

Examination of Eco-Behavioral Assessments Designed for Understanding Complex Behaviors and Environments

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Abstract

Second-generation intervention research requires methods for overcoming challenges to understanding complex learning ecologies and interactions of students. Eco-behavioral assessments (EBAs) are one solution to past intervention research challenges. EBAs record the effects of ecological variables in students' behavior and daily interactions. The utility of EBAs in second-generation research has increased substantially. Numerous EBAs now exist for use with all ages of learners and provide a valid, reliable, and cost effective method for intervention research. This paper examines 18 EBAs as well as software systems designed to support and enhance the use of EBAs. The examination serves as a comprehensive resource to better understand how EBAs can be used in answering complex questions about students' learning and for advancing second-generation research.

Keywords: Eco-behavioral assessment, Observational systems

The behaviors of students and the environments in which they participate are composed of highly complex events and interactions. Early research sought to answer broad questions regarding the efficacy of intervention efforts on global outcomes (e.g., Does early intervention lead to improved developmental outcomes? Does a particular instructional approach increase math productivity and accuracy?). In essence, the focus of first-generation intervention research in special education was on whether behavior or performance of students changed when an intervention was implemented. The input-output orientation of this collective body of knowledge has provided the field with a wealth of information regarding salient features of instruction (e.g., materials, engagement, and reinforcement) and its impact on student behavior and/or performance (Greenwood & Carta, 1987; Greenwood, Terry, & Walker, 1994). In fact, because of this research, we can identify empirically based practices that improve the outcomes of students with disabilities (e.g., Cook & Schirmer, 2003; Forness, Kavale, Blum, & Lloyd, 1997).

Although first-generation research has identified effective practices, widespread implementation of those practices continues to present challenges to the field (e.g., Carnine, 1997; Cook & Schirmer, 2003; Espin & Deno, 2000; Stone, 1998). The resulting research-to-practice gap has been the topic of discussion at federal, state, and local levels (e.g., No Child Left Behind Act) and reasons for it have been examined (e.g., Gersten & Dimino, 2001; Greenwood 2001). One consistent theme from the literature on implementing research-based practices for students with disabilities is the necessity to adapt interventions to address the individual needs, teaching strengths, and available resources within various learning environments (e.g., Abbott, Walton, Tapia, & Greenwood, 1999; Boudah, Logan, & Greenwood, 2001; Gersten & Dimino, 2001; Gersten, Vaughn, Deshler, & Schiller, 1997). In other words, practitioners are not implementing particular practices because they do not always fit into their day-to-day routine and researchers are not consistently making it clear how the practices can be implemented.

Second-generation research has expanded its focus and aims to not only understand the outcomes related to intervention, but also to understand the features or elements of complex events and interactions as they occur within the context of the learning environment. By investigating the dynamic aspects and events surrounding interventions, the relationships among environmental variables and student behavior and performance can be assessed (Odom, Favazza, Brown, & Horn, 2000). Such assessments can help

determine which elements of particular interventions are most effective and how elements may affect different students under different circumstances (e.g., Guralnick, 1997; NAEYC and NAECS/SDE, 2003).

Learning environments are multifaceted, vibrant settings where various and interrelated features may affect students' opportunities to engage and learn. Understanding the ecology of environments and the implementation of interventions within these environments provides second-generation researchers the opportunity to examine the process as well as the outcomes of intervention (Odom et al., 2000). Therefore, in order to lessen the research-to-practice gap it is necessary to approach research through means that acknowledge how student behavior and performance is an interactive process and ways that the environments in which these interactions occur have the potential to create or hinder development is necessary.

Conducting second-generation intervention research, although critical, can present several challenges. In particular, the complexities of an intervention that must account for multiple effects, or more likely interactional effects of multiple variables on students and instructional agents (e.g., teachers, families, interventionist) (Greenwood, Peterson, & Sideridis, 1994-95; LeLaurin, 1984) presents methodological, population, and cost challenges (see Pretti-Frontczak & Bricker, 2004 for a brief review of the challenges of intervention research). Further, because second-generation intervention research places less emphasis on whether a behavior can be changed and more emphasis on examining the learning opportunities designed to enhance important outcomes (e.g., Greenwood, Carta, Kamps, & Arreaga-Mayer, 1990; Pretti-Frontczak & Bricker), methods are needed to examine both the processes and products related to intervention (Carta & Greenwood, 1987). One potential method for overcoming the challenges presented by intervention research is the use of eco-behavioral assessments.

Eco-behavioral Assessment

According to Carta and Greenwood (1985) eco-behavioral assessments evolved from several bodies of inquiry including behavioral ecology, applied behavior analysis, and process-product research. Eco-behavioral assessments (EBAs) are designed to inform day-to-day practices, describe relationships between multiple variables, and lead to the creation of environments and learning opportunities that promote positive outcomes for all students (e.g., Carta, & Greenwood, 1985; Kontos, Burchinal, Howes, Wisseh, & Galinsky, 2002). EBAs allow for descriptions of classroom/home environments, examinations of key relationships and interactions, and comparisons between ecological and behavioral variables (e.g., Odom et al., 2000).

To date, EBAs have been used with many populations for a variety of purposes. For example, EBAs have been used to *describe developmental outcomes* for (a) young children who have been exposed prenatally to drugs or alcohol (e.g., Carta, McConnell, McEvoy, Greenwood, Atwater, Baggett, & Williams, 1997); and (b) preschool children receiving services in inclusive programs (e.g., Brown, Odom, Li, Zercher, 1999). EBAs have been used to *examine interactions* between teachers and students across different activities (e.g., Le Agar & Shapiro, 1995), particularly in describing the frequency in which key instructional behaviors occur (e.g., Capt, 1994a; Kamps, Leonard, Greenwood, 1991; Rotholz, Kamps, Greenwood, 1989; Schwartz, Carta, & Grant, 1996). EBAs have been used to *describe problem behaviors* within preschool environments (e.g., Bramlett & Barnett, 1993), as well as to *describe free play experiences* of young children with disabilities in inclusive classroom (e.g., Kontos, Moore, & Giorgetti, 1998). EBAs have been used to *compare social interactions and environments* for students with and without disabilities (e.g., Carta, Atwater, Schwartz, & Miller, 1990; Carta, Greenwood, & Robinson, 1987; Odom, Peterson, McConnell, & Ostrosky, 1990), and to *identify parent-child interaction factors* related to resilience in young children who are at risk (e.g., Baggett, 2003; McConnell, Rush, McEvoy, Carta, Atwater, & Williams, 2002). EBAs have been used to *describe and compare classroom*

environments (e.g., Hendrickson 1992; Pretti-Frontczak & Bricker, 2001) and the *relationship between environmental variables and student behaviors* (e.g., Rotholz et al., 1989). Moreover, EBAs have been used to *compare and monitor* the effectiveness of instructional strategies (e.g., Delquadri, Greenwood, Whorton, Carta, & Hall, 1986; Kamps, Carta, Delquadri, Arreaga-Mayer, Terry, & Greenwood 1989).

As evidenced by these examples, EBAs have been used to address complex questions regarding not only the effects of interventions, but also the relationship between events and behaviors, and to describe complex ecosystems in which students live and receive services—issues that second-generation research seek to address more fully. As eco-behavioral assessments have grown in number and use over the past several decades (e.g., Arreaga-Mayer, Carta, & Tapia, 1994; Carta, & Greenwood, 1985; McConnell, 2000; Morris & Midgley, 1990), so too has the availability of instruments, tools, and systems for collecting data on ecological features of classroom environments.

Purpose

Given the broad utility of EBAs it is important that researchers and practitioners have a comprehensive and accessible resource of existing EBAs. A select number of sources have provided partial reviews of the EBA literature and existing instruments/systems (e.g., Thompson, Felce, & Symons, 2000). Such reviews, however, have been narrow in scope. For example, a review by Odom and colleagues (2000) consisted only of EBAs used in early childhood programs serving young children with disabilities, and a review by Greenwood, Carta, and Dawson (2000), included only EBAs contained within a single software system. Thus, to date, a comprehensive and single source examining the broad range of EBAs has not been compiled. The purpose of this paper is therefore to provide such a resource for researchers and practitioners regarding EBAs in an effort to encourage and promote their use in advancing second-generation intervention research.

Review of the Literature

Our examination of EBAs began in 1996 and has evolved slowly, overcoming a number of hurdles. The first hurdle was deciding which observational systems should be considered or defined as eco-behavioral. To this end, we used a slightly modified definition of EBAs provided by Odom and colleagues (2000, p. 195) resulting in the inclusion of systems that are composed of direct observational techniques that provide information about structural (e.g., activities, group organization, group composition) and dynamic (e.g., teacher behavior, peer behavior) features of the classroom/home/childcare ecology as well as the behavior of students, adults, and/or peers in the classroom/home/childcare setting. The modified definition allowed us to include observational systems used in studies of homes and childcare ecologies as well as classrooms serving students from various ages.

A second hurdle was gaining access to work conducted using EBAs. Our search of the literature revealed that a number of projects using EBAs have disseminated findings narrowly, making access and review of the work difficult. For example, some research results and descriptions are disseminated in annual or technical reports (e.g., McConnell, McEvoy, Carta, Greenwood, Kaminski, Good, & Shinn, 1998) at conferences (e.g., Brown & Odom, 2000; Carta, Atwater, Greenwood, McEvoy, McConnell, & Williams, 1996; Odom, McWilliam, Pretti-Frontczak, & Carta, 2001; Walker & Linebarger, 2002), and on web sites (e.g., Arreaga-Mayer, Greenwood, & Utley, 2004). Fortunately, a substantial amount of work has been disseminated more broadly, in easily accessed arenas (i.e., through dissertations, articles, chapters) and it is this work that is at the heart of our examination.

Four steps were taken to conduct a comprehensive examination of the literature pertaining to EBAs. First, ERIC, PsychINFO, and the World Wide Web were searched using the terms ecobehavioral

analysis, ecobehavioral assessment, and the single term, ecobehavioral. We also searched ERIC, PsychINFO, and the World Wide Web using the names of instruments we knew to meet our definition of an EBA (e.g., ESCAPE, CISSAR, ACCESS). Searches were conducted both by the instruments' acronym and entire title. We also searched by authors who had conducted work using EBAs (e.g., Judith Carta, Charles Greenwood, Samuel Odom). Finally, we contacted researchers/authors directly via e-mail to verify answers to many of our questions.

Despite our efforts to provide a comprehensive review of EBAs, it is beyond our capacity to locate and review all observational systems that may have been used in research or practice and that meet our definition of an EBA. We chose to include only EBAs with findings disseminated in doctoral dissertations, peer reviewed articles, or readily accessible book chapters. Note, however, there are a limited number of times when work presented at conferences or disseminated on the World Wide Web is cited as an example of how a particular EBA has been used.

Our examination resulted in the identification of 18 EBAs used in empirical research (including dissertations) for students with and without disabilities. The following contains a review of those 18 EBAs. The review also contains an overview of software systems associated with one or more of the 18 EBAs and a software system that serves as stand alone EBAs (i.e., the MOOSES).

Review of EBAs. The first part of the review contains EBAs that have been used with students with and without disabilities (ages birth through 18 years of age) and with college teacher candidates. The 18 EBAs include ACCESS, CASPER I, CASPER II, CEBAI, CIRCLE I, CIRCLE II, CISSAR, CISSAR-SPED, EASE, ESCAPE, ESCRIBE, MOOSES, MS-CISSAR, an unnamed observation system by Kontos and colleagues, an unnamed observation system by McCormick, Noonan, and Heck, PICCOLI, POC, and SCOPE. Table 1 contains a summary of the 18 EBAs and provides the main citation, age group for which the EBA was designed/used, examples of past uses, and examples of ecological and behavioral categories/variables contained in the EBA.

All of the EBAs examined, except for the MOOSES, the one used by Kontos and colleagues, the one used by McCormick and colleagues, the POC, and the SCOPE, use solely a momentary time sampling procedure. The MOOSES by design does not use a time sampling procedure, but is referred to as a continuous observation system. The EBA used in work by Kontos and colleagues uses a partial interval sampling procedure and McCormick et al. use a 10 second observe/10 second record procedure. The POC uses a combination of momentary time sampling for states and frequency recording for events, and the SCOPE uses both a momentary and partial interval sampling procedure. Two of the 18 EBAs were developed and/or used specifically with infants and toddlers (i.e., CASPER I and CIRCLE I), eight were developed and/or used with preschool/Kindergarten age children (i.e., ACCESS, CASPER II, EACE, ESCAPE, system by Kontos and colleagues, system by McCormick and colleagues, POC, and SCOPE), two were developed and/or used with children birth through five (i.e., CIRCLE II and PICCOLI), and five were developed and/or used with school age students (i.e., CEBAI, CISSAR, CISSAR-SPED, ESCRIBE, and MS-CISSAR). The MS-CISSAR has also been used with college level teacher candidates. Lastly, the MOOSES can be used with any age/population because the researcher/practitioner creates the variables of interest.

Table 1
Alphabetized List of 18 Eco-Behavioral Assessments

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
ACCESS Atwater, J. B., Carta, J. J., & Schwartz, I. S. (1989).	Preschool and Kindergarten	To study ecological variables influencing a child's ability to transition from preschool to	activity, group size, context, teacher focus, prompts,

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
<i>Assessment code/checklist for the evaluation of survival skills: ACCESS.</i> Kansas City: University of Kansas, Juniper Gardens Children's Project		kindergarten (Carta, Atwater, Schwartz, & Miller, 1990). To assess teacher-student interactions during three daily activities and examine differences between preschool and Kindergarten environments (Le Ager & Shapiro, 1995).	engagement in activities, asking for assistance
CASPER I* Favazza, P. C., & Odom, S L. (1993). <i>CASPER: Code for active student participation and engagement revised. Training manual for observers.</i> Nashville, TN: Vanderbilt University.	Infants and Toddlers	To examine classroom ecologies for infants and toddlers in different types of inclusive and noninclusive environments (Odom, Favazza, Brown, & Horn, 2000).	activity initiator, student behavior, engagement, teacher behavior, social behavior, group arrangement, group composition
CASPER II* Brown, W. H., Favazza, P. C., & Odom, S. L. (1995). <i>Code for Active Student Participation and Engagement-Revised (CASPER II): A training manual for observers (Unpublished observer training manual).</i> Nashville, TN: Vanderbilt University, Early Childhood Research Institute on Inclusion.	Preschool	To describe preschool children's experiences in inclusive early childhood programs (Brown & Odom, 2000; Brown, Odom, Li, Zercher 1999). To categorize and evaluate different types of inclusive programs (Odom, Brown, Schwartz, Zercher, & Sandall, 2002). To examine the peer relationships of young children with disabilities in inclusive settings (Odom, Zercher, Li, Marquart, Sandall, 2003).	activity initiator, group arrangement, peer group composition, child behavior, child social behavior, and adult behavior
CEBAI Scott, T. M., & Sugai, G. (1994). The classroom ecobehavioral assessment instrument: A user-friendly method of assessing instructional/behavioral relationships in the classroom. <i>Diagnostique</i> , 19(2-3), 59-77	School age	To describe the development and possible application of an eco-behavioral assessment designed for classroom teachers (Scott & Sugai, 1994).	active v. passive teaching, student on task/off task. Researchers and practitioners can be individualized by creating variables
CIRCLE I* Baggett, K., Atwater, J., Peterson, P., Montagna, D., Creighton, M., Williams, R., & Hou, S. (1993). <i>CIRCLE-I: Code for Interactive</i>	Birth to six months	To examine parent -child interactions during play (Baggett, 2003).	caregiver ecology (e.g., activity, proximity), caregiver behavior (e.g., positioning, physical stimulation), infant

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
<i>Recording of Caregiving and Learning Environments - Early Infancy</i> . Kansas City, KS: Early Childhood Research Institute on Substance Abuse, Juniper Gardens Children's Project.			behaviors (e.g., social, state, engagement)
CIRCLE II* Atwater, J., Montagna, D., Creighton, M., Williams, R., & Hou, S. (1993). <i>CIRCLE-II: Code for Interactive Recording of Caregiving and Learning Environments - Infancy through Early Childhood</i> . Kansas City, KS: Early Childhood Research Institute on Substance Abuse, Juniper Gardens Children's Project.	Six to 60 months	To examine the relationship between caregiver-child interactions in the home and children's expressive and receptive vocabulary skills (Rush, 1999). To examine the variables that influence expressive language development for Latino children from low-income families (Cruzado-Guerrero, 2001). To describe child-caregiver interactions that promote development of young children exposed prenatally to drugs and alcohol (McConnell, Rush, McEvoy, Carta, Atwater, & Williams, 2002).	caregiver ecology (e.g., activity, proximity), caregiver behavior (e.g., vocal response, physical contact), child behaviors (e.g., social, partner, engagement)
CISSAR* Stanley, S. O., & Greenwood, C. R. (1981). <i>CISSAR: Code for instructional structure and student academic response: Observer's manual</i> . Kansas City, KS: University of Kansas, Juniper Gardens Children's Project. Downsized version of CISSAR Greenwood, C. R., & Carta, J. J. (1987). An ecobehavioral interaction analysis of instruction within special education. <i>Focus on Exceptional Children</i> , 19(9), 1-10	School age	To measure the quality of various instructional configurations by examining student's academic behaviors (e.g., Greenwood, Delquadri, & Hall, 1989; Walker, Greenwood, Hart, & Carta, 1994). To describe educational settings and opportunities for responding for students who are at risk and/or in urban settings (e.g., Cooper & Speece, 1990; Kamps et al., 1989). To measure the effects of Classwide Peer tutoring for increasing academic achievement and opportunity to respond (e.g., Ezell, Kohler, & Strain, 1994;	activities, tasks, structure, teacher position, teacher behaviors (no response, approval), student behaviors (academic response, task management, competing behaviors)

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
<p>CISSAR-SPED Rotholz, D. A., Whorton, D. M., Schulte, D., Walker, D., McGrale, J., Norris, M., & Greenwood, C. R. (1985). <i>Code for instructional structure and student academic response - Special education version (CISSAR-SPED)</i>. Kansas City: University of Kansas, Juniper Gardens Children's Project.</p>	School age	<p>Greenwood, Dinwiddie, Terry, Wade, Thibadeau, & Delquadri, 1984; Greenwood, Terry, Marquis, & Walker, 1994).</p> <p>To determine which instructional approach increases student achievement most for students with mild disabilities in resource rooms (Marston, Deno, Kim, Diment, & Rogers, 1995).</p> <p>To determine the behavioral effects of adding a loudspeaker system in a classroom (Palmer, 1998).</p> <p>To demonstrate the usefulness of an eco-behavioral coding system for students with severe disabilities (Rotholz, Kamps, & Greenwood, 1989).</p>	<p>activities, tasks, teacher description, teacher position, student behaviors (academic response, task management, competing behaviors)</p>
<p>EACE Capt, D.B. (1994b) <i>Eco-behavioral Assessment of Child Engagement (EACE)</i>. Unpublished observer training manual. Eugene, OR: University of Oregon.</p>	Preschool	<p>To identify program elements of integrated preschool programs that may impact successful inclusion of children with disabilities and peers without disabilities (Capt, 1994a).</p>	<p>activity structure, teacher interaction, teacher focus, child engagement, child communicative behaviors</p>
<p>ESCAPE* Carta, J. J., Greenwood, C. R., & Atwater, J. B. (1985). <i>Ecobehavioral system for the complex assessment of preschool environments: ESCAPE. Observational system manual</i>. Kansas City, KS: University of Kansas, Juniper Gardens Children's Project.</p>	Preschool	<p>To compare and contrast different types of preschools (Carta, et al., 1987).</p> <p>To examine within-classroom, static, and dynamic behaviors (Carta, Atwater, Schwartz, & Miller, 1990; Carta, Sainato, & Greenwood, 1988).</p> <p>To compare social interactions of children in different environments (Odom, Peterson, McConnell, & Ostrosky, 1990).</p>	<p>activity, materials, grouping, target behaviors, competing behaviors, teacher focus, activity initiator</p>

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
<p>ESCRIBE* Arreaga-Mayer, C., & Tapia, Y. (1992). <i>Ecobehavioral system for the contextual recording of interactional bilingual environments: Training manual</i>. Kansas City: University of Kansas, Juniper Garden Children's Project.</p>	<p>School age</p>	<p>To compare teacher activity schedules and children's participation in those activities (Ostrosky, Skellenger, Odom, McConnell, & Peterson, 1994).</p>	
		<p>To examine preschool and kindergarten environments to assist in successful transitioning for children with disabilities (Le Ager & Shapiro, 1995).</p>	
		<p>To determine the use of recommended practices for promoting language development with preschool age children (Schwartz, Carta, & Grant, 1996).</p>	
		<p>To examine variables affecting peer interactions of children with disabilities in inclusive classrooms (Sontag, 1997).</p>	
		<p>To examine children's active engagement in different settings and to identify effects of environmental and teacher variables and global program quality on active engagement (Martin, 2004).</p>	
		<p>To examine the use of an EBA with students who are bilingual and to determine which program aspects are related to academic and linguistic gains (Arreaga-Mayer, Carta, & Tapia, 1994).</p>	<p>setting, number of adults, activity, materials, teacher definition, teacher focus, language initiating/responding</p>
<p>To examine teacher and student behaviors and environmental variables that impact students with limited English proficiency (e.g., Arreaga-Mayer, Carta, & Tapia, 1995; Arreaga-Mayer, Utley, Perdomo-Rivera, & Greenwood, 2003).</p>			
<p>To evaluate two different</p>			

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
<p>MOOSES* Tapp, J. T., Wehby, J. H., & Ellis, D. N. (1995). MOOSES: A multi-option observation system for experimental studies. <i>Behavioral Research Methods, Instruments, & Computers</i>, 27, 25-31.</p>	Any	<p>instructional settings for language-minority students (Arreaga-Mayer & Perdomo-Rivera, 1996).</p> <p>To assess the effects of a school-based prevention program on the frequency and duration of specific antisocial behaviors and social interactions of Head Start children at risk for developing conduct disorders (Tankersley et al., 1996).</p> <p>To examine how peer training used within social skills and cooperative learning groups impacted the participation of students with autism (Kamps et al., 2002).</p> <p>To examine the effectiveness of a comprehensive reading intervention with children with emotional and behavioral disorders (Wehby et al., 2003).</p> <p>To examine the effects of a combined teacher, parent and child training on young children with oppositional defiant disorder (Webster-Stratton et al., 2004).</p>	generated by researcher or practitioner
<p>MS-CISSAR* Carta, J. J., Greenwood, C. R., Schulte, D., Arreaga-Mayer, C., & Terry, B. (1988). <i>Code for instructional structure and student academic response: mainstream version (MS-CISSAR)</i>. Kansas City, KS: Juniper Gardens Children's Project, Bureau of Child Research, University of Kansas.</p>	School age and College teacher candidates	<p>To examine classroom instruction for students with autism and developmental disabilities in two settings (Kamps, Leonard, & Greenwood, 1991).</p> <p>To analyze the effects of instructional variables on the engagement of students' with moderate/severe disabilities in the general education classroom (Logan, Bakeman, & Keefe, 1997).</p> <p>To identify which instructional procedures were effective in teaching language arts skills to students with learning disabilities (Greenwood,</p>	classroom task, physical arrangement, instructional grouping, teacher behaviors (focus, approval) student behaviors (academic, task management, competing responses)

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
<p>Observational System (unnamed)^b Kontos, S., Moore, D., & Giorgetti, K. (1998). The ecology of inclusion. <i>Topics in Early Childhood Special Education</i>, 18, 38-48.</p>	<p>Preschool</p>	<p>Carta, Arreaga-Mayer, & Rager, 1991). To compare the effects of instruction on basic skill acquisition for students educated by their parents versus the public school (Duvall, Ward, Delquadri, & Greenwood, 1997).</p> <p>To investigate ecological and instructional variables affecting learning outcomes for middle school students who are deaf and receiving services in two residential settings (Woolsey, 2001).</p> <p>To describe inclusive high school classrooms and examine differences in teacher/students behaviors (Wallace, Reschly Anderson, Bartholomay, & Hupp, 2002).</p> <p>To determine the usefulness of an EBA in observing and evaluating preservice teachers of students who are deaf (Roberson, Woolsey, Seabrooks, & Williams, 2004a).</p> <p>To examine the use of an EBA to measure special education teacher candidates' internship performance (Roberson, Woolsey, Seabrooks, & Williams, 2004b).</p>	<p>activity (e.g., unoccupied, onlooking), social configuration (e.g., child alone), adult involvement (e.g., ignore, minimal), teacher interactions (non, simple), child behaviors (interactions with</p>
		<p>To describe the ecology of children's experiences during free-play activities in inclusive early childhood programs (Kontos, Moore, & Giorgetti, 1998).</p> <p>To understand classroom circumstances related to children's play with peers and objects and to determine the circumstances related to</p>	

Eco-behavioral assessment ^a	Age Group	Purposes/Examples of Past Uses	Examples of Categories/Variables
		complex interactions by teachers with children (Kontos & Keyes, 1999). To examine the variables that co-exist with children's complex interactions with peers and objects (Kontos, Burchinal, Howes, Wisseh, & Galinsky, 2002).	peers, interactions with objects)
Observational System (unnamed) McCormick, L., Noonan, M. J., & Heck, R. (1998). Variables affecting engagement in inclusive preschool classrooms. <i>Journal of Early Intervention, 21</i> , 160-176	Preschool	To explore the extent to which disability status, type, and nature of activities and characteristics of co-teacher teams are predictors of engagement. (McCormick, Noonan, & Heck, 1998).	engagement, type of activity, structure of activity, size of group, teacher behavior
PICCOLI* Walker, D., Hart, B. & Reynolds L. H. (2003). <i>Parent Infant Caregiver Code for the Observation of Language Interactions (PICCOLI) (Version 2.0)</i> . Kansas City, KS: Juniper Gardens Children's Project, University of Kansas.	Birth to 40 months	To document longitudinal findings regarding language development in homes and child care settings (Atwater & Walker, 2004). To describe early literacy experiences of young children in childcare settings (Walker & Linebarger, 2004). To examine the quality of childcare in promoting language (Walker, Linebarger, Bigelow, Small, & Harjusola-Webb, 2004).	activity, materials, proximity, vocal and nonvocal social behaviors, engagement, attention, competing behaviors
POC Bramlett, R. K., & Barnett, D. W. (1993). The development of a direct observation code for use in preschool settings. <i>School Psychology Review, 22</i> (1), 49-62.	Preschool	To assist practitioners in analyzing problem behaviors within preschool environments and to examine usual behaviors through observation and then link the observations to designing appropriate intervention (Bramlett, & Barnett, 1993).	states, events, disruptive behaviors
SCOPE Pretti-Frontczak, K., & Capt, D.B. (1997). <i>System for Classroom Observations and Program Evaluation (SCOPE). Observational system manual</i> . Kent, Ohio:	Preschool	To describe how often, when, and how preschool teachers provided embedded learning opportunities (Pretti-Frontczak & Bricker, 2001).	scheduled activity, materials, grouping, teacher embedding, child behavior related to targeted skills

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Kent State University.			

^aThe * indicates the EBA is available in a computerized format.

^bIn the three studies by Kontos and colleagues a variation of the same observational system was used and counted as a single EBA.

All 18 EBAs examined contain ecological and behavioral variables. Many of the ecological variables allow for descriptions of daily activities (e.g., free play, circle, snack, academic content area tasks, gross motor). Many of the EBAs also contain variables describing the number of students involved in a particular activity (e.g., target child was engaged in solitary play, small group, large group) and the composition of students (e.g., number of students with identified disabilities). Each of the EBAs examined include variables that described the proximity/position of key adults in the environments (teachers, caregivers, other service providers) and allow for descriptions of their behaviors (e.g., level of engagement, type of verbal responses, approval, ignoring). Not only were adult behaviors variables of interest, but the EBAs examined also contain a wide variety of student behaviors including level of engagement, interaction with objects, affective states, academic responses, competing behaviors, and communicative behaviors. Because each of the EBAs examined provide for assessment of student behavior as well as environmental and instructional variables, they allow for measuring the process of intervention as well as the outcome. As illustrated in Table 1, the range of purposes, age groups, and variables of interest span an array of research interests.

Table 1 is designed to facilitate a match between future research endeavors and the use of EBAs. In other words, to provide a summary of the primary purposes for which a particular EBA can be used, appropriate populations, and a sampling of existing variables. When selecting an EBA, however, cost, training needs, and flexibility of codes should also be considered. Other than the MOOSES, the EBAs reviewed in Table 1 come with preset variables and operational definitions, potentially limiting their use to a wide variety of types of inquiry. Many of the EBAs also do not have documented psychometric properties, or only report very basic information such as interobserver agreement with the exception of the CISSAR that has documented interobserver agreement, test-re-test reliability, stability, concurrent validity, and treatment validity reports.

EBAs and technological advances. A clear trend related to EBAs is the use or reliance on technology for collecting, storing, and analyzing data. This trend is enhancing the utility and availability of EBAs to researchers and practitioners (Thompson et al., 2000). Specifically, software systems for collecting data regarding ecological and behavioral variables, training observers, calculating inter-observer agreement, managing data, and analyzing data are being developed and used (see Kahng & Iwata, 2000 for an additional review of computer systems designed for collecting real-time observational data). For example, EBASS is a software system that supports three EBAs, the CISSAR, MS-CISSAR and ESCAPE. A number of other software systems have been developed in tandem with the paper-pencil versions of the EBAs to aide in data collection, management, and analysis (e.g., ESCRIBE, PICCOLI). Table 1 provides a notation (indicated by an asterisk beside its name) of which EBAs are supported by a software system. The following is a brief description of four primary EBA software systems.

First, the Ecobehavioral Assessment Systems Software (EBASS) allows for data collection, observer training, inter-observer agreement, data management, and data analysis for the CISSAR, MS-CISSAR and ESCAPE (Greenwood, Carta, & Dawson, 2000; Greenwood, Carta, Kamps, & Delquadri, 1997). EBASS runs using Microsoft Windows, DOS, or Macintosh operating systems if PC emulation software is used. More information regarding EBASS can be found online at Juniper Gardens Children's Project (http://www.jgcp.ku.edu/EBASS/ebass_descrp.htm). Second, the Ecobehavioral System for the

Contextual Recording of Interactional Bilingual Environments (ESCRIBE) uses a similar system to EBASS that runs using DOS-based software and Microsoft Windows, or Macintosh operating systems if PC emulation software is used (Arrega-Mayer & Hou, 1992) and is also available through The Juniper Gardens Children's Project (<http://www.jgcp.ku.edu>). Third, the Interval Manager (INTMAN) is a software system designed for behavioral research using time sampled observational data (Tapp, Ticha, Eryzer, Gustafson, Gunnar, & Symons, 2004). Data are collected on Pocket PC or hand held computers running on Windows CE or Windows Mobile 2003. Data analysis is conducted on a computer with Microsoft Windows 98 or higher. Odom and colleagues (2002) used INTMAN with both the CASPER I and CASPER II. For more information contact Jon Tapp at Vanderbilt Kennedy Center (<http://www.getintman.com>). Lastly, the Parent Infant Caregiver Code of Language Interaction (PICCOLI) allows for simultaneous recording of environmental and interactional variables related to the language opportunities provided to infants and young children (Reynolds & Walker, 2003). Data analysis software allows for graphic displays of frequencies, percent occurrences, conditional probabilities, and inter-observer reliability. PICCOLI runs on Microsoft Windows based notebook computers and wireless microphones for documenting child and caregiver language samples.

One software system has been created to serve as stand alone EBAs (e.g., MOOSES). In other words, rather than supporting an EBA that originated as a paper-pencil observational tool, MOOSES was created to allow researchers and practitioners to derive their own codes/variables and then collect and analyze the data directly using hand held devices and laptop computers (Tapp, Wehby, & Ellis, 1995). The MOOSES software system allows for data collection, inter-observer agreement, multi-group analysis, and sequential analysis. Data are collected directly into MOOSES using a Windows based computer or laptop, Windows CE handheld, or Pocket PC using minimoose data collector (Tapp, 2004), or data codes using ProCoderDV - a data collection shell (Tapp, 2003). For more information on ProCoderDV visit <http://www.procoderdv.com> at Vanderbilt Kennedy Center. For more information or a free demo of MOOSES visit <http://getmooses.com> at Vanderbilt Kennedy Center. The MOOSES has been used in a wide variety of research studies (e.g., Kamps et al., 2002; Tankersley, Kamps, Mancina, & Wiedinger, 1996; Webster-Stratton, Reid, & Hammond, 2004; Wehby, Falk, Barton-Arwood, Lane, & Cooley, 2003).

Summary

As evidenced by our examination, numerous EBAs exist and can be used to address a host of second-generation intervention research questions. In particular, EBAs have been used to examine the effects and success of inclusive programs, determine the effects of various instructional strategies/programs, and measure the effects of student disability on classroom interactions. Further, EBAs have been used effectively across age ranges (infants through preservice college students) and with students with a wide range of abilities. Despite the various uses, it is clear that EBAs share common features such as an appreciation of the influence or impact of the learning and social ecology, the utility in examining complex interactions, and the reliance on time sampling procedures.

A clear trend toward the use of technology to assist in the collection, management, and analysis of observational data was also evidenced by our examination of EBAs. The software systems described provide examples of how technology is allowing researchers and practitioners to address complex questions with greater ease. Indeed, computer technology provides the means for collecting data on many important process and outcome variables concurrently and supports the analysis of the resulting data sets making descriptive as well as experimental research more obtainable.

This examination serves as a comprehensive resource for researchers and practitioners interested in EBAs. Specifically, the examination (a) identifies the utility of various EBAs, (b) allows for comparisons regarding which EBA is more applicable for a given set of questions or circumstances, and (c) demonstrates how software systems may aid in analyzing and interpreting complex datasets

concerning environmental and behavioral interactions. Lastly, and perhaps more importantly in the current age of accountability, this examination illustrates how EBAs have been used to provide programs and schools with "scientifically based research" that provides more contextual information than outcomes data alone. In other words, EBAs provide a valid, reliable, and cost effective method for overcoming many of the challenges presented by intervention research and meting requirements such as those identified in the No Child Left Behind Act. As second-generation research aims to understand features or elements of interventions and contexts in which they are implemented, EBAs provide a valuable option for researchers and practitioners.

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