

21 Prevention, Early Childhood Intervention, and Implementation Science

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Some children are at a disadvantage when they enter the public school system. Poverty, ability, home/community language, and/or cultural differences often create a mismatch between children's skills and the learning experiences they will encounter when they start school. The mismatch results in a disparity in educational achievement that may extend across school years. Program developers have designed early childhood education programs that might prevent or reduce such disparities by promoting skills children will need for early school success. Research has documented the efficacy of such prevention programs, but the eventual utility of the programs depends on the ways in which they are employed in "real-world" settings. Researchers in the emerging field of "implementation science" (Durlak & DuPre, 2008; Fixsen, Naoon, Blase, Friedman, & Wallace, 2005) are determining factors that influence the use of practices, such as school readiness curricula, and their effects on the recipients of the practices.

The purpose of this chapter is to examine the application of implementation science to prevention and early childhood intervention. We will first briefly review the history of early childhood intervention designed to prevent or ameliorate conditions that put children at risk for school failure. Next, we will review the definitions of implementation and fidelity, propose a definition that will guide our discussion of the literature, describe research that has assessed implementation and fidelity in programs for young children, and examine research that has found associations between implementation and child or family outcomes. In the latter sections of the chapter, we will describe factors that influence implementation and provide examples from a study of implementation of a school readiness curriculum and adoption of school reform.

Risk and Early Childhood Intervention: Giving Children a Positive Start

Early development is a complex transaction between children, their caregivers, and multiple contexts in which both participate (Bronfenbrenner, 1979; Sameroff & Chandler, 1975). By the time children reach kindergarten age and begin their trek through schooling, many factors will have affected their capacity to take advantage of the learning opportunities presented in kindergarten and beyond. Individual and multiple factors will affect children's development

and create risks for poor developmental outcomes. Three factors are prominent: poverty, the language spoken in the home and community, and identified developmental disabilities.

Poverty

Limited personal and material resources may make everyday life difficult for families and negatively impact child growth and development, child safety, and nutrition (Landry & Menna, 2006). Some children living in poverty are exposed to dangerous, unhealthy, and less than adequate settings that affect negatively cognitive or social development. Of course, not all poor children have difficulty, as the descriptive study of child language reported by Hart and Risley (1995) confirms, but growing up and becoming successful in school is more difficult under less-than-ideal circumstances. Importantly, childhood poverty is widespread. According to a recent report, 17.4% of all children under age 18 or 12.8 million children in the United States lived in poverty in 2006 (DeNavas-Walt, Proctor, & Smith, 2007).

English Language Learners

The population of young children who are growing up in families with a home language other than English has increased dramatically in the United States. As children enter child care and school systems, they may experience a mismatch between home and school languages and practices, which may put them at-risk developmentally (Genesee, Paradis, & Crago, 2004). Children who come from families that do not speak English as their primary language may not have the same opportunities for learning about literacy as do other children (Espinosa & Burns, 2003). These children may need more or different support in order to achieve optimal learning outcomes in school. As Tabors (1997) has argued, the type of programs needed to support individual children is based on a variety of factors including the child's age, motivation to learn English, exposure to English, support in the home for language, and the child's individual personality characteristics. Specialized training and culturally sensitive curricula are needed to support children who are learning English.

Disabilities

Infants and young children with disabilities, such as intellectual disability, autism spectrum disorders, and sensory impairments, are often identified early in life (Dunst, 2007). Early delays in cognitive, communication, sensory, or social development are markers for such disabilities and they limit children's ability to take advantage of learning opportunities that may exist in daily life and in school settings. A primary initiative in early childhood and traditional public schools has been to include children with disabilities in regular education settings (Odom, 2000), with accommodations provided to allow them as much participation and achievement as possible. Nevertheless, their disabilities often lead to the educational disparity noted previously.

Intervention for At-Risk Populations

Efforts to prepare young children for success in later life have a long history in education and prevention science. For poor children, recent early intervention history may be traced back to the 1960s War on Poverty and the initiation of the Head Start program. At that time, influential early education programs operated by researchers such as Susan Gray in Tennessee (Gray

& Klaus, 1970) and Ed Zigler in Connecticut (Zigler & Butterfield, 1968) had shown promising results for providing early childhood education experiences to children living in poverty. A program of research that examined the planned variation of early childhood education curricula having different theoretical bases extended this early research, with comparative analysis finding differences in outcomes for different approaches (Datta, McHale, & Mitchell, 1976; Smith, 1974). In an evaluation across programs, Lazar and Darlington (1982) analyzed the immediate and long-term effects of 11 intervention projects and demonstrated the general efficacy of early intervention for children living in poverty.

The Abecedarian project and the Perry Preschool project are two of the most prominent programs to have examined long-term effects. In the Perry Preschool project, African American children with IQs less than 85 were randomly assigned to intervention or control groups. A long-term follow-up of former students at age 40 showed continued difference on outcome measures favoring the treatment group (Schweinhart, 2004). In the Abecedarian project, children were also randomly assigned to intervention and control conditions. Follow-up studies have shown higher scores for children who participated in the intervention in reading and math, a trend toward less grade retention and special education needs during the school years and continued difference on outcome measures to age 30 (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002).

Current Head Start programs are the curricular descendants of the early work by Campbell, Ramey, Weikart, Schweinhart, Zigler, Gray, and others. Evaluations of outcomes for Head Start are mixed; however, a recent study using random assignment to control and implementation groups shows modest gains in cognitive and social outcomes for three- and four-year-olds (Administration for Children and Families, 2005) in Head Start programs. As Head Start evolved, services to children and families moved to an earlier age through the initiation of Early Head Start (Kamerman & Kahn, 2004). Research with Early Head Start participants has shown that children receiving services perform better on cognition, language, and social-emotional functioning than their peers who did not receive services (Administration for Children and Families, 2006). However, children from families at the very lowest level of poverty showed no effects. Although a program may have positive outcomes for some of the population, it may not be universally effective.

Discussions of optimal preschool instructional practices often identify the need for support of young children who are English learners (Chang et al., 2007) and curricular and instructional guidelines are being developed to address the needs of this group (California Department of Education, 2007). However, few empirical investigations of instructional practices targeting this group of learners have been conducted. One recent and promising effort is the use of an intensive professional development program aimed at teaching skills on classroom practices and the use of specific language and literacy strategies for young English learners (Buysse, Castro, & Peisner-Feinberg, 2008).

Infants and young children with identified disabilities, when identified early, may receive early intervention services from state agencies (Dunst, 2007), and/or they may enter programs operated by public schools at three years of age (Carta & Kong, 2007). Often young children with disabilities receive their programs in inclusive settings, which may be in a public school setting, in private child care settings in the community, in Head Start, or in state pre-k programs (Odom et al., 1999). An array of intervention approaches have been examined for use with young children having disabilities, with various levels of efficacy demonstrated (Odom & Wolery, 2003). In most cases, these services and programs are directed toward secondary and tertiary prevention, with less emphasis on primary prevention of or recovery from a disability and more emphasis on maximizing outcomes.

Two areas have been particularly prominent in primary or secondary prevention. A particular emphasis has been placed on children with challenging behaviors and early prevention efforts that might be efficacious. The preschool version of the Incredible Years curriculum developed by Webster-Stratton (Webster-Stratton, Reid, & Stoolmiller, 2008) has been applied as a class-wide curriculum that promotes social competence and prevents the occurrence of problem behavior for young children in Head Start programs. Also, the First Step program, developed by Walker (Walker et al., 1998) is a broad-based approach involving parents, community, and school resources and designed to prevent the deterioration of prosocial behavior and escalation of delinquent or criminal behavior as youth. Randomized studies have found positive effects for child participants for both of these approaches (Walker et al., 1998; Webster-Stratton et al., 2008). The broader application of the multi-tiered approach of Positive Behavior Support, as defined by Dunlap, Fox and colleagues (Powell, Fixsen, Dunlap, Smith, & Fox, 2007), has as its foundation the prevention of challenging behavior through provision of high-quality educational settings and services. For children with autism spectrum disorder (ASD), early identification and intervention are critical components of an effort to promote positive outcomes for children and families. A number of comprehensive treatment models have been developed, with some reporting positive outcomes and even recovery (Odom, Rogers, McDougle, Hume, & McGee, 2007).

Scaling Up Early Childhood Intervention

A natural evolution of the pioneering work on early childhood education and intervention programs has been movement from model programs closely monitored by researchers (i.e., often defined as efficacy research) and program developers to the wider use of the programs in conditions under which the researcher has less control (i.e., often called effectiveness research.) Rohrbach, Grana, Sussman, and Valente (2006) have called this process “scaling-up.” As programs scale up, concerns exist about how closely the scaled-up program model will approximate the prototypic program when delivered to more children and by individuals outside the original developer group. As a result, early childhood researchers and program providers have become interested in assessing the implementation of programs.

The Abecedarian Project and subsequent iterations of this model are examples of this evolution. As noted previously, Ramey and Campbell (1984) started the Abecedarian Project in the 1970s as an approach for preventing mental retardation. The intervention model consisted of a clearly articulated curriculum (Learning Games by Sparling and Lewis, 1979) and prescribed method of care. The project took place in one location (i.e., North Carolina) and was under close control of the research staff. In its original application, measures of implementation were not reported. Primary components of the Abecedarian Project served as the foundation for the Infant Health and Development Project (IHDP), which was a large, national, multi-site study (i.e., a scaling-up project) involving low-birth-weight infants and their families (Gross, Spiker, & Haynes, 1997). The purpose of IHDP was to prevent, through early developmental intervention, health and developmental problems that often accompany prematurity and low birth-weight. A main effect (i.e., effect for all low-birth-weight groups across all sites) of the type found in the Abecedarian Project was not found in IHDP. In IHDP, however, measures of implementation were collected, and sustained effects were found with children for whom a sufficient level of implementation occurred (Hill, Brooks-Gunn, & Waldfogel, 2003).

Implementation and Early Childhood Programs

Because of the great interest in early childhood education for at-risk children and the intent to base educational practice on scientific evidence of efficacy, the scaling-up issue has become critical. The study of implementation has become a central feature of efficacy and effectiveness research on early childhood programs. Yet, to study implementation, one must begin with an accepted definition and conceptualization of the process. In this section, we will discuss definition and suggest a consistent terminology, present a rationale for studying implementation in efficacy and effectiveness studies, describe methodologies for data collection described for evidence of process/product outcomes, and identify issues that linger in our consideration of the concept.

Definition and Meaning

One of the major challenges facing the application of fidelity/implementation to prevention science and early childhood education is agreement on a common definition. Conceptualizations and descriptions of fidelity and implementation vary, with the terms sometime being used synonymously and at other times having unique meanings. Durlak and DuPre (2008) provided a very simple definition of implementation being “what a program consists of when it is delivered in a particular setting” (p. 329), and Fixsen and colleagues (2005) added that implementation is “a specified set of activities designed to put into practice a . . . program of known dimensions” (p. 5). In this chapter, implementation will be the organizing construct. We will define implementation as the program delivered to and experienced by participants, in our case “at-risk” children and their families.

In this review of studies assessing fidelity of implementation in K–12 curriculum intervention research, O’Donnell (2008) noted that definitions have often varied between structural features (i.e., adherence to a criterion number or set of procedures) and process features (i.e., quality with which a curriculum is used by participants). Current researchers often draw from the Dane and Schneider (1998) multi-component conceptualization of fidelity, which consists of adherence to the program, dose (i.e., the number of lessons or amount of content that the implementer provides), quality of program delivery, participant reactions or acceptance, and program differentiation (i.e., discriminating between programs that are implementing well or poorly). To this list, Durlak and DuPre (2008) added the concepts of monitoring of control or comparison conditions (i.e., in treatment research), program reach (i.e., involvement and representativeness of participants), and adaptation (i.e., changes made when program is delivered by practitioners or service providers).

Conceptual Model of Implementation

Building on the work of these implementation scientists, we offer a conceptual model of the implementation process, which appears in Figure 21.1 (from Odom, in press). The initial step in this process is the development of the intervention, the efficacy testing by the developer, and the preparation of intervention materials to be delivered to prospective implementers. At this point, developers usually have an ideal prototype for how the intervention should be implemented. When the intervention is delivered to users (e.g., teachers), the developer becomes a purveyor (i.e., a person advocating for and perhaps supporting the adoption of the intervention). When users receive the intervention, they often adapt procedures in the intervention to fit their context; adaptation will be discussed more fully in subsequent sections. The actual

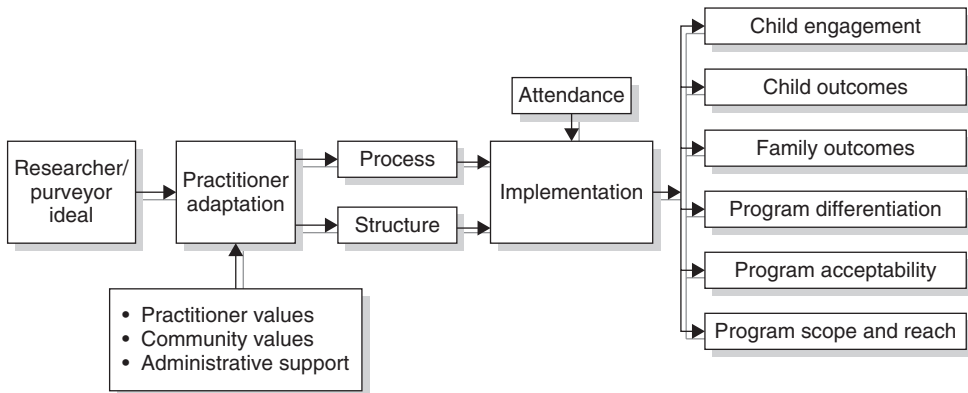


Figure 21.1 Elements of the Implementation Process.

implementation is measured by the purveyor or users with structural variables (i.e., the amount of intervention delivered and/or received) and/or process variables (i.e., the quality of program delivery). Child attendance is another variable that affects implementation at this point also. The implementation of the intervention may affect a range of variables, such as participant response (e.g., children's engagement in the curriculum activity), child outcomes, family outcomes, program differentiation (e.g., discriminating between high and low implementers), program acceptability (e.g., implementers' attitude about the program), and program reach (e.g., scope and representativeness of implementers relative to the entire organization/school district/community).

Rationale for Studying Implementation

A primary reason for studying implementation is, by definition, to determine precisely what occurred when an intervention or treatment was delivered. Such documentation allows the researcher to examine the relationship between the degrees or features of implementation and outcomes that occur for children. Alternatively, it could allow the researcher to document that an intervention had no significant effect even when it was implemented properly. An example of the former use of implementation is the Love and colleagues study (2005) that documented positive impact of Early Head Start home- and center-based combination programs that fully implemented performance standards, in contrast to those that partially implemented the standards. Alternatively, an example of the latter is findings by St. Pierre, Ricciuti, and Rimdzius (2005) of no educationally important impact for Even Start programs when they were fully implemented.

In efficacy and effectiveness research, assessment of implementation may also take place in control or contrast groups, in order to monitor the features of the treatment that may also be occurring in the control group. When core features of a program are implemented in control classrooms, it may result in the absence of or diminished effects for the treatment (Greenberg, Domitrovich, Graczyk, & Zins, 2005). In the Preschool Curriculum Evaluation Research Consortium (2008) studies, the Vanderbilt site conducted a randomized study of the relative effectiveness of the Creative Curriculum and Bright Beginnings curricula. Their assessments of fidelity indicated that, despite random assignment, teachers in both conditions were

implementing both core components of both curricula at nearly equivalent levels. As might be expected, there were no differences between the treatment and control groups on any of the dependent measures. Without the implementation assessments, one might conclude that there were no differences between the curricula, but in fact, one cannot draw any conclusions about treatment differences because it appeared that very similar activities were happening in classes in both conditions.

Adaptation of interventions by service providers, as noted, is a primary issue in implementation research (Durlak & DuPre, 2008), as will be addressed more fully in a subsequent section. To assess adaptation, one must have a clear standard of comparison that is provided by implementation measures. Further, clear and well-articulated implementation measures allow adopters to more easily replicate interventions or treatments, provide a means for monitoring their own replication efforts, and are tools for purveyors to assess the replicators' replication. Fixsen and colleagues (2005) proposed that a systematic process for providing feedback to replicators or adopters is critically important for ensuring high levels of and sustained implementation.

Last, in setting standards of evidence for prevention programs, Flay and colleagues (2005) noted that a system for documenting and using implementation information is a necessary feature of effectiveness research. In fact, several meta-analyses of different types of prevention programs (i.e., drug prevention, aggression reduction and bullying prevention) have documented that studies in which researchers monitored implementation yielded greater effect sizes as compared to studies in which no implementation was assessed (Dubois, Holloway, Valentine, & Cooper, 2002; Tobler, 1986; Wilson, Lipsey, & Derzon, 2003).

Methodology for Studying Implementation

Given that constituent features of implementation are different, methodologies for assessing the features vary also. In two recent reviews, Durlak and DuPre (2008) and O'Donnell (2008) analyzed different dimensions of research studies of implementation for mental health prevention programs (59 studies) and K–12 curriculum research in education (23 studies), respectively. They reported four primary methods of assessing implementation: observation (42% and 34% of the methods employed, respectively), self-report (44% and 12%), interview (6% and 31%), and archival records (6% and 15%). Observational assessment of implementation usually consists of a person external to the program watching program operations and completing an assessment of program features that occurred. For example, in their study of a school readiness and primary prevention program for socioemotional problems for preschool children, Webster-Stratton and colleagues (2008) collected direct observational data on teachers' behavior and interaction in classrooms. To examine the effects of a coaching and web-based intervention to promote delivery of a school readiness curriculum, Pianta, Downer, Mashburn, Hamre, and Justice (2008) analyzed videotapes of teachers' interactions with children, finding that the quality of teacher–child interaction occurred in their coaching prevention/intervention model. In both of these examples, researchers examined the quality of teacher behavior. In addition, Webster-Stratton and colleagues (2008) documented the number of lessons completed by the teacher, the use of video vignettes (a key implementation component), and small group activities.

Program participants may also provide information about implementation. Often this consists of service providers who are using an intervention or curriculum completing an implementation checklist. In an examination of factors moderating the class-wide use of a peer tutoring program in elementary classrooms, Greenwood, Terry, Arreaga-Mayer, and Finney

(1992) had teachers complete a procedural checklist that reported the features of the intervention implemented on randomly selected days. Also, in some studies, evaluators conduct interviews with program implementers to determine whether intervention procedures are employed. For example, Mihalic, Irwin, Fagan, Ballard, and Elliott (2004) used both questionnaires and phone interviews to determine adherence and quality of implementation of a violence and drug prevention program and Mills and Ragan (2000) used a 45-minute taped interview, subsequently coded by program staff, to assess fidelity of a integrated learning system in an educational context.

Researchers sometimes use archival records to gauge some features of implementation. For example, adherence to national program standards is a commonly accessible form of information that Love and colleagues (2005) found strongly associated with the impact of Early Head Start. To assess factors affecting math achievement in schools, Ysseldyke and colleagues (2003) used the number of objectives accomplished and mean number of math problems attempted by each class as gauges of implementation of curriculum-based instruction.

As noted in the conceptual model described previously, program attendance and/or participation by children and families have been used as a measure of implementation (i.e., sometimes described as a dosage feature of implementation). In their examination of the sustained effects of the IHDP program, Hill and colleagues (2003) found an association between number of days children participated in the program and outcomes for children at age eight. With Head Start children, Hubbs-Tait and colleagues (2002) documented the positive relationship of child attendance to teacher ratings of social competence.

Measurement of implementation usually generates a level or percentage of implementation present. Complete adherence to an intervention plan with exacting quality of delivery could ideally lead to 100% implementation, yet in reality implementation rarely approaches this ideal. In their review of 59 implementation studies of mental health and education interventions, Durlak and DuPre (2008) found that studies were generating positive effects with implementation levels of approximately 60% and that only a few studies had levels greater than 80%. In preschool prevention programs that occur in the community, the level of implementation will undoubtedly vary with the teacher and community. A challenge for purveyors and program implementers is to determine the minimum degree of implementation needed to achieve positive effects. The search for the “key ingredients” of prevention/intervention models that lead to positive effects is an important direction for program providers.

Paired with the issue of variance in intervention is the acknowledged tension that exists between the need for high levels of implementation and the adaptation, mentioned previously, that may occur in implementation settings (Fixsen et al., 2005). For programs to be sustainable, they undoubtedly will need to fit the context, and in such cases, teachers and service providers may adapt procedures. Such adaptations result in lower levels of measured implementation, but could be functional in the modification for local sites, perhaps even leading to stronger effects (Durlak & DuPre, 2008). Alternatively, such adaptations could lead implementers to choose only a small number of treatment features that they want to use in their program. In their examination of the implementation of the DARE drug prevention program, Lynman et al. (1999) reported that the program itself was popular and teachers reported wide use of the program, but implementation data documented that only a small number of treatment features were routinely employed in the classes. They also reported that, despite its popularity, the effects of the program were marginal.

Accurate, reliable, valid measurement is a central feature of efforts to promote implementation of prevention and intervention programs for children. Multiple organizations and

professional groups have included assessment of implementation in their criteria for studies of efficacy and effectiveness (Flay et al., 2005; Mowbray, Holter, Teague, & Bybee, 2003; Odom et al., 2004; Smith et al., 2007). However, Durlak and DuPre (2008) note that “science cannot study what it cannot measure accurately and cannot measure what it does not define” (p. 342). Two implications for future research may be drawn from this literature. First, researchers and evaluators need to reach consensus about the constructs associated with implementation, and second, standards for measurement for the construct should be established.

Association of Implementation and Outcomes

A primary reason for documenting implementation is to determine that there is an association between the prevention/intervention program, treatment, or innovation and outcomes for the recipients of the program, in our case children and families. This association is usually demonstrated in efficacy and effectiveness research through randomized experimental designs, in which case the information on implementation substantiates that the treatment program occurred. In an early article on treatment efficacy of early childhood programs, however, Dunst (1987) noted that one may examine the correlational relationship between measures of implementation and outcomes and draw some inferences about the effects of the program. With the increasing sophistication of statistical modeling, for example through structural equation modeling, one may anticipate variables that may moderate, mediate, or confound interpretations of outcome and statistically account for them in analyses. Although without experimental designs one cannot make causal inferences, one can make arguments for “causal-like” inferences if sufficient statistical controls are employed (Thompson, Diamond, McWilliam, Snyder, & Snyder, 2005).

For prevention and early intervention programs, investigators have examined relationships between different measures of implementation and child and family outcomes. For example, Wilson and colleagues (2003) conducted a meta-analysis of school-based programs designed to reduce and prevent aggressive behavior and found that programs implemented well and intensively had the greatest impact. Individual studies noted previously in this review have documented child and family outcome effects associated with number of days children participated in the IHDP program (Hill et al., 2003), adherence of program quality standards in Early Head Start programs (Love et al., 2005), and child attendance (Hubbs-Tait et al., 2002). In their examination of implementation features of a preschool readiness curriculum for four-year-old children with different risk variables, Odom and colleagues (2008) found significant associations between the implementation variables, such as quality ratings, amount of curriculum completed, and child attendance, and child outcomes.

The type of analysis that documents the association between implementation features and child outcome is also noteworthy. In the Odom and colleagues (2008) study, the implementation variables were continuous and statistical associations between implementation and outcome variables were analyzed. Alternatively, some studies have characterized classes or programs as “high” and “low” implementers and examined group differences between these groups. For example, in the Ysseldyke and colleagues (2003) study noted previously, classrooms/teachers were categorized as high and low implementers, and child math performance differences were analyzed between groups. Although this was a successful approach in the Ysseldyke and colleagues (2003) study, Durlak and DuPre (2008) noted that such between-group analyses may be less sensitive to implementation-outcome associations than the analysis of implementation as a continuous variable.

Factors That Influence and Facilitate Implementation

The recognition of the importance of implementation has been heightened by the interest in factors that affect implementation and facilitation strategies. Several groups of researchers have proposed conceptual models of variables affecting implementation, with each of these models reflecting the ecological systems theory of human development proposed by Bronfenbrenner (1979). The primary work with regard to early childhood and prevention has focused on implementation of a specific intervention/prevention treatment, curriculum, or service. However, the broader literature on school reform and adoption of innovation also has relevance for the examination of factors affecting implementation and is included in this discussion.

Conceptual Models: The Context of Implementation

To understand the context of implementation, Fixsen and colleagues (2005) articulated a framework for developing evidence-based intervention practices within organizations. The components of the framework are identified as the source, destination, communication link, feedback and influences. Source refers to the core intervention components or “package” itself. Destination represents the practitioner (e.g., teacher) who works with the consumer (e.g., student). The communication link is the core implementation components or “drivers” of the process that ensure that the practitioners have the knowledge and resources to provide the implementation. These components include staff selection, pre-service and in-service training, ongoing consultation and coaching, staff and program evaluation, facilitative administrative support, and systems interventions. The feedback mechanisms refer to evaluations of staff, program, and fidelity. Finally, influences are the local and state professional and sociopolitical factors that can impact policies that determine practices such as licensing, funding, and/or staff and agency collaboration. These factors are arranged in a Bronfenbrenner systems-like model with source at the center and influence at the most macro level.

To describe the contextual factors that may affect the quality and process of implementation, Chen (1998) offered a conceptual framework. In this framework, the Actual Intervention is comprised of both the planned intervention and the implementation supports. Factors that can influence the Planned Intervention include the program model, quality of delivery, target audience, and participants’ responsiveness. Components of Planned Implementation Support are the pre-planning activities, quality of materials, technical support model, quality of the technical support and the implementer readiness. Factors at the classroom (e.g., implementer characteristics and behaviors, classroom climate, peer relations), school and district (e.g., administrative stability and leadership/support, awareness of student needs, school goals, climate, and communication), and community levels (e.g., school-community relations, school-family relations, community support/readiness) likewise have an impact on the success of the implementation.

In order to further to understand factors associated with implementation quality, Domitrovich et al. (2008) also proposed a multi-tiered, conceptual model. This model outlines three interdependent factors that influence the quality of implementation for preventive interventions in schools: macro, organizational, and individual factors. Macro-level factors, the most distal influences, are policies and practices (fiscal, regulatory, and administrative) at federal, state, and district levels that can exert an impact on the implementation of evidence-based programs. Examples may include standards-based reforms or monetary supports for professional development. Organizational-level factors include components of the shared

school environment that influence implementation such as characteristics of the school (e.g., size, geography, student mobility), administrative leadership, the school's mission or policies, the capacity of the organization (funds, materials, equipment, knowledge and skills), the decision-making structure (roles and responsibilities), the school climate and organizational health, the classroom climate such as relationships between teachers and students, cooperation among staff members, sense of belonging, and the organizational culture (i.e., norms, beliefs and assumptions of the membership). Individual-level factors are the third level of the framework and they include professional training of teachers, teachers' psychological characteristics (e.g., burn-out, willingness to implement or persist, and so on); and staff attitudes about the implementation and their histories with previous programs.

Phases of Implementation and Differential Strategies

Implementation is not only influenced by multiple factors but it also is a dynamic process that may occur in phases. Strategies designed to promote implementation may be most appropriate and effective at specific phases of the process. Greenberg and colleagues (2005) identified phases of implementation as (a) pre-adoption (i.e., the period before training when service providers prepare for implementation), (b) delivery (i.e., provision of training and technical assistance—a time when the intervention is introduced and initial training is provided to the teacher), and (c) post-delivery (i.e., period of time after initial delivery of training when the intervention continues or does not continue to be used). At each phase where specific strategies have been found to be facilitative, the implementation has a greater chance of success.

Early and Joint Planning. During the pre-adoption phase, service providers prepare for implementation, and detailed planning during this stage enhances implementation. Detailed plans describe processes for “dialogue, project management, setting benchmarks for progress, gathering and communicating feedback, and making decisions about significant changes” (Elias, Zins, Graczyk, & Weissberg, 2003, p. 312). Clearly, the teachers who are implementing the intervention need to be involved at the pre-planning stage to ensure that they “buy into” the intervention (Greenberg et al., 2005).

Quality of Materials. Most interventions that are implemented in early childhood programs have instructor manuals for the teachers. In fact, “manualization” is a critical feature of implementation (Smith et al., 2007). Manuals that are visually appealing, user-friendly, age-appropriate and culturally sensitive are more likely to be used by the teachers, thus contributing to implementation success (Greenberg et al., 2005). Access to these curriculum materials may positively affect implementation at the delivery phase of the intervention.

Availability and Quality of Technical Support. Technical support is the means to ensure that teachers implement well the interventions for which they have received training. It has its greatest impact during the pre-adoption and delivery phases. Such technical support is provided to teachers through professional development activities. Garet, Porter, Desimone, Birman and Yoon (2001) identified characteristics of professional development that led to teacher learning. Those characteristics were: (1) activities that were sustained and of long duration, (2) a clear focus on the content of the intervention, (3) teachers' active involvement in learning the content, and (4) ongoing professional development that was part of the daily life of the school. Showers and Joyce (1996) specified additional strategies that contribute to successful implementation. Among the strategies is professional development that includes coaching (from either experts or peers) when the teachers implement the new program in their classroom and feedback about the success of their implementation. In fact, Joyce and Showers (2002) described a study conducted in which 95% of the teachers who received

in-class coaching in addition to training that included demonstration, practice, and feedback used their new skills in the classroom. In contrast, only a small percentage of teachers who received training without the coaching actually used the newly trained skills in their classroom.

Implementer Readiness. Greenberg and colleagues (2005) suggested that teachers' likelihood of implementing an intervention depends in part on their readiness for the intervention. Readiness refers to teachers "feel[ing] positive about a program, value what it contributes . . . and [showing a commitment] to its goals" (p. 37). Elliott (1988) found that there was a moderate to strong relationship between whether teachers believed an intervention would be effective and whether or not they perceived it to have the desired effect. In their study of preschool inclusion for children with disabilities, Lieber and colleagues (1998) noted that teachers' beliefs about the inclusion process affected strongly their ability to implement and success in implementing strategies to support learning for children with disabilities. Clearly, assessing teachers' beliefs about or attitudes toward intervention approaches may well affect implementation at the delivery and post-delivery stages of intervention.

Contextual Factors. Greenberg and colleagues (2005) indicated that the larger classroom or school context also affects teachers' ability and willingness to implement a new intervention. Within the classroom itself, a positive classroom climate is associated with successful implementation. That may include the teacher's relationship with the children and with the other adults that work in the classroom. Understanding and designing strategies for promoting a positive social climate may impact implementation at the delivery and post-delivery phases of implementation.

Like Greenberg and colleagues (2005), Fixsen and colleagues (2005) also proposed stages of the implementation process. During the initial Exploration phase, the purveyors of the program examine community needs and create agreements with those who will implement the program. The Installation phase involves the preparatory activities and arrangements necessary to do the work. In the Initial Implementation (beginning phase of operation) and Full Implementation phases the program itself becomes fully operational and all facets or components are delivered. The Sustainability phase focuses on factors that may lead to the program's continuation or demise once the implementation practices are established. Finally, Innovation refers to the adaptations at a local site that are necessary for shaping the program for the unique features of a site while maintaining the core features of the program.

Factors Associated with Adoption and Implementation

Implementing preventive programs in real-life settings such as schools is influenced by a variety of factors. Rohrback and colleagues (2006) conducted a comprehensive review of the implementation literature and identified major factors that predicted success. At the organizational level, major factors included the administrative leadership's commitment to and support of innovation, decentralized management and participatory decision-making, open communication patterns, the stability and adequacy of school resources, a shared vision and goals, a willingness to initiate the change, the positive school climate, and culture (trust, collaboration). At the provider level factors identified were the teachers' or providers' attitudes toward, comfort with, and commitment to making the innovation work as well as their teaching skills and self-efficacy. Innovation-level factors focused on the program being well specified, attractively packaged and easy to use, and incorporating teaching methods that were familiar to the teacher/provider. Finally, the fourth level, the training level, described training

and technical assistance prior to and during implementation that may be delivered using a variety of formats.

Two Case Examples of Factors Affecting Implementation

In early childhood programs, implementation can be described for the provision of a specific prevention curriculum or treatment, or it can be thought of more broadly as adoption of a school reform. Two case examples are provided to illustrate the facilitators of and barriers to implementation for a preschool readiness curriculum in a randomized efficacy study and more broadly the adoption, use, and sustainability of preschool inclusion.

Children's School Success: Implementation of a Prevention Curriculum

The Children's School Success (CSS) project aimed to improve the educational outcomes for young children considered at risk for school failure due to poverty, limited English fluency or identified disability. The five-year (2003–2008) project was funded by the National Institute on Child Health and Development, the Department of Education and the U.S. Department of Health and Human Services (#HD046091, PIs Odom, Butera, Diamond, Hanson, Horn, Lieber, & Palmer, 2003). CSS investigators developed a curriculum for four-year-old children in classrooms and implemented it in five distinct geographic regions in the United States, and conducted a multi-site experimental study investigating its effectiveness. Based on research about children's early learning and activities that promote the development of skills children need to be successful during the early elementary grades, the CSS curriculum focused on academic content and social competence. The academic content included curricular goals related to math (beginning numbers and operations, geometry and spatial sense, measurement, pattern/algebraic thinking and displaying and analyzing data), science (measurement and mapping, properties of matter, color and light and neighborhood habitat) and language and early literacy (oral language, phonological awareness and letter/print knowledge). The social-emotional curricular component included content related to emotional literacy, empathy and perspective-taking, friendship skills, anger management, interpersonal problem-solving, and skills related to being successful in school. Preventing children's problem behavior and promoting prosocial problem-solving was also emphasized. The curriculum content also included a focus on individualization so that teachers could accommodate all learners. Between 2004 and 2008, teachers in 48 Head Start, state preschool or community-based classes were provided with an initial three days of professional development about implementing CSS and a follow-up day later in the year to help them individualize the curriculum activities. Throughout their implementation year, CSS teachers were assisted by curriculum coaches who, visiting them at least weekly in their classrooms, collaborated in planning lessons, modeled the use of various curriculum activities, and provided feedback about their implementation.

To assess implementation, CSS staff completed seven fidelity of treatment observational ratings in each class. These ratings assessed the quality of implementation for the science/math, literacy and social components of the curriculum. In addition, CSS staff calculated the percentage of the curriculum that each teacher completed. In order to understand facilitators of and challenges to implementation, CSS investigators conducted a qualitative study of factors associated with teachers' high or low levels of implementation (Lieber et al., in press). Employing a case study methodology that included field notes of observations collected throughout the intervention year along with interview, artifact, survey and

questionnaire data, a reiterative yearly cross-case analysis yielded a total of 17 themes that clustered into three areas (Teacher, Curriculum and Instruction, and Beyond the Teacher). Using a ranking system described by Miles and Huberman (1994), teachers were rated as high, middle or low implementers.

Nine themes were identified as particularly descriptive and robust in explaining teachers' level of implementation, comprising two related to the "Teacher", three related to "Curriculum and Instruction" and four related to "Beyond the Teacher". Although themes related to Curriculum and Instruction and Beyond the Teacher were identified as important factors serving to facilitate or hinder CSS implementation, teacher characteristics were identified as particularly influential across the study. Teachers with high levels of CSS implementation were motivated to undertake the changes required in their teaching, innovative in integrating the curriculum into their daily teaching activities, and stated that they appreciated the opportunity to participate in the project as a partner. Conversely, teachers with low levels of implementation demonstrated a lack of motivation and had difficulty integrating CSS concepts into their teaching. The findings of this study support the importance of implementer readiness in the implementation of early childhood interventions (Elliott, 1988; Greenberg et al., 2005; Lieber et al., in press). Lieber and colleagues (in press) suggest that teachers' perception that they had exercised choice in participating in CSS and that their own expertise and preferences were acknowledged may have influenced the degree to which they viewed themselves as partners in the implementation process and affected their motivation to implement the curriculum.

Preschool Inclusion: Factors Affecting Adoption and Sustainability of Innovation

Inclusion of preschool children with disabilities in classes with typically developing children is an organizationally complex practice. Because traditional public schools do not begin until kindergarten, but local education agencies are required to provide services to children with disabilities down to the age of three, school system service providers must search for inclusive options either outside the schools system (e.g., private preschools or Head Start programs) or in early childhood programs within their system (e.g., state pre-kindergarten program). Although preschool inclusion takes different forms in different school programs, it is often an innovation introduced into a school system (i.e., if inclusive options were not provided previously). The process and many of the factors that affect specific treatment implementation also affect broader adoption of innovations such as preschool inclusion in school systems (Fullan, 2001).

To examine barriers and facilitators to preschool inclusion, investigators with the Early Childhood Research Institute on Inclusion (ECRII) conducted a study of inclusion in 16 nationally selected preschool programs. The study, called the ecological systems study of inclusion (Odom, 2002), tracked the factors affecting implementation of preschool inclusion across a five-year period. Data were collected at the child, teacher, family, administrative, and state/national policy levels. Data were summarized in case studies and case summaries. Analyses of the case studies revealed common factors that affected the success with which local programs and school systems were able to initiate and maintain inclusive programs for preschool children, as well as factors leading to the sustainability of the programs.

As ECRII began, inclusion at the preschool level was becoming more widespread around the nation. This allowed investigators to identify and examine the factors that facilitated the "innovation" of preschool inclusion (Lieber et al., 2000). These factors, at the same time, also often served as barriers to inclusion when they were absent. The strongest facilitator was the

presence of key personnel to influence policy. An individual school or community leader in a decision-making position often provided the impetus for systems change. Another and related influence was a shared vision (philosophy and definition of inclusion) among staff members and agencies in both regular early childhood education and special education systems. Also, state and national policies were identified as providing the impetus for the creation and implementation of inclusive programs. Other factors found to facilitate inclusive preschool practices included the provision of training and/or external support that provided opportunities and funding for training and collaboration, as well as organizational structures that linked services through interagency agreements. Finally, community influences also played a role; these were often parents who advocated for the establishment of inclusive services.

To examine the viability and sustainability of the inclusive programs, ECRII researchers visited the programs again at the end of the five-year period. Of the 16 original programs, four had experienced growth (i.e., increased number of children with disabilities in inclusive settings), six of the programs were stable (i.e., ongoing strong commitment to inclusion), six of the programs exhibited minimal change (i.e., weak commitment to inclusion and reduced numbers of children in inclusive settings) and one program was disbanded, which we called regression (Odom, Wolery, Lieber, & Horn, 2002). [Please note that this total number of programs is 17 because one program divided into two types of inclusion programs, and we characterized them separately at the end of the study.] Programs that experienced growth or stability typically were characterized as having a “critical mass” of individuals who were committed to and supportive of inclusive services. They were able to balance support and pressure from different parts of the system and adapt beliefs and practices in response to program and community change. They had a broad-based ownership of inclusion. Programs in which there was minimal change or regression had begun with a limited commitment to inclusion from the school system and/or limited pressure for and support for inclusion from various local systems. These systems did not provide the training and support to sustain collaborative efforts. For instance, some programs established collaborative arrangements between preschool Head Start and public school agencies. Lack of opportunities and resources for training and collaboration in some cases became serious barriers to the maintenance of inclusion. These services, thus, were observed to be dynamic enterprises that required sustained leadership and collaborative supports to enable them to be maintained and adapt to changing needs.

Themes in Case Summaries

Although they represent different forms of implementation (i.e., in an efficacy trial and in school reform), factors affecting implementation in both CSS and the inclusive programs in the ECRII study were apparent and exemplified some of the themes emerging from the implementation science literature. For in-class implementation to occur, training, professional development, and ongoing coaching support (for CSS) were important, although the success of these was moderated by teachers’ beliefs, motivation, and “readiness” to implement. Teachers’ participation in the decision-making processes was a critical feature of both CSS and ECRII. For both studies, classrooms were clearly seated within broader ecological systems, and factors operating outside the classroom (e.g., district or program policies, support from key administrator) had major impacts on the degree to which teachers implemented the CSS curriculum or an inclusion model. These projects were relatively short-term, but the phases of implementation, mentioned by several researchers (Fixsen et al., 2005; Greenberg et al., 2005) probably did have an effect. For inclusion models, implementation evolved both positively and negatively, and factors affecting the directions have been discussed. For CSS,

implementation only occurred for one year, and the CSS researchers have indicated that being able to implement a curriculum for more than a single year would affect both implementation and sustainability of the curriculum, which again is a theme identified by multiple implementation scientists (Fixsen et al., 2005; Greenberg et al., 2005).

Conclusion

Prevention of school failure and promotion of school success, intertwined and inversely related goals, are primary concerns for this country. Early childhood education programs specifically designed for preschool children at risk for school failure have been proposed by individuals as lofty as the U.S. president, as a way of preventing school failure and fostering children's success in school. Research is beginning to reveal the types of early childhood curriculum models that are producing positive outcomes (e.g., Bierman et al., 2008). The likelihood of these models having a more general positive impact on society will depend on implementation. The emerging science of implementation will inform purveyors of early childhood models and service providers interested in taking these models to scale about the processes necessary for promoting successful implementation and positive outcomes for children.

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