Bovaird, 2007).

Some 20 years ago, Reith and Evertson (1988) discussed the role that preinstructional, instructional, and postinstructional variables play in determining the outcomes of classroom instruction. They identified the arrangement of classroom space and student seating, allocation of instructional time, development of rules and procedures for academics, and behavior as preinstructional variables; engagement time, teaching strategies, student success rate, and performance monitoring as instructional variables; and evaluation and teacher feedback as postinstructional variables. Viewed together, these three overlapping sets of variables define the ecology of the classroom.

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Given the educational mandates of recent federal legislation, the purpose of this article is threefold: (a) to explain ecobehavioral assessment (EBA) and analysis as they relate to instructional effectiveness, (b) to discuss the implications of scaling up current and future applications of EBA and analysis to improve instruction, and (c) to highlight parallels that exist among EBA, functional assessment, and RTI and the benefits that derive from including a contextual analysis in making decisions about instruction.

## EBA and Analysis and Their Relationship to Instruction

Few would question that the home and community environments have a profound influence on a student's readiness for beginning schooling as well as later academic success (Shonkoff & Phillips, 2000). Many children come prepared to deal with the rigors of academic instruction and social and interpersonal demands of the classroom. However, for other children, socioeconomic status, culture, and family-related factors can have a negative impact on language and social development and academic achievement, which, in turn, places them at risk for school failure (Berliner, 2006; Greenwood, Carta, Kamps, & Arreaga-Mayer, 1990; Hart & Risley, 1995). Both administrators and classroom teachers recognize the negative effect that home and community factors may have on student performance. However, many education personnel fail to see that school-related factors may have a deleterious effect on student learning as well (Arreaga-Mayer, Utley, Perdomo-Rivera, & Greenwood, 2003; Greenwood, Arreaga-Mayer, & Carta, 1994; Greenwood, Carta, & Atwater, 1991; Greenwood, Horton, & Utley, 2002; Soukup et al., 2007; Ysseldyke, Kosciolek, Spicuzza, & Boys, 2003).

A growing body of research documents the fact that student academic achievement is inextricably linked to specific classroom factors, including time spent learning a subject or skill, rate of active engagement, rate of correct responses to instruction, and opportunity to respond and practice specific skills (Greenwood, Delquardi, Stanley, Terry, & Hall, 1985, 1986; Greenwood et al., 2002; Hall, Delquadri, Greenwood, & Thurston, 1982; Soukup et al., 2007). Indeed, West (2008) reported that the manipulation of so-called "alterable" contextual variables (e.g., clarity of expectations, academic success) can have a bigger influence on pupil performance than "unalterable" outside factors (e.g., economic status, ethnicity, home language, neighborhood stability). Accordingly, there is good reason to believe that quality classroom instruction can mitigate virtually any negative life force impinging on a child (Greenwood, 2001; West, 2008).

A teacher's ability to deliver quality instruction begins with reliable and valid information on a student's strengths and weaknesses. School personnel routinely administer formal as well as informal tests to capture various kinds of information necessary to make sound decisions about curriculum and instruction. However, assessing student performance based only on academic tests ignores the importance of environmental (e.g., community resources and class size) and instructional factors (e.g., content covered and amount of practice provided). As Christenson and Anderson (2002), Salvia and Ysseldyke (2001) and Ysseldyke and Christenson (1987) stressed, assessment of the instructional environment (e.g., clarity of directions and classroom management) and other environmental factors (e.g., family and school support) is a critical component of the overall assessment process. Sheridan and Gutkin (2000) also emphasized the importance of looking at the ecological systems (e.g., school, family, and community) that encompass students' lives to provide students with meaningful and effective services. It follows that knowledge of preinstructional, instructional, and postinstructional variables is prerequisite to decision making regarding classroom instruction (e.g., Burns et al., 2004; Reith & Evertson, 1988; West, 2008).

### *What Is EBA?*

According to Carta and Greenwood (1985), EBA is a model that directly assesses classroom variables and their potential relationship to effective instruction. It provides a sequential picture of the interrelationship between environmental and instructional factors (e.g., classroom settings, type of instruction, and teacher behaviors) and a student's opportunity to respond (Greenwood, Schulte, Kohler, Dinwiddie, & Carta, 1986). An ecobehavioral approach draws on at least three different fields: applied behavior analysis, behavioral ecology, and process–product research in education. It allows the observer to collect data on ecological variables, teacher behavior, and student behavior once during each minute (Greenwood et al., 1990). Thus, EBA provides momentary time sampling information on ecological factors and student behavior with the same frequency and priority (Greenwood & Delquadri, 1988).

Various authorities (e.g., Greenwood, Schulte et al., 1986; Lee, Soukup, Little, & Wehmeyer, 2009; Robertson, Woolsey, Seabrooks, & Williams, 2004) have asserted that the use of an ecobehavioral approach to classroom assessment provides insight regarding how student academic performance is affected by focusing on what ecological variables (e.g., type of task), teacher behavior, and student behavior are interrelated. For example, Lee et al. (2009) used EBA to investigate factors related to student and teacher that may affect the inclusion of students with intellectual and developmental disabilities in the general education curriculum. They reported that teacher and student variables are correlated, they strongly predict students' access to the general curriculum, and they are influenced by environmental factors such as task difficulty. In focusing on the classroom environment and students' response to instruction, researchers are better able to understand the relationship among classroom ecology, teacher instruction, and student behavior and ultimately short- and long-term academic achievement or underachievement.

EBA differs from traditional behavioral assessment in that student behavior is measured as it relates to the temporality of various classroom variables. These factors include the physical arrangement of the classroom, student grouping for instruction, curriculum, teaching strategies, and the teacher's behavior toward the students. Such an approach to assessment yields valuable information on the complex functional relationships between student responses and classroom ecosystems (Greenwood, Peterson, & Sideridis, 1995). Its value is predicated on the fact that student achievement is significantly related to variables that can be manipulated by school personnel, namely, teachers' attitudes, instructional practices, school resources, and classroom climate (Greenwood, 1991; Kozol, 1991; McLoyd, 1998; West, 2008).

Various authorities (Hendrickson et al., 1996; Salvia & Ysseldyke, 2001; Ysseldyke & Christenson, 2002) recommended the use of multiple approaches to collecting data with which to design an intervention for a target student. They stressed that an intervention will be most effective within a supportive host environment. Although functional assessment is commonly associated with nonacademics, Ysseldyke and Christenson (2002) advocated the use of functional assessment of academic behavior (FAAB) so that school personnel are able to (a) gather relevant information on an individual student, (b) identify instructional needs and supportive learning conditions for that student, and (c) assist educators in developing instructional interventions that can positively affect student outcomes. They identified 23 support-for-learning factors in three different contexts: classroom instructional supports, home supports, and home–school supports. The 12 classroom supports were classroom environment, instructional match, instructional expectations, instructional presentation, academic engaged time, progress monitoring, relevant practice, adaptive instruction, informed feedback, student understanding, motivational factors, and cognitive emphasis. As evidence-based assessment tools, functional behavioral assessment (FBA) and FAAB explain the relationship between the student's behavior and environmental events that predict the occurrence and nonoccurrence of a student's behavior and academic achievement (McIntosh, Brown, & Borgmeier, 2008; Ysseldyke & Christenson, 2002). Along with other ecobehavioral strategies, FBA and FAAB seem to be effective ways to collect information on multiple variables that influence students' academic achievement (Hendrickson et al., 1996) and which together compose the ecology of the classroom (Ysseldyke & Christenson, 2002).

## *What Are the Advantages of EBA?*

EBA entails the recording of discrete academic behaviors (e.g., writing, reading) and grouping these academic behaviors for analysis, along with teachers' behavior and the overall classroom ecology (Greenwood, Abbott, & Tapia, 2003). The use of direct observation allows the observer to systematically collect information on individual students that reflects both temporal and sequential interactions within the classroom, including teacher and student behavior (Greenwood et al., 1995; Greenwood, Schulte et al., 1986). For example, Gable, Hendrickson, and Sealander (1997) discussed the use of a scatterplot to compile information on the temporal (sequence in time) and sequential distribution (sequence of events) and the interplay between teacher and pupil behavior—academic and nonacademic. One practical way to use a scatterplot is as a momentary time sampling procedure (i.e., noncontinuous, point-in-time observation). Teachers can both collect baseline data and evaluate the impact of an intervention while conducting instruction. A second advantage is that in hand scoring the scatterplot teachers can capture the relative severity of a behavior problem (by circling high-intensity behavior) or use a numerical record to document the amount of time a student is likely to be attentive to instruction (i.e., *first observation* = 1, *second observation* = 2, *third observation* = 3, etc.). By looking at the amount of elapsed time and the point at which the student begins to falter, teachers can make proactive decisions about adjustments in instruction. It is important to keep in mind that when using a noncontinuous observation system more data are necessary to make sound instruction decisions.

A number of researchers (e.g., Arreaga-Mayer & Perdomo-Rivera, 1996; Greenwood, Delquadri et al., 1986; Knutson, Simmons, Good, & McDonagh, 2004; Soukup et al., 2007; Ysseldyke et al., 2003) have relied on an ecobehavioral approach to critically examine the influence of specific classroom variables (e.g., teacher behavior, task materials, grouping arrangements) in terms of student response to instruction (e.g., academic responding, task management, appropriate vs. inappropriate classroom behavior) and student academic achievement. These investigators have looked at the interplay among those variables and their influence on student learning, the underlying premise being that greater academic gains result from student engagement in writing, reading, and discussing subject matter topics and are linked to the design and implementation of classroom instruction. Poor design and weak delivery lead to less academic engagement, fewer academic responses, more inappropriate student behavior, and, in the end, lower academic achievement.

The results of EBA studies show that failure to deliver effective instruction compounds the already negative effects of low socioeconomic, cultural, and familial factors that place many young children at risk. For example, Greenwood

(1991) and Greenwood et al. (1985) studied urban children in Chapter I schools and found that those children spent less time on academic subjects and were significantly less engaged than students in suburban non–Chapter I schools. Kamps, Leonard, Dugan, Boland, and Greenwood (1991) investigated instruction in 11 classrooms serving students with autism. They identified procedures, activities, and teacher behaviors that had the highest conditional probability of increasing student academic responses. Their results indicated that pupil performance improved when teachers used media materials to increase discussion and used a variety of materials with frequent rotation, small group (no more than five students) instruction, and frequent choral responding. After identifying these variables, Kamps and colleagues sought to determine the functional relationships between these procedures and students' responding and academic learning. They found that students with autism were more engaged in learning when those procedures were part of classroom instruction.

In a related study, Ysseldyke et al. (2003) looked at the effects of an instructional learning system, Accelerated Math, on math achievement and students' conduct within an Accelerated Math setting. They reported that instructional arrangements, teacher–student interactions, type of instructional activities, students' time engaged in academic tasks, and time engaged in active responding were all related to students' achievement outcomes, which help to explain why some students perform well and others poorly in school. Furthermore, Wallace, Anderson, Bartholomay, and Hupp (2002) used an ecobehavioral approach to investigate teacher behavior, students' responses, and classroom ecology in high school inclusive classrooms that successfully integrated students with disabilities. Their study revealed two important findings: (a) students in successful programs had higher levels of academic responding and (b) teachers in these programs spent the majority of their time instructing, managing, and interacting with their students.

## How Can School Personnel Conduct an EBA?

Researchers have developed several ecobehavioral coding systems with multilevel taxonomies to assess general education, special and bilingual education, and preschool programs. Each of the systems has been validated through empirical research. The systems originally were designed for paper-and-pencil data recording; later, computer software was developed for desktop and laptop computers. Stanley and Greenwood (1981) developed the first observation instrument, *Code for Instructional Structure and Student Academic Response* (CISSAR). This instrument uses a momentary time sampling procedure, which is noncontinuous and reflects behavior occurring at a point in time. CISSAR consists of 55 codes that enable the observer to measure (a) classroom ecology, (b) teacher behavior, and (c) student behavior. Examples of codes assessed by CISSAR include the following: (a) under student behaviors it codes academic responses such as reading aloud and writing, (b) under teacher behaviors it includes teacher position (e.g., at desk and behind the student), and (c) under ecological variables it measures structure such as small group and entire group (Greenwood, Schulte et al., 1986). Using the CISSAR, Soukup et al. (2007) examined the ecological variables that promote more access to the general education curriculum for elementary students with intellectual and developmental disabilities. Their results suggest that curricular accommodations and modifications in the general education classroom, the amount of time spent with nondisabled peers, and the physical location of students in the classroom relative to each other were highly predictive of increased student access to the general education curriculum.

The CISSAR taxonomy has been adapted for use in various educational environments (e.g., preschools) with students from diverse backgrounds, of different ages, and with and without disabilities. The *Ecobehavioral System for Complex Analyses of Preschool Environments* (ESCAPE; Carta, Greenwood, & Atwater, 1985) was developed and validated to reflect the distinctive preschool environment. Like CISSAR, the ESCAPE taxonomy includes ecology, teacher events, and the behavior of young students (i.e., 3–5 years of age) with and without disabilities. It also uses a momentary time-sampling recording procedure, and it was the first instrument designed to be used on a laptop computer (Greenwood, Arreaga-Mayer, et al., 1994; Greenwood et al., 1995). Carta, Atwater, Schwartz, and Miller (1990) used ESCAPE to compare the ecological and behavioral variables between special education preschool and regular kindergarten classrooms to better understand the reasons children fail when they transition from one environment to another. Examining how the classroom environment affects students' behavior facilitated the development of interventions to support successful student transition from special education preschool to regular kindergarten. Their study indicated that the location (tables vs. floor) and group size (small group vs. large group) of instruction, the level of children's active engagement, and teachers' use of verbal prompts were among the most meaningful differences between the two classrooms. It documented some of the challenges children face in moving from a special preschool to a general education kindergarten.

The *Mainstream CISSAR* (MS-CISSAR; Carta, Greenwood, Schulte, Arreaga-Mayer, & Terry, 1987) is an extension of the CISSAR and was developed to account for the inclusion of students with disabilities in general education classrooms. This instrument was designed to be used on a laptop computer. The MS-CISSAR includes a number of teacher categories (aide, peer tutor) and is appropriate for use in general and special education classrooms with students from

**Table 1.** Mainstream Code for Instructional Structure and Student Academic Response Observation Codes

| Variable | Category | Examples |
|---|---|---|
| Ecological | Activity | Reading, math |
| | Task | Worksheet, computer |
| | Physical arrangement | Divided group, individual |
| | Instructional grouping | Small group, independent |
| | Setting | General ed. class, library |
| Teacher | Description | Substitute teacher, aide |
| | Position | Back of room, at desk |
| | Teacher behavior | Question, discipline |
| | Teacher focus | Target student and others |
| | Approval or disapproval | Approval, neither |
| Student | Academic response | Writing, reading silently |
| | Task management | Raise hand, attention |
| | Setting | Self-abuse, aggression |

6 to 15 years of age (Greenwood, Arreaga-Mayer, et al., 1994; Greenwood et al., 2002; Kamps et al., 1991; see Table 1). Finally, Robertson and colleagues (2004) used the MS-CISSAR to evaluate teachers in training in a residential school for the deaf in five different classrooms. Direct classroom observation is extremely useful to making data-based decisions regarding instructional accommodations and/or modifications to support inclusive education. Table 1 shows the MS-CISSAR's coding system for observing ecological, teacher, and student variables, their categories, and examples.

Another coding system, the *Ecobehavioral System for the Contextual Recording of Interactional Bilingual Environments* (ESCRIBE), yields a detailed analysis of the methodological and instructional variables that the literature shows are important in the delivery of quality services to bilingual students (e.g., language used by the teacher; Arreaga-Mayer, Carta, & Tapia, 1994). As in the case of other instruments, it is based on a momentary time sampling system (Arreaga-Mayer et al., 2003; Greenwood et al., 2002). Arreaga-Mayer and colleagues conducted several studies using ESCRIBE. The focus of their investigations was on culturally and linguistically diverse (CLD) students' language and behavior and the types of interactions that correlate with gains in academic and language development. Their data suggested that CLD students were not learning English in American schools because, in English as a second language (ESL) classrooms and in general education classrooms, CLD students spent little time in oral engagement (i.e., linguistic opportunities).

By analyzing instructional arrangements, Arreaga-Mayer et al. (2003) found that in both classroom settings, ESL and general education, the most common format of instruction was large group and independent seat work. Unfortunately, neither of these instructional arrangements facilitates high rates of verbal exchanges. Assuming the results are representative, many CLD students likely have a limited opportunity to engage in linguistic interactions, a critical component to language acquisition and academic achievement. Teacher behavior (e.g., lecture format and lack of attention to language development), along with the limited academic engagement, negatively affects CLD students' classroom performance. These data provide information that is essential to the design of effective instruction for CLD students.

The various EBA instruments that have been described here have been computerized by the EcoBehavioral Assessment System Software (EBASS). The software was written for Microsoft's disk operating system (MS-DOS). This software has proven useful to observers because it not only prompts the observer to record the events but also provides analyses and interpretation of the data recorded and their graphic display (Greenwood, Carta, Kamps, & Delquadri, 1997). Examples of analyses produced by EBASS include (a) conditional probability, meaning the likelihood that a student will engage in a particular behavior under various conditions, and (b) profile analyses, which allow the observer to compare the target student to a typical student in the same classroom (Greenwood et al., 2003). Table 2 illustrates an EBASS printed teacher report and Table 3 a printed standard report of MS-CISSAR molar analysis. Table 4 provides an example of conditional and unconditional probabilities of behavior occurrences (e.g., engagement) given a task, instructional arrangement, or teacher definition as provided by an ecobehavioral analysis. That information is extremely useful in making decisions about the complexity and intrusiveness of instructional intervention. More recent observation instruments (e.g., CIRCLE) have been written in a different software system (e.g., Windows). EBASS is being updated to enable its use in more modern technology such as the operating system on palm or personal digital assistant systems, such as Palm OS and Windows Mobile. Few problems have arisen. The most common challenges to the use of these computerized instruments by teachers and other school personnel are (a) accessibility to the instruments and (b) availability of training in their use, both of which can be resolved. If a school system decides to use one of the EBA systems, they can contact Harriett Dawson Bannister (hdawson@ku.edu) at Juniper Gardens Children's Project, Kansas City, Kansas. Training on EBA takes 3 days and costs $750.00 per day, in addition to the presenter airfare and hotel. The current software and training manual cost approximately $350.00 (H. D. Bannister, personal communication, April 1, 2009). More information can be obtained at the following Web site: http://www.jgcp.ku.edu/~jgcp/products/EBASS/ebass_training.htm.

**Table 2.** Sample EcoBehavioral Assessment System Software Printed Teacher Report of Mainstream Code for Instructional Structure and Student Academic Response Molar Analysis

| Instruction | | Teacher | | Student | |
|---|---|---|---|---|---|
| Grouping | *n* | Position | *n* | Response | *n* |
| Whole class | 80.25 | In front | 2.53 | Writing | 6.90 |
| Small group | 18.25 | At desk | 0.67 | Play academic | 9.09 |
| One on one | 1.23 | Among students | 96.30 | Read aloud | 3.87 |
| Independent | | Side | | Read silently | 16.16 |
| No instruction | | Back | 0.51 | Talk academic | 0.51 |
| | | Out | | Answer academic question | |
| | | | | Ask academic question | |
| | | | | Attend to task | 55.58 |

Note: *n* = frequency of intervals observed.

**Table 3.** Sample EcoBehavioral Assessment System Software Printed Standard Report of Mainstream Code for Instructional Structure and Student Academic Response Molar Analysis

| Physical Arrangement | | | Task | | | Teacher Definition | | |
|---|---|---|---|---|---|---|---|---|
| Code | Frequency | % Occurrence | Code | Frequency | % Occurrence | Code | Frequency | % Occurrence |
| Entire group | 16 | 100.0 | Readers | 11 | 68.75 | Regular | 16 | 100.0 |
| Divided group | | | Workbook | 1 | 6.25 | Special ed. | | |
| Individual | | | Worksheet | | | Aide or para. | | |
| | | | Paper and pen | 3 | 18.75 | Volunteer | | |
| | | | Discussion | | | Substitute | | |

**Table 4.** Ecobehavioral Analysis Example: Probability of Student Academic Engagement Given Teacher Behaviors

| Teacher Behavior | Frequency | % | Frequency | Probability | *z* Score |
|---|---|---|---|---|---|
| Conditional probability | | | | | |
| No response | 12 | 18.6 | 9 | 0.75 | 0.961 |
| Attention | 25 | 37.9 | 17 | 0.68 | 0.875 |
| Talk academic | 17 | 25.8 | 6 | 0.35 | –0.895 |
| Quest academic | 12 | 18.2 | 3 | 0.25 | –1.227 |
| Unconditional probability | | | | | |
| Total sequences used | 66 | 81.5 | 35 | 0.53 | |
| Total sequences recorded | 81 | | | | |

Note: Conditional probability = probability of student behaviors given the teacher behaviors; unconditional probability = probability of student behaviors independent of any teacher behaviors.

## *What Is an Ecobehavioral Analysis?*

According to Repp and Deitz (1990), ecobehavioral analysis is a scientific procedure that provides a way to determine how a behavior is influenced by its environment (e.g., physical structural and the behavior of others in that setting). Similarly, Greenwood and his colleagues (1990) contend that ecobehavioral analysis is a direct-assessment approach that focuses on student academic behaviors within a learning environment and the persons within that instructional environment (Arreaga-Mayer & Perdomo-Rivera, 1996; Greenwood, 1991; Greenwood et al., 1990). Ecobehavioral analysis provides researchers information on behavioral acceleration (or deceleration) and maintenance during academic instruction (Kamps, Leonard, & Greenwood, 1991). Accordingly, ecobehavioral analysis provides units of analysis (i.e., the temporal relationships between classroom and student variables) that are extremely useful in identifying and then manipulating factors that will produce positive changes in student outcomes (e.g., academic gains; Greenwood et al., 1991).

There are numerous examples of the application of ecobehavioral analysis in classroom research. For instance, Greenwood and his colleagues (e.g., Carta & Greenwood, 1985; Greenwood, Carta, Kamps, Terry, & Delquadri, 1994) used molar (unconditional) and molecular (conditional) analyses to look at the classroom environment. Molar analyses provide information on what is taught, in what type of instructional arrangement (e.g., small group), how much time is spent on academics and nonacademics, quality and levels of student participation, and the number of opportunities students have to respond during instruction. By using molecular analyses, Greenwood et al. (1990) were able to gather detailed information on various ecological factors (e.g., worksheets vs. academic games) and their effects on student behavior and to study different instructional arrangements and the type of student response required in each arrangement and the impact of changes in ecological and behavioral factors over time.

### *How Do EBA and Analysis Support Effective Instruction?*

Analyses of descriptive data (see Tables 2 and 3) and the conditional probability of student responses (see Table 4) provide researchers and practitioners several possible conclusions that may guide them to develop effective interventions for students with and without disabilities. The descriptive data (molar analysis) identify instructional activities, environmental variables (e.g., materials), and procedural variables (e.g., lecture) that lead to higher versus lower pupil response rates. Consistent with the RTI model, EBA provides information that is essential to making decisions about the level, complexity, and/or intrusiveness of an intervention. Knowing the percentage probability of occurrence of factors that may produce more active engagement and an increased number of correct responses, teachers would be able to adjust instruction accordingly. For example, the conditional probability analysis may show that a particular student is more actively engaged in math instruction when the teacher is in close physical proximity and verbally or nonverbally attends to a student's needs. This kind of precise information is essential to the development of effective instruction.

## RTI Assessment Model

The 2004 reauthorization of the Individuals with Disabilities Improvement Education Act contained language that addressed the concept of RTI. The recommendation for implementation of RTI came as an alternative model to the "wait and fail" model (i.e., IQ–achievement discrepancy formulae) for the identification of learning disabilities; however, RTI has also been used as an assessment of progress of students receiving prevention instruction (Gresham, 2005). RTI is a problem-solving, data-driven model that is composed of multiple tiers or levels of complexity or intrusiveness of intervention—primary prevention, secondary prevention, and tertiary prevention (National Association of State Directors of Special Education, 2005).

Pupil assessment and progress monitoring are fundamental to the development of an individualize education program and the decision to move to a different level of intervention (e.g., Fuchs et al., 2003). By incorporating EBA and FAAB into an RTI model, it is possible to identify the covariation of and the interdependency among teacher–pupil interactions and the contexts in which they occur and, in turn, to make timely adjustments in instruction (Greenwood et al., 1991). Therefore, knowing the probability of occurrence of desired behaviors through the use of EBA and analysis and being able to connect variables that promote student academic engagement to academic achievement, it is more likely that students will positively respond to intervention (Cheney, Flower, & Templeton, 2008; Greenwood et al., 2003). For RTI to be an efficient and effective problem-solving model that focuses on screening, early intervention, and prevention, data collected must be comprehensive and come from multiple sources that together provide information on student academic achievement, student behavior, teacher behavior, and instructional environments (Burns et al., 2008).

## Discussion

Today, school personnel face myriad challenges associated with both an increasingly more CLD student population and the expectation that all students will be "successful learners." Fortunately, an impressive body of research has accumulated on ways to critically examine various aspects of the teaching and learning process and to make timely adjustments in instruction. For example, in looking at factors associated with the achievement gap between students of low socioeconomic status and high socioeconomic status, researchers (e.g., Greenwood, Arreaga-Mayer, et al., 1994; Greenwood, Carta, Kamps, Terry, & Delquadri, 1994) have combined descriptive and experimental methodologies (Bijou, Peterson, & Ault, 1968) to examine the complexities of the ecology of the classroom. Among the findings that hold the most significance for school personnel is that teaching strategies such as advanced and graphic organizers, scaffolding, learning strategies, direct instruction, and classwide peer tutoring have a predicable and positive effect on classroom performance of all students. The latter strategy, peer tutoring, affords teachers a practical way to promote skill mastery and fluency, both of which are essential to improving academic achievement (Nelson, 2008).

With the current emphasis on RTI, we see an EBA approach to assessment of classroom instruction as a complementary strategy for teachers to compare present conditions to what research suggests represents best practices, such as high rates of academic engagement (85%) and opportunities to respond (e.g., 1–3 per minute for new material, 80% correct pupil response to new material vs. 90% correct responses during review; Gunter, 2008; Reith & Evertson, 1988), and to examine pupil-specific responses to instruction, teacher–pupil interactions, the impact of varying instructional arrangements, and the fidelity of classroom instruction (Lane, Bocian, MacMillan, & Gresham, 2004; Reith & Evertson, 1988; Ysseldyke & Christenson, 2002). Each of these variables can be objectively measured and compared to predetermined standards. That information is especially useful in the design of instruction most appropriate for a particular student population (Arreaga-Mayer & Perdomo-Rivera, 1996; Bulgreen & Carta, 1992; Greenwood, 1991; Greenwood et al., 2002; Soukup et al., 2007; Veerkamp, Kamps, & Cooper, 2007).

An ecobehavioral approach to assessment is not limited to academics in that it reflects principles and practices associated with FBA (Gresham, Watson, & Skinner, 2001). EBA primarily is concerned with accelerating student academic responding and rates of academic learning, whereas FBA is primarily concerned with decelerating inappropriate classroom behavior and promoting a more acceptable replacement behavior. EBA is a useful analog to FBA with regard to assessment and management of students with learning and/or behavioral problems (Ysseldyke & Christenson, 2002). That is, EBA can yield specific information about an individual student's inappropriate classroom behavior and identify the specific ecological variables that may evoke, maintain, or decrease inappropriate classroom behaviors (Evans, Gable, & Evans, 1993; Gable, Hendrickson, Warren, Evans, & Evans, 1988).

While acknowledging the benefits associated with a FBA of students' challenging behavior, Hendrickson and colleagues (1996) asserted that the same principles can be applied to collecting data to inform academic instruction. They offered readers a model, based on the work of Mace, Yankanich, and West (1988), and multiple case studies to illustrate its use. Subsequently, Wehby, Lane, and Falk (2003) further validated the efficacy of the Hendrickson et al. model. Viewed together, these authors' work demonstrated the overlap and practical use of FBA and an emergent RTI model.

## Conclusion

Notwithstanding the fact that the definition of special education is individualized and specialized instruction (U.S. 108th Congress, 2004), we have yet to put into every classroom practices of proven effectiveness that reflect those "alterable variables" consistent with a positive teaching and learning environment. However, given the current educational climate, the need exists to make greater use of an ecobehavioral perspective on classroom assessment and instructional decision making. By applying strategies that stem from this perspective, it is possible to identify those variables that promote high rates of student active engagement and high rates of correct responding that lead to high rates of teacher praise, all of which translates into increased academic achievement. Absent knowledge of the classroom ecology, it is impossible for teachers to make good decisions regarding specific accommodations, modifications, and adaptations in instruction to support academic achievement of all students.

Gable (2004), Greenwood (2001), and Sasso (2001), among others, have discussed some of the differences between education and other professions (medical and legal professions). They argue that the education profession has accepted standards of practice that are based more on their popularity than empirical research. However, recent federal legislation (Individuals with Disabilities Education Act and No Child Left Behind) has placed strong emphasis on the classroom use of scientifically based practices. Although this is a laudable goal, it is premature to speculate about its impact on the classroom behavior of general and special education teachers. It appears that more school personnel are revisiting the accumulated research on what constitutes effective classroom instruction and ways to put into practice strategies and procedures proven to produce positive student outcomes. We feel that there is ample evidence to believe that the use of EBA would facilitate achieving the goals embodied in federal legislation.

In sum, given what we know about the reciprocal relationship among preinstructional, instructional, and postinstructional variables, the use of ecological analysis has far-reaching implications regarding the development of more effective and efficient classroom interventions. If we are going to close the growing achievement gap between White and minority students, high-income and low-income students, and students without and with disabilities, we must look closely at those variables that account for the greatest amount of variance in student outcomes. As previously discussed, research based on EBA and analysis of the instructional environment and FAAB has contributed a substantial amount of information on how to better address the diverse needs of students with and without disabilities. The classroom application of EBA and FAAB is congruent with an increasingly more widely accepted RTI model. Together, they hold real promise for realizing the goal that all students become successful learners.

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