

The Tie That Binds

Evidence-Based Practice, Implementation Science, and Outcomes for Children

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A primary effort in early intervention and early childhood special education (EI/ECSE) is to use science to discover the most effective approaches for promoting positive outcomes for infants and young children with disabilities and their families. Syntheses of the literature are identifying practices having empirical support, but a gap still exists between evidence-based practice and the actual practices practitioners use in EI/ECSE programs. In this article, implementation is proposed as the link between evidence-based practices and positive outcomes. Strategies for promoting implementation through “enlightened professional development” are proposed.

Keywords: *implementation; professional development*

The distance between a practice appearing in a journal article in *Topics in Early Childhood Special Education* and its use in a program for a 3-year-old child with developmental delays is great. In the past 30 years, the research literature on the efficacy of early intervention and early childhood special education (EI/ECSE) has grown considerably. With this growth in the field have come important changes (e.g., inclusion, family-center intervention, etc.) and a broadening research base. However, the practices identified as having empirical evidence of effectiveness are often not used in EI/ECSE programs. In this article, I propose a focus on implementation as the tie that binds EI/ECSE practices that have emerged from the literature as evidence based to outcomes for children in classrooms, communities, and homes.

In beginning a discussion of evidence-based practice (EBP) and implementation in EI/ECSE, several operating assumptions are important to state. First, I assume that education science will inform us about the efficacy and effectiveness of practices that produce positive outcomes for infants and young children with disabilities and their families. By efficacy, I mean the positive effect of an intervention when the researchers or purveyors are in close control of the intervention and its application in a research study. Applied research that appears in journal articles is most commonly efficacy research. Studies on the variations of milieu communication training (Kaiser & Hester, 1994; Yoder & Warren, 2002) are excellent examples of efficacy research. Effectiveness research is the study of

effects of EI/ECSE practices when they are implemented in “real-world” conditions with less oversight by the purveyor. This research has sometimes been called “scaling-up” research, in that the interventions are implemented widely in real-world conditions. Positive behavior support (Horner et al., in press), and classwide peer tutoring (Buzhardt, Greenwood, Abbott, & Tapia, 2007) are two examples of effectiveness research that have been conducted in the broader field of special education.

A second assumption is that even with the increase in knowledge about intervention practice, the use of EBP in EI/ECSE programs has not increased substantially. When the Division of Early Childhood (DEC) first established recommended practices, a validation survey revealed that most practitioners agreed that the practices identified were important, but they also noted that many of the practices were not happening in their programs (Odom, McLean, Johnson, & LaMontagne, 1995). In the subsequent decade, and with a revision of the recommended practices (Sandall, McLean, & Smith, 2000),

Author’s Note: This article is dedicated to Pat Trohanis, a pioneer in professional development and technical assistance in early intervention and early childhood special education. I also wish to thank my colleagues on the Children’s School Success Project for allowing me to use it as an example in this article. Correspondence may be addressed to: Samuel L. Odom, FPG Child Development Institute, University of North Carolina at Chapel Hill, CB 8180, 105 Smith Level Road, Chapel Hill, NC 27599-8180; e-mail: slodom@unc.edu.

there may well have been greater utilization than occurred earlier, but my educated guess is that practices in the field still vary greatly from an evidence-based norm.

The third assumption is that in order to realize the promise offered by research on intervention and instructional efficacy, teachers must implement the practices in their classroom in a way similar to that intended by the purveyors. That is, to be useful, the practices have to be used, and when the essential elements of the practices are employed, they will produce positive effects for children and families.

The Continuum of Concepts: Wired, Tired, and Expired

Wired® is a magazine in the popular press that covers issues about technology, society, and current trends. In each issue, the editors, somewhat facetiously, select a concept or theme of interest and then identify a representation of the theme that is most contemporary and “hot,” which they call “wired”; representations that are still active and important but are not the visionary next steps, which they call “tired”; and representations that are passé or no longer at the forefront of the most active thinking about the issue, which they call “expired.” For example, a topic for the August 2008 issue was sugar substitutes, and the examples were expired, Sweet ’n Low®; tired, Splenda®; and wired, Truvia®. In this article, I apply this rubric for discussing approaches that may lead practitioners to use EBPs in programs for infants and young children with disabilities and their families. The approaches appear in Table 1. This discussion focuses primarily on in-service issues and the introduction of innovation or change in ongoing service systems.

Expired

One can think of expired approaches for moving research into practice as those that have occurred in the past, may have been important in their time, but have less relevance for our efforts today. A primary, traditional approach has been for authors to identify practices through narrative reviews that appear in edited journal

articles, book chapters, or textbooks. The expectation is that the practitioners will read about these practices and use this knowledge to implement an EBP in their classroom or program. The problems with narrative reviews are that the author may not have systematically or completely analyzed the literature, the article may not have passed peer review, the article may reflect the biases or only the theoretical orientation of the author, and/or most importantly, little detail about how to use the practices in classrooms exists in the article. Narrative reviews are useful for other purposes (e.g., introducing a practice broadly, describing conceptual or theoretical frameworks) and are often appropriately used in preservice education. But for promoting use of practices, they are of limited utility.

In the field of EI/ECSE, another expired approach is to base the selection of practices solely on professional opinion. In the first set of DEC Recommended Practices, researchers, teacher educators, practitioners, family members, and administrators identified recommended practices, and the identified practices went through a field validation process (McLean & Odom, 1996). Although one of the criteria for selecting practices was that they be based on research, there was not a systematic attempt to find the research base that supported the individual practice, primarily because of a lack of resources. At the time, the set of recommended practices may have provided useful information for the field, but the process would be classified as expired by current standards because of the necessity of grounding practices in the scientific literature.

“One-shot workshops” are also conceptually expired professional development approaches if our objective is to effect sustainable change in EI/ECSE programs. Researchers have repeatedly reported that teachers do not consistently use practices introduced in single workshops or presentations (Farkas, Johnson, & Duffett, 2003; Guskey, 1986; Joyce & Showers, 2002). Such workshop or presentation formats certainly have other objectives, such as describing new concepts, sharing general knowledge about practice, or influencing attitudes, but they usually do not result in sustained change in practice or adoption of innovation.

Table 1

Expired, Tired, and Wired Approaches to Promoting Evidence-Based Practice for Children and Families

Expired	Tired	Wired
<ul style="list-style-type: none"> Practices based only on professional opinion Narrative reviews of the literature 	<ul style="list-style-type: none"> Meta-analysis What Works Clearinghouse Quantitative reviews of studies and aggregation of results 	<ul style="list-style-type: none"> Practice-based review of evidence Implementation science Enlightened professional development

Tired

Tired approaches are ones to which professionals in the field have for years devoted time and energy, but even with these efforts, the gaps between research and practice have continued to exist. The approaches are often still relevant and even essential features of the most current and important work we are doing today, but they have not in themselves been sufficient to foster a move from science to application.

Meta-analysis could be thought of as such a tired approach. Since Glass and colleagues (Glass, McGaw, & Smith, 1981) established meta-analysis as a tool for synthesizing effects of the same independent variable (a treatment or intervention) across different studies, meta-analysis has been a frequently used methodology in the social sciences. In special education, researchers (Kavale, 2007; Swanson, 2000) have used meta-analysis to aggregate the literature and identify practices that produce the greatest effect sizes, and these analysis have provided guidance for individuals needing to make decisions about instructional practices that might be most effective (Forness, 2001).

For early intervention, Casto and Mastropieri (1986) summarized the intervention literature following a meta-analytic approach, generating much criticism from the field (Dunst & Synder, 1986; Strain & Smith, 1986) and some reanalysis of their findings (Shonkoff, 1987). Because single-case experimental design is a primary methodology used in EI/ECSE, one ongoing concern about meta-analysis when applied to EI/ECSE is the lack of agreement about the best way to compute effect sizes (Jenson, Clark, Kirchner, & Kristjansson, 2007; Olive & Franco, 2008), which is necessary for aggregating effects across studies. Even with these problems, meta-analysis may in some circumstances, when there are enough group designs, generate some useful information about the potential power or weaknesses of intervention approaches. However, meta-analyses usually do not provide detailed procedural information about the practices studies.

EPB is a slightly different tradition that has emerged to gather evidence from scientific research that may support the use of specific practices. The movement to identify EBP in EI/ECSE has its procedural and conceptual roots in the evidence-based medicine movement that originated in the United Kingdom (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996) and is very much in practice in the United States. Concerned that health care professionals were basing their practice on information other than scientific research, leaders of the EBM movement in the United Kingdom created a consortium, called the Cochrane Collaborative (<http://www.cochrane.org/>), to summarize scientific research on which to base medical and health

care practices. In the United States, a comparable consortium, the Campbell Consortium, was established to gather evidence from social science research to inform practice in human social services. The manifestation of this movement in education is the What Works Clearinghouse (WWC), which is funded through the Institute of Education Science in the U.S. Department of Education. The WWC staff and associates compile reviews of research articles that have examined the efficacy of instructional or intervention approaches, conduct rigorous reviews of each article following a detailed evaluation methodology, and then summarize the strength of the scientific support for the instructional approach. The process followed by the WWC and the other consortium is different from meta-analysis in that it does not require reviewers to conduct a statistic calculation of effect size. Like meta-analysis, however, the WWC has, to date, not established criteria for analyzing single-case-design research studies. In addition, potentially strong educational practices are identified (although none in EI/ECSE), but there is little guidance about how to apply the practices in the classroom.

Professional and state organizations have also been involved in identifying EBP. Division 12 of the American Psychological Association was among the first organizations to establish the level of evidence needed to identify a "psychosocial" treatment practice as "efficacious" or "probably efficacious" (Chambless & Hollon, 1998). Other professional organizations (Society for the Study of School Psychology/American Psychological Association, Kratochwill & Stoiber, 2002; Council for Exceptional Children Division of Research, Odom et al., 2004) have established criteria for evaluating the quality of the research studies as well as amount of evidence needed. To guide the practices of early intervention personnel, the Department of Health in the state of New York established a task force that analyzed the literature and proposed practice guidelines for infants and young children with disabilities (New York State Department of Health Early Intervention Program, 1999).

Notably, DEC conducted a revision of its Recommended Practices in the early 2000s. This time beginning with a substantial review of all the intervention literature published in the 1990s, the DEC Task Force used a research base to substantiate potentially efficacious practices and incorporated professional and family expertise and values in the final identification of practices. Although the link between specific studies and practices and the level of evidence needed to substantiate a practice was not articulated, blending scientific evidence and practical knowledge was an important dimension of this process. In their model for determining EBP in EI/ECSE, Buysse and Wesley (2006)

emphasized strongly the need to include both scientific evidence and practitioner expertise.

Given the great activity currently in place to identify EBP, what makes this a tired concept? The EBP work, when conducted in a rigorous manner, is a necessary but not sufficient activity for moving research into practice. It is necessary in that it is identifying the practices having scientific support. As the EBP identification methodology evolves, more precise information is going to be identified for whom and under what conditions practices may be effective. This will be a valuable innovation in the EBP movement. Again, this is a necessary, but not sufficient, step. Lacking from this movement are the procedural details for applying practices in EI/ECSE settings.

Two notable exceptions exist. First, Dunst and Trivette (2009 [this volume]) base their practice-based synthesis approach on an analysis of the procedural features of the practice and examine functional or statistical relationships between the practice and the outcome. By focusing on procedures, details about the elements of the practice that are most critical may be teased out. This has allowed Dunst and group to develop teacher-friendly materials that explain how to use the practice in a classroom, home, or community. (Please note that this slips into the Wired column in Table 1 because of its relevance and potential utility.) Developers at DEC have also described practices in different formats and venues (<http://www.dec-sped.org/recommendedpractices.html#literatureSources>). But even with these steps, having a practitioner only read about a practice may not be sufficient for supporting its use in the classroom. The key is in the implementation of practice. Implementation is the “tie that binds” EBP to positive and desirable outcomes for infants and young children with disabilities and their families.

Wired

Wired topics are hot topics. They are ahead or at the forefront of current movements and represent the next steps for the field. Even when their conceptual roots and activities have existed for years, they are topics whose times have come, and they have the promise of moving the field forward. Primary wired movements in EI/ECSE today are implementation science and the associated area of enlightened professional development.

Implementation Science

Although wired, a problem that exists with implementation science is the varied definitions of implementation. From the prevention science field, Durlak and DuPre

(2008) defined implementation as the procedures of which “a program consists when it is delivered in a particular setting” (p. 328). In their monograph, Fixsen and colleagues (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005) defined implementation as “a specified set of activities designed to put into practice a . . . program of known dimensions” (p. 5). Building on these definitions, Odom and colleagues (in press) described implementation as a “program delivered to and experienced by participants . . . and their families.” For the purposes of this article, I will use the latter as the working definition of implementation.

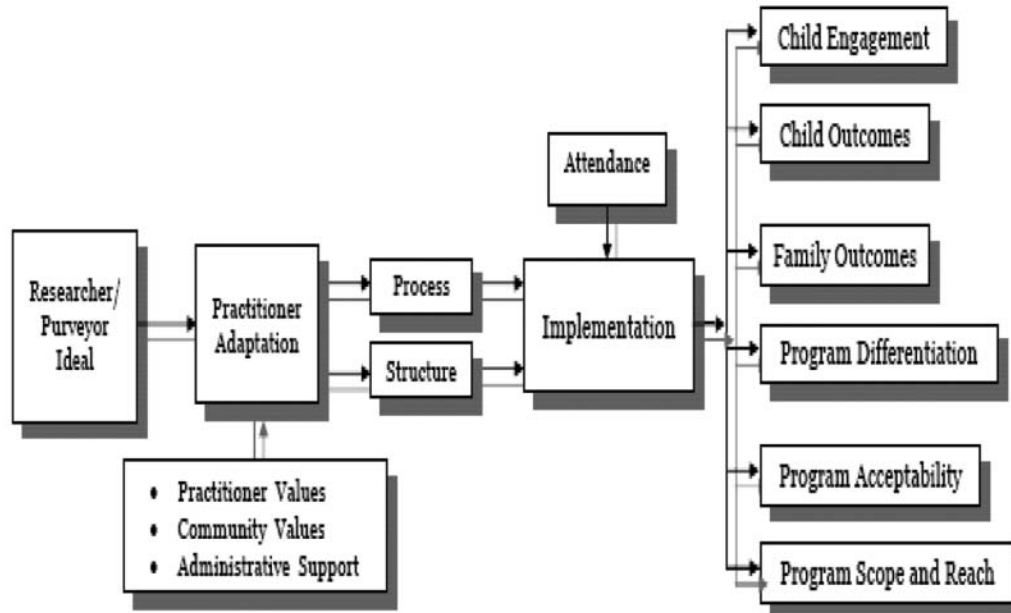
From the literature, implementation may be seen as a process consisting of several components. A diagram of this implementation process appears in Figure 1. Each of the elements of this model may be unpacked to determine the features of implementation that may affect desired outcomes, which appear in the right side of the figure.

In this discussion of the components of the implementation process, I will use examples from a curriculum evaluation study that is currently under way, called the Children’s School Success (CSS) Project (Odom, Butera, et al., 2008). The purpose of the CSS Project is to promote “school readiness” for 4-year-old children at risk for early school problems, who we defined as children living in poverty, children with identified disabilities, and children who are English language learners. A primary feature of the CSS Project has been to develop a curriculum that preschool teachers can use in their classrooms to promote early literacy, math, science, and social competence. The content of the CSS curriculum was drawn from other literacy, math, science, and social curricula that had previously established some evidence of efficacy. This content was integrated across areas and written into 133 daily lessons. More detail about the CSS curriculum may be found at the CSS Web site (<http://css.crlt.indiana.edu/>). The CSS Project conducted a cross-site randomized experimental study of the efficacy of this curriculum and also examined features of implementation in the experimental classrooms. To date, approximately 100 classes from California, Kansas, Indiana, West Virginia, and Maryland and more than 1,000 children have participated in the study.

Purveyor

Implementation begins with a “gleam in the eye of the purveyor,” that is, an idea or a research finding that may lead to an effective intervention approach (see Note 1). Through research and development, the initial idea becomes an empirically supported intervention or curriculum. The purveyor will document procedures in curriculum or intervention manuals, and perhaps provide

Figure 1
Implementation Process



materials for implementing the curriculum. This “manu-
alization” of intervention approaches is an essential step
in the implementation process (Smith et al., 2007). In the
CSS Project, daily lessons documented the activities,
lessons, and interactions that should occur in the class-
room. The lessons specify materials and books necessary
for the curriculum activities and were written in a way
that is understandable to teachers. The clarity, detail, and
attractiveness of curriculum and intervention materials
as well as the match between the theoretical orientation
of the curriculum and teacher philosophy are factors that
affected the degrees to which teachers employ the prac-
tices in the classroom (Lieber et al., in press).

Practitioner Adaptation

It should first be acknowledged that a purveyor delivers
the EBP in different ways, and the potentially more effec-
tive ways will be discussed in the subsequent section on
enlightened professional development. But for this model
of implementation, one can assume that the EPB interven-
tion is delivered to the practitioners, and in most cases, prac-
titioners will adapt the model to fit their specific classroom
context (Durlak & DuPre, 2008). Such adaptations almost
always occur, and they are based on practitioner values,
community values, administrative support, and undoubt-
edly other variables (Backer, 2002). An inherent tension

often exists between purveyors and practitioners, with pur-
veyors wanting practitioners to implement the curriculum
exactly as it was designed and practitioners wanting to mod-
ify components of the practice to fit their context.

In the CSS Project, teachers were introduced to the cur-
riculum in a set of workshops, and then site coordinators
visited teachers each week to observe, coach, and plan
activities. Many teachers made strong efforts to implement
all components in their classes, whereas others selected
parts of the curriculum to employ and, in some cases,
employed very little of the curriculum at all. Researchers in
implementation science have documented the process of
adaptation and noted that the key to successful adaptation
is when teachers implement the “core” or essential com-
ponents of the practice. This, of course, requires that the
researcher identify the core elements ahead of time.

Process and Structural Features of Implementation

The adaptation process and ultimately implementa-
tion itself may be conceptualized as having two dimen-
sions: process and structure (O’Donnell, 2008).

Structure. The structural features of the EBPs or curric-
ula refer to the quality of the intervention delivered. This

quantity may be the number of hours of instruction per week, number of lessons covered, or the amount of homework assignments returned. For example, the CSS curriculum has a specified number of lessons, and within the daily lessons, there were science, literacy, math, and social activities. To assess the structural feature of implementation, site supervisors at the end of the year reported the proportion of the curriculum completed in each individual area (Odom, Fleming, et al., 2008). Durlak and DuPre (2008) noted that it is not realistic to expect that all practitioners will implement the entire set of content. From their work in community human service programs, they proposed that an 80% structural implementation rate may be a maximum for many interventions, with more realistic expectations being around 60% to 80%. In the CSS Project, the overall average proportion of curriculum implemented varied from 68% to 87%, across components of the curriculum and classrooms.

Process. Process is a second dimension of implementation that refers to the quality with which practitioners implement the curriculum. Process measures examine how well teachers deliver lessons (O'Donnell, 2008) or the quality of the interactions between the teacher and children (Justice, Mashburn, Hamre, & Pianta, 2008). The purveyor, or other researchers, often measures quality through observational techniques that are usually gathered multiple times during the year. In the CSS Project, quality rating measures were developed for the literacy, science and math, and social components of the curriculum. Site coordinators completed rating measures after observing for a full day in a classroom. Seven observations were collected during the year.

Child attendance. Child attendance is a feature of implementation over which purveyors or practitioners may have little control, but it might be built into such an implementation model because it affects the child's potential exposure to the EBP or curriculum. When children are present in class, they have the opportunity to experience the lessons teachers deliver and the quality of the instructional interaction with the teacher. Their attendance represents the proportion of opportunities available. In the CSS Project, the proportion of the total number of school days that the child was present was one variable factored into the potential assessment of implementation.

Outcomes. Implementation is almost always tied to outcomes. The logic is that if the practitioner implements the curriculum, EBP, or intervention at a high level, it will produce positive outcomes. The specific outcome depends on the curriculum or EBP. The outcome itself might be a

process variable, such as child engagement, or it may be more summative, as through developmental or learning outcomes or family outcomes. In addition, implementation assessment is sometimes used to differentiate programs that are high and low implementers, to reflect the teacher's acceptability of the program, or to identify the scope of the EBP or curriculum use (e.g., how much it is used throughout a district).

In the CSS Project, structural (proportion of curriculum completed), process (quality ratings), and attendance were assessed for classes and children in the experimental curriculum group. In addition, a combined implementation variable was calculated by multiplying the average quality rating by the proportion of lessons completed (i.e., the combined variable). Odom, Fleming, and colleagues (2008) examined the association among these features of implementation and performance on language, literacy, math, and social outcome measures (i.e., posttest scores with pretest scores first covaried). Different features of implementation were associated significantly with different outcome variables, but a trend in the finding was that when process and structural variables were combined, they had the most frequent significant associations with outcomes. Attendance, also, when combined with the structure or process variables, was associated with several child outcomes. The recommendation from this study was that both structural and process implementation should be assessed in studies of efficacy and effectiveness.

Enlightened Professional Development

From the Carnegie Foundation on the Advancement of Teaching, Hutchings (2008) proposed a fundamentally divergent view of teaching in which she stated that teaching is "not a matter of individual expertise employed in the privacy of one's classroom but a set of practices that have and need a social and organizational context" (p. 2). Although one might look at the implementation model in Figure 1 to understand the process, it provides little information about how to promote implementation of an EBP or curriculum. Prominent models of implementation, such as those proposed by Altschuld and colleagues (Altschuld, Kumar, Smith, & Goodway, 1999), Durlak and DuPre (2008), Fixsen and colleagues (2005), and Wandersman and colleagues (2008), often follow an ecological systems approach (Bronfenbrenner, 1979). Similarly, many of the foremost authorities on adoption of innovation in school (Fullan, 1991) specify that a set of organizational supports is necessary for practitioners in educational systems to be able to implement innovations, such as EBPs. Professional

development, training, and/or technical assistance are such primary organization supports. As noted, the modal training approaches in the past have been stand-alone workshops or presentations without ongoing support. Fortunately, there are a variety of wired professional development practices that currently or in the future have promise for supporting implementation of EBPs. These procedures are called “enlightened professional development” in that they recognize the necessity of steps beyond the workshop for taking EBPs into every day practice.

Enlightened professional development approaches build on our increased knowledge of the social dynamics of professional teams as well as the ongoing advances in technology. Space constraints prevent a detailed discussion of each of these approaches, but in each of the highlighted practices below, references to most detailed information are provided.

- *Models of teaming and team building:* Although not new, an understanding of the collaborative team process and models for both team building and collaboration may support adoption and use of EBP (Hayden, Frederick, & Smith, 2003).
- *Coaching and consultation:* Coaching and consultation differs from team building in that the coach or consultant comes from outside the classroom or program and can provide (a) demonstrations of practices in program settings, (b) feedback, and (c) support for ongoing self-evaluation (Buisse & Wesley, 2006; Wesley & Buisse, 2006).
- *Communities of practice:* Emerging as a potentially important model of professional development and support, communities of practice link practitioners with common interests in instructional practices to provide a venue of mutual support, information, and reflection (Buisse, Sparkman, & Wesley, 2003). As the ease of communication outside of classrooms or even school settings increases through advances in technology, the potential for virtual communities of practice will be enhanced.
- *Online instruction:* Teachers may obtain training online courses, a common form of teaching now, that provide information about specific practices or instructional approaches. This approach becomes professionally wired through its potential of embedding video demonstrations of practices, specific designation of modules of EBPs, and provision of implementation checklists that practitioners may use in self-evaluation.
- *Web-based video and visual access:* The video capabilities of the Web provide great potential for remote training and feedback. The Telemedicine concept has for a good while been providing diagnostic and treatment consultations for patients in remote locations. In early childhood education, Pianta and group (Pianta, 2006) have demonstrated a process called My Teaching

Partners for capturing on video teachers’ delivery of lessons and a system of feedback on the approaches they are following in classrooms. Such feedback could well be applied to implementation of EBPs in EI/ECSE.

- *Web-based interactive systems:* Web-based forums for communication may well advance the professional development and EBP implementation efforts in the field. A step beyond e-mail communication, the use of *wikis*, a wired form of a professional blog, allows individuals to post comments in ongoing and potentially interactive ways. Winton and colleagues (see Buisse, Winton, & Rous, in press) have used this format very productively at their Early Childhood Community Web site (<http://www.carnegiefoundation.org/perspectives/sub.asp?key=245&subkey=2768>) to gather professional knowledge around practices in EI/ECSE. Moving this technology to local-level use may be a next wired approach to supporting implementation in local programs and communities.

A caveat exists with all of these approaches, however. There is little research on the efficacy of the professional development practices for producing changes in professional practice and child outcomes (Winton, McCollum, & Catlett, 2008). This will also be the next major step of the field.

Conclusion

The systematic identification of EBP in EI/ECSE has great potential for enhancing the lives of infants and young children with disabilities and their families. The tie that binds EBPs to positive outcomes for children in families is implementation in classrooms, homes, and communities. The emerging field of implementation science is beginning to inform us about factors that support implementation of innovative practices, with such factors embedded in the social and organizational systems in which EI/ECSE programs are situated. A primary support that underlies implementation is professional development, and enlightened approaches to professional development offer great promise for leading effective practices from the proverbial laboratory to the classroom, home, and community.

Note

1. Traditionally, a purveyor is the developer of a new approach, such as a curriculum. When considering implementation of evidence-based practices (EBPs), however, the purveyor may be a researcher who develops a focused intervention or a development professional who is acting as a change agent for promoting EBPs in a program.

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