



Applied Behavior Analysis in Early Childhood Education: An Overview of Policies, Research, Blended Practices, and the Curriculum Framework

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Abstract

In this manuscript we attempt to provide a narrative history of the relationship between applied behavior analysis and early childhood education by examining the policies and research that have collaboratively shaped both fields. In addition, given the rapid pace at which early childhood education has changed in the last 25 years, we provide an overview of a recommended model for delivering early childhood education services, to illustrate its congruence with the practices and principles of applied behavior analysis. Lastly, we hope that this manuscript may be used as a bridge between the fields of early childhood education and applied behavior analysis given their similarities and shared purpose, to improve the lives of all recipients of their services.

Keywords Early childhood education · Applied behavior analysis · Blended practices · Curriculum framework

Applied Behavior Analysis in Education

The relationship between the fields of applied behavior analysis (ABA) and education extends across decades with recent federal policy recognizing the benefits of this relationship and bringing guiding principles of ABA to the forefront of teacher responsibilities. For example, the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA) required teachers to assess functions of challenging behavior (i.e., functional behavior assessments), and the 2004 reauthorization stressed that teachers use positive behavior interventions and supports to address the needs of children with disabilities. For teachers of students without identified disabilities, IDEA 2006 permitted states to use Response to Intervention (RTI), a multi-tiered problem solving approach to address behavior across domains while emphasizing core-principles of ABA such as (a) consistent formative progress monitoring, (b) data-based decision making, (c) instruction *and* prevention, and (d) matching intervention intensity with student-specific

needs (Ardoin, Wagner, & Bangs, 2016; Barnett, Daly, Jones, & Lentz, 2004; Fuchs & Fuchs, 2006). In addition, IDEA 2004 mandated that teachers use “research-based intervention, curriculum, and practices” (p. 2787). These policies support a notion that research should guide practice in federally funded schools and classrooms.

In their seminal work on ABA, Baer, Wolf, and Risley (1968) embedded the notion that research-guide practice by stating that the study of applied behavior be analytic, technological, and conceptually systematic. Present-day standards for behavior analysts extend this notion, dictating that the use of non-scientifically based interventions may result in removal of an analyst’s certification or licensure (Bailey & Burch, 2016). These standards and other factors (e.g., professional competencies, billing requirements) governing behavior analysts have been a critical component in retaining the profession’s focus on research rather than trends, fads, and pseudoscience (e.g., Leaf et al., 2016). For example, the ethical compliance code for behavior analysts indicates that practitioners should not provide services outside their boundaries of competence. Therefore, if a behavior analyst with no experience or training working with children with feeding problems is asked to work with a 3-year-old diagnosed with pediatric feeding disorder, the behavior analyst may choose to refer that child to a more appropriate provider (Bailey & Burch, 2016). In addition, if environmental conditions interfere with the implementation of an intervention (e.g., lack of

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personnel to follow through with procedures), then the behavior analyst may recommend changing the focus of services or helping the client identify new services from another professional (Bailey & Burch, 2016). For classroom teachers, there are different factors that affect their ability to provide research-based practices as mandated by federal law. For example, teachers are trained to work with relatively heterogeneous populations of students, while behavior analysts may choose to specialize in more specific populations. Teachers are also required to provide a free and appropriate public education, for which the term *appropriate* is continually changing based on case law (Katsiyannis, Yell, & Bradley, 2001). Therefore, teachers may find themselves constrained by the amount resources deemed to be appropriate to meet their students' needs. Although both behavior analysts and teachers are required to provide research-based practices of instruction, it is clear that there are factors that affect each's ability to provide such services.

With regards to the impact of these factors on teachers, some researchers suggested that the use of function-based interventions in school settings put forth in IDEA 1997 extended beyond the school-based research of that time (Nelson, Roberts, Mathur, & Rutherford Jr, 1999). More recently, researchers and practitioners have repeated similar refrains identifying significant gaps between research and practice (Cook & Odom, 2013). To address these issues, the Institute of Education Sciences and the Office of Special Education Programs provided funding to research new practices using methodologies rooted in implementation science and train new school-based service providers with backgrounds in ABA-related evidence-based practices (see also Institute of Education Sciences, 2017; Office of Special Education Programs, n.d.). To date, researchers and higher education programs have made substantial gains. Research-based and ecologically valid procedures have been established for assessing challenging behavior in school classrooms (e.g., structural analyses, trial-based analyses) and providing access to positive behavior supports through RTI for students with and without disabilities. Of the programs preparing individuals to become behavior analysts, the majority are housed in education-related departments (e.g., special education, school counseling; Shepley et al., 2017), with most working behavior analysts primarily serving school-aged populations (i.e., children, adolescents; Behavior Analyst Certification Board, 2011). In addition, the education-related jobs seeking behavior analysts are not limited to teachers, but also include teaching assistants, counselors, and school psychologists. Furthermore, data indicate that the field of education accounts for more than a quarter of the demand for all behavior analysts with only the healthcare industry accounting for a larger percentage (Burning Glass Technologies, 2015).

Applied Behavior Analysis in Early Childhood Education

The demand for behavior analysts by the field of education should not be viewed as a new trend given that school-based practitioners have been using ABA-based interventions for quite some time (Hursh, 1991). A more appropriate characterization of the current trend may be that schools are seeking behavior analysts that are board certified (i.e., BCBA®) (see also Burning Glass Technologies, 2015), a classification that did not exist until 1998 (Behavior Analyst Certification Board, n.d.). For years prior to 1998, researchers and instructors training future teachers wrote textbooks (Heward, Heron, Hill, & Trap-Porter, 1984; Wolery, Bailey, & Sugai, 1988), published across journal disciplines (Shabani, Carr, Petursdottir, Esch, & Gillett, 2004) and received federal grants to research the use of ABA-based interventions in school-based settings (Wolery, Ault, Doyle, & Gast, 1986).

The emphasis on applied behavior analysis was particularly prominent within early childhood special education (ECSE), where the beginnings of a behavioral approach to early intervention can be traced back to Hart and Risley (1968, 1995) seminal work on incidental teaching. In response to Hart and Risley's research, the work of other behavior analysts, and the 1986 Amendments to the Education for All Handicapped Children Act (PL 99-457), the field of ECSE developed rapidly. By the 1980s, assessment, curricula, and instruction were rooted in a behavioral approach to service provision (Carta, Schwartz, Atwater, & McConnell, 1991). Reasons for this alignment were evident in the field's focus on (a) single-case research allowing for the development and monitoring of individualized programs to meet the distinct needs of families and children, (b) procedural fidelity to increase reliability that an intervention was responsible for changes in behavior, (c) research-based decision making when selecting interventions, and (d) social validity to ensure that measurable changes in behavior were also of importance to families and children (Strain et al., 1992). These ABA-based foundations of ECSE were challenged in 1987 when the field of early childhood education (ECE) and the National Association for the Education of Young Children (NAEYC) disseminated a position statement providing guidelines for developmentally appropriate practice (Bredekamp, 1987). The guidelines were in response to a push for increased accountability associated with academic curricula in early childhood settings, and specified "types of activities [NAYCE] deemed appropriate for children between birth and age 8" (Carta, 1995, p.1). Although well intentioned, the all-encompassing nature of the guidelines struck many researchers in the field of ECSE as insufficient to meet the needs of children with special needs and those from culturally diverse backgrounds (Carta, Atwater, Schwartz, & McConnell, 1993).

Around the time of NAEYC's guidelines for developmentally appropriate practice, policy began playing a pivotal role in shaping the landscape of early intervention. In 1986, the amendments to the Education for All Handicapped Children Act (PL 99-457) required states to provide a free and appropriate public education in the least restrictive environment to children with disabilities between the ages of 3 and 5 years old, and offered grants to states to provide services to children with disabilities ages 0–2 years old. In addition, the 1990 Americans with Disabilities Act mandated that child care centers could not refuse services to children with disabilities. These policies pushed for inclusion of children with disabilities in public and private early childhood settings. As noted by Carta (1995), these acts “mean[t] that full inclusion of young children with special needs will become a reality” (p. 9). In some states, this was already the case. The 1990 Kentucky Reform Act made Kentucky the first state to have inclusive public early childhood classrooms statewide, with no self-contained preschool programs.

In response to policies pushing for greater inclusion in early childhood and to better understand the philosophies and practices of each other's field, NAEYC and the Council for Exceptional Children's Division for Early Childhood (DEC), the professional organization for individuals working with young children with special needs, began a dialogue to clarify position statements (Bredenkamp, 1993), find common ground (Carta, 1995; Wolery & Bredenkamp, 1994), and make a plan to move forward with the purpose of improving the education of young children (Bredenkamp & Copple, 1997). Through their collaboration, an idea emerged that children with *and without* disabilities should receive individualized instruction aligned with each child's needs, preferences, and learning histories (Grisham-Brown, Hemmeter, & Pretti-Frontczak, 2005). This idea is referred to as a blended practices approach to ECE.

Blended Practices

Blended practices encompass a range of research-based practices from the fields of ECE and ECSE, which benefit all children and include authentic assessment strategies, responsive interactions, engaging environments, small group instruction, and systematic instruction (Grisham-Brown & Hemmeter, 2017). Embedded instruction is a practice that perhaps best typifies blended practices. To the fullest extent possible embedded instruction takes advantage of naturally occurring (a) discriminative stimuli, (b) motivating operations, (c) prompts, and (d) contingencies present throughout early childhood activities and environments. For example, a child working on using a pincer grasp to open food items may receive targeted instruction during meal times. The presence of an unopened bag of food (i.e., discriminative stimulus)

signals the availability of food (i.e., reinforcement), and the deprivation of food that builds between snacks and meals functions as an establishing operation increasing the value of food as a reinforcer. Upon presentation of the unopened bag, a practitioner can engage in a response prompting strategy, such as graduated guidance or most to least prompting (Wolery, Ault, & Doyle, 1992), to help the child perform the target behavior. After multiple trials occurring across meal times, other routines, materials, presence of varying peers, and days, the practitioner should begin to see a transfer of stimulus control in which the child begins independently using a pincer grasp to open food items and access other materials requiring a pincer grasp. Understanding the dynamic, yet consistent interactions between a child and an early learning environment allow a practitioner to embed systematic instruction within activities that require meaningful target behaviors (Snyder et al., 2015). These activities should be based on a child's preferences, and likewise, a practitioner's instructional strategy should be based on the child's past learning history.

Blended practices are not specific to any type of child; rather, blended practices should be individualized for all children in any early childhood environment, thereby making their implementation challenging to early childhood personnel. Some children will require additional trials planned throughout the day in order to learn certain skills. For children with restricted or limited interests, there may be difficulty identifying naturally occurring reinforcers, and more arbitrary reinforcers may be needed before naturally occurring contingencies function as reinforcement. In addition, for children lacking foundational skills such as object manipulation, play, attending, and imitation, there may be limited activities in which meaningful behaviors can be targeted. For these children, it may be necessary to supplement embedded instruction with brief direct instructional sessions that offer more structure and fewer distractions (Wolery & Hemmeter, 2011); this may be of particular need when targeting the initial establishment of stimulus control and other related learning-to-learn behaviors (Green, 2001).

As the above examples highlight, planning for the individualized needs of all children across all early childhood activities can be an onerous endeavor, especially when working in classrooms with 20 children. The continuum of needs can extend from those who benefit simply from an enriched and interesting environment, to those who require tens of trials a day with systematic instructional procedures across a variety of foundational skills. To guide instructional decisions regarding type of instruction, intensity of instruction, and amount of data collection needed, Grisham-Brown et al. (2005) proposed a curriculum framework for answering these and other decision-making questions related to serving young children in blended programs.

Curriculum Framework

The structure of the curriculum framework is best visualized as an umbrella consisting of four main elements: assessment, scope and sequence, activities and instruction, and progress monitoring (see Fig. 1). If any one of these elements is missing then the umbrella does not function. Each element in the umbrella is broader in focus at the bottom and more individualized at the top, promoting a three-tiered approach to service provision. The elements are supported by collaborative partnerships between teachers, families, and related service providers. Influencing all elements of the umbrella is data-driven decision making, professional development, and a leadership plan that is rooted in research for supporting teachers, children, and families. In the next section, we describe the four primary elements of the curriculum framework, their relationship to tiered services in ECE, and the roles a behavior analyst may serve within each element. Refer to Table 1 for summarized recommendations on the role of a behavior analyst within ECE programs.

Assessment

The purpose of assessment is to collect information about young children. Assessment may be used for (a) screening to determine if a child requires additional assessment, (b)

diagnosis or eligibility determination to see if a child qualifies for certain services, (c) program planning to help determine what to teach and how to modify instruction, (d) reporting progress to see if a child is making gains, and (e) program evaluation to determine if a program is meeting the needs of children, families, and stakeholders (Grisham-Brown & Pretti-Frontczak, 2011). We are going to focus on assessment for the purpose of program planning.

The goal of high quality program planning in ECE programs is to link assessment practices with instruction. In addition, states require programs to report student-specific data; therefore, programs must also link assessment with their state's standards. To accomplish the multiple objectives of assessment, early childhood educational programs often use a type of criterion-referenced assessment known as a curriculum-based assessments (CBAs). A CBA measures student performance overtime using stimuli embedded within an educational program's curricula. A CBA is appropriate for early childhood classrooms because it "helps teachers identify specific learning outcomes that can be addressed as part of curriculum planning and development" (Grisham-Brown & Hemmeter, 2017, p. 22). For successful program planning, it is critical that an early childhood program select a CBA that allows for authentic assessment of developmentally appropriate skills across all developmental domains for all targeted populations. In addition, a CBA should be technically adequate and promote collaboration among professionals and families (Bagnato, Neisworth, & Pretti-Frontczak, 2010).

Within the field of ABA, many behavior analysts have experience with program planning assessments such as The Assessment of Basic Language and Learning Skills-Revised (ABLLS-R; Partington, 2008) and the Verbal Behavior Milestones and Placement Program (VB-MAPP; Sundberg, 2008). Despite their reported utility, ease of use, and widespread adoption by behavior analysts, the assessments are not common in ECE programs. We propose two reasons for this. First, ECE programs provide services to all children who may have varying levels of delays across a variety of developmental domains. Therefore, to capture the breadth of behaviors that comprise a child's current state of development, an assessment needs to account for behaviors across all developmental domains. In addition, the assessment should be sensitive to differences in ages across each developmental domain to better align intervention with assessment. Second, within the field of education, assessments need to be technically adequate. This is often mandated by federal policy, particularly when accountability is tied to funding (see also Cameto et al., 2009). Technical adequacy refers to the validity, reliability, and bias of an assessment, providing critical information to consumers making decisions regarding for what purpose to use a particular assessment (Grisham-Brown & Pretti-Frontczak, 2011). The notion of aligning an assessment with its intended purpose should be of particular importance to

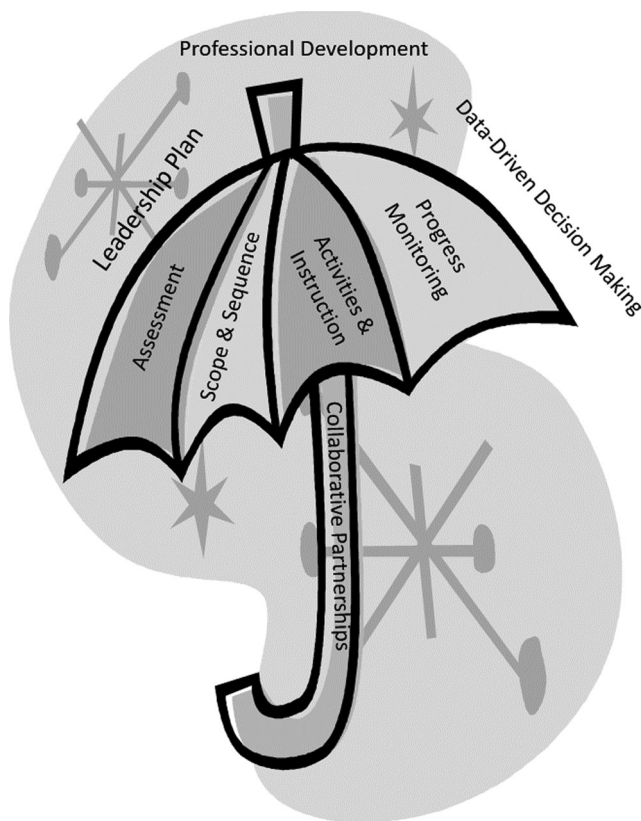


Fig. 1 Umbrella model of the curriculum framework. Adapted from Grisham-Brown and Hemmeter (2017)

Table 1 Recommended roles for behavior analysts in early childhood education programs by curriculum framework component and tier of service

Tier	Assessment	Scope and sequence	Activities and instruction	Progress monitoring
1	–	–	Training staff on conducting embedded learning trials, positive behavior supports, differential reinforcement, and responding to incorrect or undesirable behavior	–
2	Identifying potential reinforcers	Selecting appropriate dimension of behavior to target for instruction	Training on systematic stimulus-transfer procedures and small-group direct instruction Training on peer-mediated instruction	Developing data collection systems Training on data collection systems
3	Identifying potential reinforcers Determining functions of communication Conducting FBA to determine function of behaviors interfering with learning	Determining needed pre-requisite skills to make gains during tier 1 instruction Identifying behaviors that may function as pivotal behaviors or behavioral cusps Selecting socially appropriate replacement behaviors based on results of FBA	Developing a function-based BIP Training on BIP procedures Developing individualized instructional strategies Training on individualized instructional strategies	Developing individualized data collection systems Training on individualized data collection system Training on analyzing data Training on making data-based decisions

FBA functional behavior assessment, BIP behavior intervention plan

early intensive behavioral intervention providers as their field begins to identify the limitations of certain assessments (Gould, Dixon, Najdowski, Smith, & Tarbox, 2011). For example, assessments designed for screening or eligibility determination should be not used for program planning. We strongly urge early intensive behavioral intervention providers and researchers to review the ECE literature on assessment to develop a more thorough understanding regarding the technical adequacy and intended purpose of assessments when making decisions regarding appropriate and inappropriate assessments for program planning within their field.

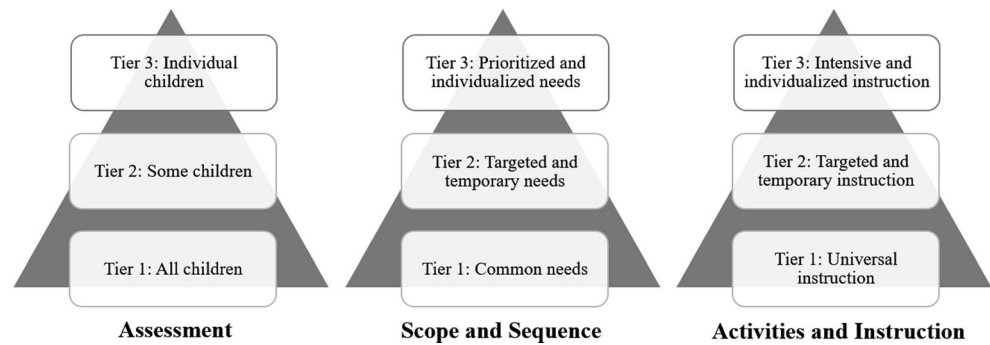
The curriculum framework suggests that three pieces of information be collected for program planning purposes. Information on a child's developmental status and performance in early childhood content areas (e.g., preliteracy) are assessed using the ECE program's selected CBA. In addition, information on the family's concerns and priorities should be gathered, which may be accomplished through a systematic process for involving families that is part of the CBA (e.g., Assessment, Evaluation, and Programming System for Infants and Children, 2nd Edition; Transdisciplinary Play-Based Assessment and Intervention). Finally, each child's interests and preferences based on child learning histories should be examined.

Tiered Assessment and the Behavior Analyst In a blended classroom, tier 1 assessment involves assessing *all children* using a CBA and gathering family information regarding a child's interests and preferences and the family's priorities (see Fig. 2). With tier 2 assessment, *some children* might need more specialized assessment related to their development or

their interests. *Individual children* may need the most intense level of program planning assessment that involves multiple team members, a transdisciplinary assessment process, and perhaps the use of highly specialized program planning assessment instruments (e.g., Communication Matrix; Rowland & Fried-Oken, 2010).

Behavior analysts may offer a particular set of research-based practices proven effective for identifying children's interests—preference assessments. For infants and toddlers still developing communication, the use of free-operant preference assessments may be critical to gathering information on interests and potential reinforcing materials. For children with restricted interests who display minimal engagement with materials, the use of more structured preference assessments, such as a multiple or paired stimulus assessments, may be necessary. Behavior analysts may also provide a novel perspective within a transdisciplinary team for students with communication delays, by identifying both the forms *and* functions of a student's communicative behavior. Knowing (a) what a student's communicative behavior looks like, (b) why the behavior is occurring, and (c) what is maintaining the behavior are critical questions to answer when identifying communication skills to target for instruction and developing communication interventions. Lastly, the greatest strength of a behavior analyst within the assessment component of the curriculum framework is undoubtedly their ability to identify the function of challenging behavior. For students with challenging behaviors that interfere with their learning or the learning of others, federal law requires that a functional behavior assessment be conducted. Research suggests that university programs teaching early childhood professionals struggle with preparing their graduates to use functional assessments

Fig. 2 Tiered models in early childhood education based on the curriculum framework



(Hemmeter, Snyder, Fox, & Algina, 2008). Given the unique training of behavior analysts, ECE programs should utilize the knowledge and expertise of behavior analysts for (a) identifying children's interests and preferences, (b) assessing functions of communicative behaviors, and (c) determining the functions of challenging behavior.

Scope and Sequence

After assessment data have been collected, they must be analyzed by professionals to determine what to teach; this is the scope and sequence of instruction. The scope and sequence element of the curriculum framework functions as a connector between the assessment component and the activities and instruction component. *Scope* refers to the breadth of developmental domains and content areas that will be taught, and *sequence* refers to the arrangement and order in which behaviors will be targeted for instruction. Determining what to teach for each child is influenced by assessment information obtained from the CBA and family input. In addition, ECE programs must also consider state and federal standards (e.g., Head Start Early Learning Outcomes) as program accountability and funding is often linked to child progress on these standards.

Tiered Scope and Sequence and the Behavior Analyst The tiered scope and sequence model addresses common needs at the base of the triangle (see Fig. 2). These are the needs of all children and promote greater levels of independence and access to naturally occurring reinforcement. For example, once a child learns to communicate, the child can begin controlling access to preferred materials in the environment. However, some children may display delays related to certain common needs. A child may only use approximations of words or continue using one word utterances as his classmates begin using more complex phrases. These children may require tier 2-targeted instruction focusing on improving the quality, fluency, or latency of certain behaviors. Tier 3 addresses prioritized or individualized needs. These are typically foundational skills that prevent a child from accessing environments and activities. Depending upon the age of the child, foundational skills include object manipulation, attending,

generalized imitation, and pretend play. It should be noted that the target behaviors for tiers 2 and 3 should be aligned with the common needs of all children in tier 1.

Since the beginnings of ABA, researchers have devoted much study and thought to identifying what behaviors to teach to yield socially valid outcomes for individuals (e.g., Hawkins, 1986). This research has been foundational to behavior analysts in the field who work on a daily basis identifying the needed pre-requisite skills for an individual to acquire a meaningful target behavior. For example, behaviorists in the field of ECSE identified specific attending responses as a prerequisite behavior needed for some children with developmental delays to make gains in acquiring academic content (e.g., Lane, Gast, Shepley, & Ledford, 2015). In addition, behavior analysts have developed conceptualizations of certain behaviors, called behavioral cusps and pivotal behaviors. Behavioral cusps refer to behaviors that, if acquired, will provide access to new reinforcers and settings for an individual (e.g., crawling; Cooper, Heron, & Heward, 2007). Pivotal behaviors are those that produce concomitant changes in non-targeted behaviors (e.g., self-instructing; Smith, Ayres, Alexander, Ledford, Shepley, & Shepley, 2016). With regard to students engaging in challenging behavior, the selection of a socially appropriate replacement behavior that may be used across settings and is widely understood by individuals in those settings (e.g., manual sign vs. vocal language vs. picture exchange vs. speech-generating device) is of paramount importance to the maintenance and generalization of a behavior change program. We think that the dual expertise of ECE and ABA practitioners related to scope and sequence should be shared and explored to better identify meaningful target behaviors, required pre-requisites of those behaviors, and appropriate replacement behaviors for children needing tier 2 and 3 services and children engaging in challenging behaviors. This becomes especially critical in programs with large numbers of children with diverse needs, where early childhood educators need support in identifying those skills that are the most socially valid, as opposed to selecting numerous arbitrary goals that tend to be restatements of the common outcomes taught to all students (e.g., prioritizing letter and numeral identification in children with no functional form of communication).

Activities and Instruction

The activities and instruction element encompasses the practices and dosages of interventions that are used to teach target behaviors. In addition, the component provides guidance on the activities during which interventions should be implemented. The activities and materials used in early childhood classrooms should set the occasion for meaningful target behaviors and take advantage of natural reinforcement contingencies. Teachers can increase the likelihood that activities do this by reviewing data on child interests and incorporating these into environments. In addition, the activities should support both common needs of all children and more individualized needs of some children.

A typical schedule of activities in an early childhood classroom often includes a diverse makeup of teacher and child-led activities. Across these activities, a teacher must identify when target child behaviors will most likely be needed and determine what, if any, instructional practices to use to promote the desired level of performance of the behaviors (Grisham-Brown & Hemmeter, 1998; Grisham-Brown, Pretti-Frontczak, & Hemmeter, 2002). This allows for behaviors to be taught in the environments *where* they will be used and during the activities *when* they will be used.

Tiered Activities and Instruction and the Behavior Analyst

Across tiers, the practices and dosages of interventions used to teach target behaviors vary in their level of individualization and intensity (see Fig. 2). In tier 1, universal practices are used to provide access to the core curriculum (i.e., the skills outlined in an ECE program's selected CBA) for all children. Classroom layouts should be based on principles of universal design for learning with appropriate supports (e.g., assistive technology) considered for all children. In addition, teachers should explicitly teach the behavioral expectations for all activities in the daily schedule, including how to transit and wait appropriately between activities. Universal procedures based on ecologically valid research should be incorporated throughout activities at each tier (e.g., embedded instruction, play narration, linguistic mapping, contingent play imitation, language expansion, responsive interaction strategies). In tier 2, universal practices are supplemented with intensive or systematic instructional practices. The practices in tiers 1 and 2 may be the same (e.g., embedded instruction); however, the number of opportunities or trials per day to practice a target behavior is often increased from tiers 1 to 2. If different practices are used, they typically require more complex procedures and additional planning to ensure that classroom resources (e.g., personnel, children's preferred materials, physical space) are distributed accordingly during the times when implemented. Common examples of unique tier 2 interventions include systematic instruction, small-group direct instruction (Ledford, Lane, Elam, & Wolery, 2012) and peer-mediated

instruction (Strain, 1981). In tier 3, practices may be similar to other tiers (e.g., embedded instruction); however, individualized modifications are made. For some children, this may involve providing a specific attending cue and requiring a specific attending response before embedding a specific instructional strategy into an activity (e.g., constant time delay, system of least prompts). Other children may require a change in environment with direct instruction provided at a table with dense schedules of reinforcement utilizing individualized reinforcers (Heal & Hanley, 2011; Wolery & Hemmeter, 2011). For managing challenging behavior in tier 3, a functional behavior assessment should be conducted to support the development of a function-based intervention. Regardless of the intervention used, it is important that it is individualized based on a child's data and learning history (Ledford et al., 2016).

The fields of ABA and ECSE have identified numerous research and evidenced-based practices for targeting developmentally appropriate behaviors in young children, extending across all tiers. It should be noted that many of the researchers examining these practices come from or work in programs that actively emphasize the relationship between ABA and ECSE by publishing across journal disciplines and using terminology that is accessible by practitioners in both disciplines. In addition, ECSE has routinely evaluated practices to determine if research supports implementation with resources typical of early childhood classrooms (Ledford, Hall, Conder, & Lane, 2016). Furthermore, to determine appropriate dosage of tier 3 interventions, single-case designs may provide an empirically based model of data collection for evaluating treatment intensity (Barnett et al., 2004). As the field of ECE continues shifting to support the individualized learning needs of all children, we think the activities and instruction component of the curriculum framework that provides the greatest opportunities for collaboration between ECE and ABA practitioners and researchers (Barton et al., 2016). One advantage that behavior analysts may have over some early childhood educators, is that they are required to have completed a master's degree. Therefore, many behavior analysts may have additional content knowledge and experience with instructional strategies that are discussed across the ABA and ECSE literature. ECE programs should take advantage of this and use behavior analyst to train their staff on instructional strategies across all tiers of the activities and instruction component.

Progress Monitoring

Progress monitoring refers to analyzing data to make decisions about intervention effectiveness, a child's developmental progress, and family satisfaction (i.e., social validity). Formative, summative, and combinations of the two types of data should be used for progress monitoring. To determine the effectiveness of an intervention, a specific dimension of behavior (e.g., frequency, duration) can be compared prior to,

and after, the implementation of the instructional practice. To appropriately examine the developmental progress of a child, it is critical that a teacher understands the conditions under which the targeted dimension of a behavior was measured. Data indicating that a child can label letters on a flashcard provides minimal information about the child’s cognitive development. It is imperative that the data allow for a holistic examination of target behaviors across settings, materials, activities, environments, instructors, times of day, and reinforcement contingencies. Given that early childhood teachers may serve 20 or more children in a classroom, teachers often need to use written descriptions of target behaviors to document the various conditions under which target behaviors do and do not occur. This can be done in the form of anecdotal notes and A-B-C data collection (i.e., antecedent-behavior-consequence), both of which should include information on the conditions under which the documented behavior occurred. Regardless of the type of data collection being used, there should be a plan in place for how and when the teacher and related service providers will collect data on target behaviors. In addition, there should be a plan in place for when the teacher and related service providers will review the data on target behaviors. To monitor family satisfaction, teachers need to have an open dialogue with parents, in which parents feel comfortable providing unbiased views related to their satisfaction.

Tiered Progress Monitoring and the Behavior Analyst The tiered progress monitoring model answers many questions about for whom, how often, and for what behaviors should data collection occur across the tiers (see Fig. 3). At tier 1, all common outcomes identified by an ECE program’s CBA are measured for all children. Depending upon the program and

the needs of the children, these data may be collected and monitored one to four times a year using the CBA. Across tier 2, data are collected on behaviors specific to some children through weekly or monthly probe sessions. For tier 3, data are collected on behaviors specific to an individual child, and these data are collected and reviewed as often as needed to align instructional practices and intervention intensity with a child’s needs.

Consistent data collection and monitoring have always been a foundational principle of ABA services. Furthermore, ABA practitioners receive extensive training in (a) developing data collection systems for numerous dimensions of behavior, (b) visually analyzing data to determine effectiveness of intervention, and (c) planning for generalization across conditions. An area in which ABA practitioners may be less well versed relates to evaluating social validity as research trends over the past decades suggest typically accepted methods may be subject to bias (Ledford, Hall, et al., 2016). Within progress monitoring, the fields of ABA and ECE offer unique strengths that should be understood by both fields.

Access, Maintenance, and Challenges to ABA-Based Support in ECE Programs

As the shared and differing strengths of ECE and ABA are further understood, we hope relationships between practitioners in both fields will grow to better support the needs of all young children they serve. To ensure that the relationship is positive for all involved, we propose some general steps for establishing and maintaining the relationship, along with potential challenges that may be encounter along the way.

Fig. 3 Tiered progress monitoring model in early childhood education based on the curriculum framework

	What outcomes are being monitored?	For whom are data collected?	How often should performance monitoring occur?	What does performance monitoring look like?
Tier 3:	Prioritized and individualized outcomes	Individual child	Minute-by-minute, hourly, daily, weekly	Continuous systematic data collection
Tier 2:	Targeted and temporary outcomes	Some children	Repeated, weekly, monthly	Targeted probes on target behaviors
Tier 1:	Common outcomes	All children	Annually, semi-annually, quarterly	Re-administering CBA

Access Behavior analysts with board certification may be found through searching the registry on the website of the Behavior Analyst Certification Board (<https://www.bacb.com>). For certain ECE programs, there be additional means to identify a behavior analyst. Programs funded with public dollars are often part of a local school district. These programs should seek out resources within their district and identify behavior analysts or individuals with training in ABA. Although an individual may not have a classification as a board certified behavior analyst, many individuals working in public school systems should have received coursework in applied behavior analysis (e.g., school psychologists, special education teachers, behavior support personnel) and may provide sufficient services. For situations in which a school district does not employ an individual with appropriate training in ABA, districts may need to hire one as a consultant or consider employing one full-time. School districts and ABA providers should ensure that the needs of the ECE programs align with the competencies of the behavior analyst; that is, a behavior analyst should have experience and training in ECE.

Maintenance For maintaining a constructive and collaborative working relationship, it is important that all parties (a) understand the purpose of the relationship, (b) agree on their respective roles and responsibilities, and (c) set a criteria for terminating or reevaluating the relationship. Regarding the purpose of the relationship, both parties need to identify who is the primary recipient of services. Some behavior analyst may be brought in to provide teacher training, in which case a particular teacher or group of teachers may be the primary recipients. Others may be asked to develop a behavior intervention plan for a particular student, therefore, the student would be the primary recipient of services. In some situations, behavior analysts may be asked to develop a system for implementing schoolwide positive behavioral interventions and supports, in which case the recipients are all teachers and staff in the school. By establishing the primary recipient of services, both parties can move forward to identify the goal (i.e., purpose) of the relationship. For example, does a teacher need training on the Picture Exchange Communication System; does a student need individualized instructional procedures to make gains in pre-academic skills; or does a school need a data collection system for monitoring tier 2 interventions within their schoolwide positive behavioral interventions and supports? Once a goal is established, then a behavior analyst can provide information on the types of services required of both parties that will have the greatest likelihood of achieving the goal. This may include specific types of practices and anticipated dosages of interventions and trainings from the behavior analyst, as well as the amount of resources (e.g., time, personnel) that a school or teacher will need to provide. Given evidence that client gains are maximized when services are continued

by indigenous service providers (e.g., parents, teachers; Wetherby et al., 2014; Yoder & Stone, 2006), it is recommended that teachers and schools plan to participate in trainings to ensure appropriate interventions will maintain when behavior-analyst-provided services are removed. After both parties are in agreement on the types of services, amounts of services and resources with the greatest likelihood of resulting in success, then a criteria for terminating services should be established. This criteria should clearly state a client's level of performance that needs to be established in order for services to be terminated. If the client is a teacher, this criteria may indicate a certain level of procedural fidelity with a behavior intervention plan. For a student, the criteria may pertain to a certain percentage decrease in challenging behavior with a concomitant percentage increase in a socially appropriate replacement behavior. Once the criteria is reached, then services for that particular goal should cease, and both parties may pursue a new purpose for the relationship.

Challenges

There are multiple variables that affect access to appropriate behavior analytic services, including (a) the number of behavior analysts in a given area, (b) training backgrounds and areas of expertise for those behavior analysts, (c) the demand for behavior analytic services in the area, (d) a program or school district's availability of funds for behavior analytic services, and (e) differing foundational learning philosophies between ECE and ABA. Although recent analyses indicate that the number of board certified behavior analysts is growing relatively rapidly (Behavior Analysis Certification Board, 2013), the growth is not spread evenly across each state; therefore, it is possible that some school districts might not be able to access the amount of services they request, even if funds are available. In addition, the demand for behavior analysts from various different industries is increasing from year to year (Burning Glass Technologies, 2015), which may affect the amount of services provided to some schools given additional requests for services by non-education-related industries. Furthermore, reviews of behavior analytic coursework suggest that many behavior analysts may not receive extensive training in consultative models of service delivery, a highly valued skill for working in schools and providing services as an indirect service provider through teachers and staff (Shepley et al., 2017). Regarding the foundational philosophies of each field, there are some shared similarities particularly between ECSE and ABA related to social learning theory, ecological systems theory, and behaviorism. Traditional ECE programs rely heavily on maturational and constructivist approaches to learning that focus on environmental arrangement, hands-on activities, and teacher encouragement to facilitate learning, with minimal emphasis on teacher prompting

and systematic instruction. As noted by Wolery and Bredekamp (1994), the differing philosophies between the fields may result in practices that are incompatible with one another. As research recognizes the benefits of both fields, recommendations for inclusive early childhood classrooms have continually stressed the need to incorporate practices that have been informed by multiple philosophical foundations (Warren & Yoder, 1994; Schreibman et al., 2015), such as blended practices.

An additional challenge, when providing or receiving behavior analytic services, is the likelihood of obtaining desired outcomes. Behavior analysts cannot guarantee that services will be effective. However, a behavior analyst should be able to guarantee the identification of interventions that are *not* effective for their clients. This is a defining and differentiating feature of behavior analytic services, particularly those provided by board certified behavior analysts. While it is never desirable that the goal of services not be achieved, the identification of ineffective interventions should be seen as a silver lining. Rather than wasting resources reevaluating interventions that have already been proven ineffective, future services providers (e.g., teachers, speech-language pathologists, occupational therapists, other behavior analysts) can focus on new interventions to better determine individualized procedures that promote learning for a particular child. To navigate the conundrum of potential ineffective interventions, we recommend behavior analysts adhere to the following: (a) develop interventions that are systematic, (b) describe interventions in replicable detail, (c) ensure interventions are being implemented as described, (d) assess children's pre-requisite skills or conditions surrounding the interventions that may need to be modified to increase the likelihood of future success, and (e) document information with teachers, administrators, and program directors.

Moving Forward

Whether the buzz words in ECE are *inclusion*, *blended practices*, or *curriculum framework*, we hope it is apparent that for the last 25 years, there has been a strengthening alignment between the guiding principles of ECE and ABA. Gone are the days of “folklore and personal accounts... ‘how to’ practical books... [and] think pieces” guiding the field of ECE (Johnson & Johnson, 1992, p. 442), driven out by federal policy supported with science. However, despite the decades of similarities, the fields often operate in isolation, citing and looking within their own journals to find answers and make claims. This is troubling and worrisome for numerous reasons. One reason is that certain journals often fail to publish procedural fidelity data, which is a core principal of both ECE (Ledford & Wolery, 2013) and ABA (Gresham, Gansle, & Noell, 1993). As teachers and behavior analysts attempt to

stay abreast with state-of-the-art instructional technologies, it is critical that researchers collect procedural fidelity data so consumers can be certain that reported changes (or lack of changes) in child behavior are a result of the intervention as described. An additional concern with ECE and ABA functioning independently is that children in early childhood classrooms without access to behavioral consultation services have a significantly increased likelihood of being expelled (Gilliam, 2005), thus missing out on early childhood services that have repeatedly been associated with later success in school and life (Demming, 2009). To move forward, practitioners and researchers who associate themselves exclusively with either ABA or ECE need to recognize the benefits and similarities of both fields, especially as ECE focuses on individualizing instruction for all children and using data to guide decision making. We recommend that behavior analysts and early childhood teachers (as well as para-professionals, teaching assistants, speech-language pathologists, occupational therapists) listen to one another, examine the research supporting each other's claims, and work together to find ecologically valid solutions to challenges in ECE environments. Given the changes over the last 25 years, we anxiously await the changes to come in the next 25 years.

Compliance with Ethical Standards

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

Conflict of Interest Collin Shepley declares that he has no conflicts of interest. Jennifer Grisham-Brown is the co-creator of the curriculum framework model.

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