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Second Generation Research on the Effectiveness of Early Intervention

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This commentary discusses the program of research carried out by the Utah State Early Intervention Research Institute (EIRI) in the context of the characteristics associated with second generation research in early intervention. Specifically, the series of EIRI research studies focused on the three program features of age of start, intensity of intervention, and parent participation. This commentary provides an evaluation of these program features in terms of scientific quality, specificity of the research, and consistency with contemporary developmental/ecological approaches. Directions for future research are noted, and these include: greater emphasis on establishing expectations for outcomes derived from developmental models, multisite studies to permit more effective specificity analyses, and emphasis on identifying the characteristics of children and families who are at greatest risk of not responding to prevailing early intervention services and supports.

It is becoming increasingly clear that the field of early intervention is moving rapidly through a transition, from what might be referred to as first generation research, toward second generation research on the effectiveness of early intervention (Guralnick, 1988, 1989, in preparation). First generation research was primarily concerned with overall analyses of efficacy. It succeeded in answering important political and scientific questions despite numerous methodological problems, the extraordinary heterogeneity in intervention approaches and subject samples, and the lack of a coherent and systematic program of research. In essence, meta-analyses of these first generation studies (Casto & Mastropieri, 1986; Shonkoff & Hauser-Cram, 1987), supported by more traditional efficacy analyses (Guralnick & Bennett, 1987), concluded that early intervention in the global sense was indeed effective, with average effect sizes expected to range between one-half and three-quarters of a standard deviation.

When first generation efforts led to the conclusion that the provision of early intervention programs produced positive effects, it was against a backdrop in which professional knowledge, parent advocacy, public awareness and understanding, program availability, family and social supports, and disability-related educational materials were growing but still limited. For families who could access programs as part of an emerging community service or through participation in research-related interventions, comparisons with the then prevailing environments for families unable to find these programs or services produced effect sizes noted above.

However, marking the end of first generation research with the passage of Public Law 99-457 in 1986, it must be recognized that profound changes have occurred not only in approaches to research but also in the community of services and supports to families. In fact, although the transition is not entirely complete, today's environment in which second generation research is being carried out bears little resemblance to that which

faced first generation investigators. For example, the early intervention system in a substantial number of today's communities is increasingly being guided by sophisticated, developmentally sound, and validated curricula and materials implemented by well-trained professionals.

But other equally remarkable changes have occurred, as the evolution of early intervention programs has affected the context of virtually all aspects of child and family life. Indeed, contemporary approaches in the field of early intervention have established higher expectations for families, friends, and the general community; encouraged the development of new resources and the creation of family supports and their coordination; and enhanced the quality and quantity of professional training. Moreover, information on disability and risk issues has become readily available through resource centers and parent groups, and entire service systems have been altered — creating coordinated procedures related to identification, diagnosis and assessment, program planning, and program implementation. In short, progress in the field of early intervention has irrevocably altered the ecology both for families with children who are at risk and for those with established disabilities. It is within this context of greater knowledge, higher expectations, and new levels of support that second generation investigations must be conducted.

Issues Addressed in Second Generation Research

In contrast to the more global scientific and political questions addressed by first generation investigators, second generation research builds upon this foundation and is concerned with a series of different but related issues (Guralnick, 1989). In particular, second generation research is designed to address questions of greater specificity. That is, having answered the global efficacy question (a question to which we can never meaningfully return in view of the changed ecology of services), attention now turns to the far more demanding task of identifying the child characteristics, family characteristics, and program features that interact to optimize one or more outcomes within the framework of contemporary early intervention services.

A multidimensional model representing this interaction of critical factors is presented in Figure 1. Child and family characteristics include the child's type and severity of disability or at-risk status, family resources and adaptability, need for social supports, and related demographic factors, as well as interactive factors such as the quality of parent–child interactions. Program features include the duration and intensity, timing (e.g., age of start), and comprehensiveness of early intervention; the level and nature of family involvement, and the curricular or developmental approach that is adopted. Outcome measures are equally varied and can include child outcomes in a range of developmental domains, effects on families, the impact on family–child relationships, or even outcomes associated with integrative measures such as the child's social competence (see Guralnick, 1990). As research yields information that can be entered into this matrix, our field begins to establish a second generation database that informs educational and clinical practice, helps us to understand the mechanisms through which interventions have their effects, enhances the efficiency and cost effectiveness of our interventions, and establishes a realistic set of expectations for all concerned (Guralnick, 1991, in preparation).

In addition to specificity, two other characteristics of second generation research relate to its scientific quality and the ability to incorporate contemporary developmental and ecological principles into intervention approaches. First, questions concerned with specificity in particular must meet rigorous scientific standards. Longitudinal prospective designs; random assignment; careful documentation of interventions, procedures,

and compliance; as well as the thoughtful selection of assessments used by observers unaware of experimental conditions are essential to second generation research (see LeLaurin & Wolery, 1992). Second, theoretical and empirical advances occurring during the first generation of research have improved our understanding of family dynamics, parent–child relationships, and the pathways through which biosocial factors influence development. In fact, by casting interactions within a developmental/ecological model, we not only tend to incorporate our knowledge of biosocial influences on development within an intervention framework in more meaningful and realistic ways, but also attend more closely to relationships among critical factors. It is this understanding of interrelationships that helps us interpret how these factors might modulate or mediate both the formal and informal aspects of early intervention programs. As a consequence, we gain a better sense of the mechanisms through which early interventions can be expected to have their effects.

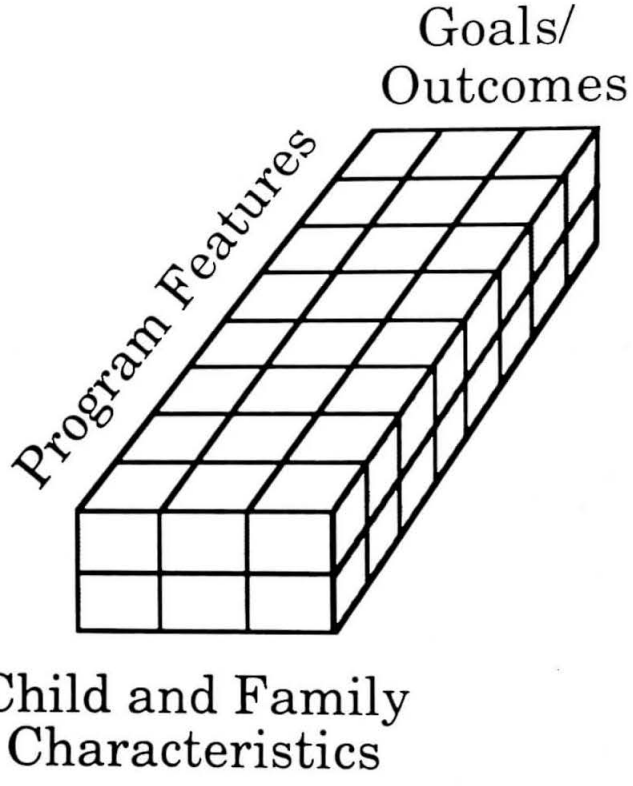

Figure 1. An organizational framework for designing and analyzing early intervention efficacy research (from Guralnick, 1989; copyright (1989) by PRO-ED, Inc.; reprinted with permission).

Organization of the Commentary

The editor of *Early Education and Development* has asked me to provide a commentary on the program of early intervention efficacy research carried out by the Utah State Early Intervention Research Institute (EIRI) as published in this issue. Among the many program features in our field, three were selected by EIRI. The first concerned whether there are any benefits to beginning intervention earlier rather than later. The second concerned the relationship between the intensity of intervention and outcomes for children and families. The third focused on the role of family involvement, an issue central to P.L. 99-457. The approach I have taken to organize this commentary is to

consider this body of work in terms of the three characteristics of second generation research described above: Do studies meet exemplary scientific standards? Has our understanding of the specificity of effects been improved? Are the interventions consistent with contemporary developmental/ecological approaches? For this commentary, I had the benefit of reviews by a number of anonymous experts participating in the peer review process, and I thank those colleagues for their insights.

Quality of Science

It is important to note that the six studies reported in this issue of *Early Education and Development* fall firmly within the domain of second generation research in the field of early intervention. Collectively, the Early Intervention Research Institute (EIRI) has managed to raise the expectations and standards for investigations that will follow. Even a cursory review of the research program will evoke an appreciation of the extraordinary efforts required to maintain internal consistency within a consortium of such considerable scope and magnitude.

One of the most striking features of this collection of studies is the care that was taken to ensure that each investigation met the highest of scientific standards. Their ability to carry out randomized prospective designs, to carefully describe the interventions that were to be provided, and to establish safeguards that protect against biased data collection, should put to rest any concerns that practical problems in the field inevitably require compromise with sound scientific methodology.

The ability to minimize attrition over many years also attests to the high quality of the EIRI longitudinal research program. It is possible to quibble over a number of methodological issues, such as whether sufficient information was available regarding treatment verification, but these would be only minor variations within a well-designed and well-implemented research program.

Specificity

As reflected in the Casto and White article (this issue) introducing the six studies, the issue of specificity was central to the organization of all of the studies that comprised the Utah State Early Intervention Research Institute. In general, each program feature (i.e., age of start, intensity, and parent participation), including curricular approaches and their content, was well described and defined, although no attempt was made to systematically vary child and family characteristics in accordance with program features. In fact, a variety of different samples of children were included such as those with visual impairments, medically fragile infants, as well as heterogeneous groups of young children with disabilities (e.g., developmental delay, motor impairments). Accordingly, for the most part, each study must stand alone, as each contained a unique configuration of child and family characteristics in relation to one of the three program features.

Child and family characteristics were carefully and thoughtfully assessed. Detailed evaluations of family demographics in particular allowed analyses consistent with the concept of specificity. In addition, an extensive and diverse set of core measures and measures specific to individual studies enabled analyses that addressed outcomes for both children and families. Although concerns about the rationale for selecting these measures will be discussed in a subsequent section of this commentary, the fact remains that the comprehensiveness of the outcome measures could yield linkages among program features, child and family characteristics, and outcomes not typically found in early intervention research.

A specificity framework requires that careful attention be given both to the nature of the particular interventions that constitute the program features of interest and to the

nature of other program features that are relevant. For example, not only is intensity of intervention important, but one must also consider related program features, such as family coping styles, available support systems, family resources, curricular approaches, and behavioral characteristics of the children investigated. In this way, a recognition of the context's ability to potentially moderate outcomes is recognized, and the tendency to overgeneralize for a specific program feature is minimized. Moreover, it is equally essential that similar features associated with the comparison group be identified. This is particularly important when conducting second generation research because, as noted earlier, the overall early intervention ecology for children and families at risk or those with established disabilities has undergone considerable change in the past 20 years. In essence, only when we completely understand the prevailing conditions for specific program features in the comparison groups as well as in the intervention groups will we be able to determine the meaning of variations of those program features.

The importance of specificity for both intervention and comparison groups can be found in the study by Boyce, Smith, Immel, Casto, and Escobar (this issue) designed to examine the "age of start" issue. In this investigation, a heterogeneous sample of medically fragile children who were graduates of neonatal intensive care units (NICUs) and experienced intraventricular hemorrhage as neonates was selected to participate in an early intervention program that began when the children were either 3 months or 18 months of age. Although the authors contend that this general design examines whether "earlier is better," the way the question is phrased directs our attention away from the specificity issue. In particular, it is important to note that the late intervention group was quite likely to have experienced a reasonably high level of intervention and supports from the outset. These were middle-class families, generally well-educated, and financially stable (fathers averaged over 40 hours of work per week; and less than half the mothers were employed, averaging approximately 10 hours of work per week). Moreover, because their children were graduates of NICUs, these families were certain to have been in contact with a range of health professionals and to have participated in some follow-up program with access to information and related supports. In fact, as the authors noted, approximately 25% of the late intervention group received therapy of some type or participated in group care. Services connected with group care programs were not reported, but it is reasonable to assume that a considerable number of parents in the late intervention group took advantage of the formal and informal support systems related to early intervention found in their communities.

As we know, particularly during the first three years of life, these support systems are important contributors to the development and well-being of children and families (e.g., Dunst, Trivette, & Cross, 1986). Middle-class families in particular tend to seek out a variety of different formal and informal supports and services, even when their child is enrolled in a formal early intervention program (Shonkoff, Hauser-Cram, Krauss, & Upshur, 1992). In fact, relatively well-educated families of premature/low-birthweight children are able to prevent major declines in their child's development that are typical of this high-risk group even without participating in intensive early intervention programs (Brooks-Gunn, Gross, Kraemer, Spiker, & Shapiro, 1992; Infant Health and Development Program [IHDP], 1990). Presumably, their own abilities and the prevailing level of early intervention services and supports are sufficient to create an environment that promotes the health and development of their child.

What then was the major difference between the experiences of the early and late intervention groups in this study? In point of fact, the main difference was that the early group received primarily center-based sensorimotor stimulation delivered by a developmental therapist approximately once per month. Overall, this meant that the children in the early rather than late intervention group experienced an additional 17 hours of

intervention on average, distributed across a 15-month period. Parents were also given weekly assignments, but it is unclear how much time parents devoted to these tasks.

In essence, it can be stated that the question posed in this study is not whether earlier intervention is better than later intervention. That is much too general a question within the framework of specificity. Rather, the study is asking whether the addition of an average of 17 hours of a narrowly focused, sensorimotor stimulation program to the already existing substrate of early intervention supports and services makes a difference. As the results revealed, this additional intervention produced no immediate effects, although the trend for some measures tended to favor the sensorimotor group when tested at 42 months of age. Whether other combinations of subject samples (child and family characteristics) in relation to curricula or service intensity (program features) will have an impact beyond that of prevailing levels of early intervention services, constitutes, of course, the essence of second generation research.

The investigation by Goetze, Immel, Escobar, Gillette, Coury, and Hansen (this issue) raised a related issue in connection with the program feature of intensity. This was an especially creative study, providing a transition team and coordination model that permitted different intensities of interventions to be investigated. Nevertheless, as the results indicated, given the prevailing level of early intervention services and the participation of children in private therapy in the lower intensity group, adding a few more hours per month of what appears to be similar types of early intervention services does not have any consistent impact on child or family measures. Moreover, as others have reported, the fact that more biologically vulnerable children appear to be least responsive to even highly intensive interventions (IHDP, 1990) suggests that unusually creative intervention approaches for the populations represented in Goetze et al. (this issue) will be required to yield gains beyond those provided by existing systems of supports and services.

This program feature of intensity was a major focus of the EIRI group, and included children with a variety of disabilities. The investigation by Behl, White, and Escobar (this issue) compared the effects of monthly general parent discussions with weekly home-based interventions for children with visual impairments. Interventions (high-intensity group) extended for a minimum of one year, and were primarily child focused. Once again, generally intact, relatively affluent, well-educated families were participants. As such, it can be expected that should parents in the discussion-only group become concerned about specific developmental or behavioral issues they would seek professional advice, or perhaps services would be provided in the context of their daycare or preschool program. Approximately 50% of the children participated in these programs and 10% received private therapy.

Accordingly, for the relatively sophisticated families in the discussion group (low intensity), the existing early intervention network may have been sufficient to prevent secondary problems from occurring in their children, with the addition of a formal, home-based, weekly, child-focused curriculum averaging about 30 hours per year for each family yielding little additional benefit. Although there may be other reasons why the more intensive intervention was not more effective than the less intensive intervention comparison group (see discussions of sample size and developmental/ecological issues in the following sections), this study and others should encourage future investigators to more closely examine the network of early intervention services that families with children at significant risk typically access.

Beyond these issues, intensity itself is a deceptively simple construct, and separating it out from comprehensiveness or even the content of intervention (providing not only more intervention but interventions that address different developmental issues) is neither easy nor perhaps possible to accomplish (Guralnick, 1991). For example, for

premature, low-birthweight children, Ramey et al. (1992) have reported that the greater the degree of participation (intensity) in a preventive early intervention program, the better the outcomes. However, participation was defined as a composite quantitative index of completed home visits, group parent meetings attended, and the child's attendance at a specially designed daycare program. Whether the intensity of intervention, its comprehensiveness, or some combination including coordination among the elements of the intervention was responsible for this important outcome is a critical issue for future research. In addition, the study by Lovaas (1987) focusing on children with autism, including continuing positive effects obtained from their long-term follow-up (McEachin, Smith, & Lovaas, 1993), also suggests that intensity/comprehensiveness is a program feature that should be explored further, and may be closely tied within the specificity framework to particular child and family characteristics.

Child and Family Characteristics

As discussed earlier, specificity analyses that allow results to be entered meaningfully into the matrix in Figure 1 also require a thorough knowledge and understanding of child and family characteristics. For example, severity of an established disability (as assessed by standard measures) in particular has been shown in previous research to account for a major proportion of the variance in intervention outcomes (Palmer et al., 1988; Shonkoff et al., 1992). Similarly, available research suggests that even with low-birthweight premature infants (using birthweight to index severity), differential responsiveness occurs to even intensive and comprehensive interventions, with children at greater biological risk showing little or no responsiveness to the intervention (IHDP, 1990). Moreover, other findings have suggested that even highly intensive early intervention programs only benefit families with certain characteristics (Brooks-Gunn et al., 1992).

For the most part, the authors of the EIRI studies reported in this issue of *Early Education and Development* noted that the size of their subject samples exceeded those of most previous investigations. Yet, as discussed in the initial section of this commentary, second generation research is unusually demanding, particularly when specificity issues are of interest. In view of the variability in child and family characteristics common to the EIRI studies, and the fact that the samples were still relatively small, it is difficult for these investigations to yield definitive results within a specificity framework. This is particularly the case for children with low-incidence disabilities as found in Behl et al. (this issue), in which approximately 15 subjects per group were available at each assessment period. The heterogeneity and the specific characteristics of the subjects in the study of variations in the intensity of intervention by Taylor, White, and Kusmierek (this issue) is also of special concern. Few details regarding child characteristics were noted, and test scores reported in the results suggested the existence of an unusually heterogeneous sample. Without more information about the sample or the use of specific inclusion criteria for subjects, understanding the relationship between any program feature and the characteristics of the children in connection to outcomes will not be possible.

Accordingly, given the wide developmental ranges of the children in most of the EIRI samples and the known interaction with family characteristics, considerably larger samples with planned heterogeneity (stratification) may be essential to allow discovery of differential effects in connection with child and family characteristics. For this to occur, multisite investigations will be necessary. Subgroup analysis is a powerful tool for examining specificity issues, but will certainly require multisite collaborative research. Alternatively, a relatively homogenous and smaller sample with well-defined child and family characteristics can be selected to test particular relationships that have been

suggested either empirically or theoretically. Again, however, multisite collaborations will be needed to obtain a sufficient number of subjects with specific characteristics.

Developmental/Ecological Issues

Longitudinal studies create an unusual burden for investigators because they require choices to be made that cannot be altered throughout the many years that children and families are followed. This becomes an even more perplexing problem when the field in which an investigator is engaged is in a period of transition in almost every respect. In particular, intervention goals, approaches, outcome measures, and their interrelationships are guided explicitly or implicitly by a developmental/ecological model of how child development can be influenced and how family well-being can be enhanced.

The importance of establishing a conceptual framework was recognized by EIRI investigators and described in the introductory paper by Casto and White (this issue). For the most part, a general systems approach was adopted, which was primarily reflected in the care taken to obtain child, family, and community measures. Nevertheless, for the series of studies, no particular developmental/ecological approach was identified. Often, especially for the program feature related to parent involvement, the approach taken was to adopt what appeared to be the most commonly applied intervention at the time.

One major theme that has emerged in the early intervention field that is especially relevant for longitudinal studies, has been a shift from a skills/didactic/child-focused orientation to a more developmentally based/relationship-focused/family-centered orientation (Guralnick, 1989). Although admittedly this characterization simplifies what is certainly a complex issue, it nevertheless reflects a meaningful difference as to what constitutes contemporary thinking and practice in the field of early intervention. It is beyond the scope of this commentary to expand on this topic, but increasing concern has been expressed about the usefulness of a skills approach, and support is emerging for a more developmental orientation (Mahoney, Robinson, & Powell, 1992).

An analysis of the interventions selected by EIRI across the three program features of age of start, intensity, and parent involvement, clearly indicates that they fall well within the skills/didactic/child-focused approach. Specifically, the central feature of the study by Boyce, Smith, et al. (this issue) was primarily a narrow sensorimotor intervention delivered by a therapist. The study by Taylor et al. (this issue), although including a general parent-oriented approach, appeared to emphasize teaching skills to parents in sessions designed to improve their child's development in one or more basic developmental domains. A similar though broader skills approach was applied in the study by Goetze et al. (this issue) with a strong didactic component for the developmental intervention aspect of the program. For studies by Innocenti, Hollinger, Escobar, and White (this issue) and Boyce, White, and Kerr (this issue), the parent program was highly skills-oriented, focusing on "target behaviors" parents selected for their child. In contrast, in the investigation of children with visual impairments (Behl et al., this issue), a more broadly based intervention program was provided.

The extent to which the use of a skills orientation rather than a developmentally based approach to early intervention was responsible for the failures to find differences between the intervention and comparison groups for most of the studies reported in this issue of *Early Education and Development* cannot be determined, as other factors discussed throughout this commentary may have contributed. Nevertheless, the lack of effectiveness of the interventions suggests that contemporary practices involving more family-centered, less didactic, and more relationship-based models could serve as a reasonable

alternative framework for future research and guide the selection of specific program features.

A contemporary developmental framework could also be of value in helping to establish the rationale connecting intervention approaches and outcomes. The EIRI researchers are to be commended for selecting a wide range of both child and family measures, but the relationship to the overall ecology of influences on development needs further clarification. For example, it is important to know the rationale for expecting why a narrowly focused sensorimotor curriculum (Boyce, Smith, et al., this issue) or a didactically oriented parent component (Innocenti et al., this issue; Boyce, White, & Kerr, this issue) would alter family functioning. Moreover, in view of the complex role of social support, a corresponding developmental rationale and set of expectations for that outcome are equally essential.

It is certainly the case that the field of early childhood development has not yet established generally accepted models of the pathways and relationships among factors related to parent participation, social support, family functioning, or parental stress. Nevertheless, well-developed models and approaches as well as an extensive empirical base are available (e.g., Ramey et al., 1992; Shonkoff et al., 1992), and these have provided a framework for establishing expectations and assisting in interpreting outcomes among the many child, family, and program variables. As suggested by specificity issues, a complete understanding of the impact of early intervention requires an explicit consideration of mediating, moderating, and reciprocal influences among critical variables.

Contemporary research related to parental stress, family functioning, social support, and parent involvement illustrates this point. With respect to parental stress and family functioning, a number of recent investigations of families with young children with disabilities suggest that, despite additional stress associated with caring for a child with disabilities, these families do not differ in their ability to function nor in terms of felt parental stress in comparison with families without a child with disabilities (Dyson, 1991; Innocenti, Huh, & Boyce, 1992; Mahoney, O'Sullivan, & Robinson, 1992; Orr, Cameron, Dobson, & Day, 1993).

Associations between parental stress and severity of a disability and motor impairment do exist (e.g., Mahoney et al., 1992; Shonkoff et al., 1992), and legitimate concerns regarding the usefulness of the various stress measures for families with a child with disabilities can be offered (Glidden, 1993). Nevertheless, framed within a developmental approach, we are beginning to appreciate the coping abilities of all families and are laying to rest a "pathological" approach as the modal response of families to the presence of a child with disabilities (Krauss, 1986). Future research on the effects of early intervention on parental stress and family functioning must consider the possibility that existing supports and services available within the early intervention system may be sufficient to help maintain cohesion and adaptability within most families and help parents cope with additional child-related stress. As a consequence, more intensive interventions, for example, are not likely (nor expected) to have any detectable effects. In contrast, identifying families at risk for difficulties in this domain and designing appropriate intervention-related supports and services will hopefully prove to be a fruitful approach.

In addition, research on the relationship among participation in parent groups (the third program feature investigated in the EIRI studies), the importance of social support, and family functioning further emphasizes developmental perspectives that consider how interrelated features moderate outcomes. For example, early work with an at-risk sample involving an individualized consultation model suggested that participation in the program was associated with adverse effects for families with a low need for support; for those parents with a higher need for support, however, participation resulted in

beneficial effects (Affleck, Tennen, Rowe, Roscher, & Walker, 1985). More recent studies have revealed equally complex interrelationships (Pianta & Ball, 1993). Moreover, recent descriptive research for a large sample of families with children with disabilities also revealed a complex pattern. Specifically, attendance (versus nonattendance) at parent support groups was associated with increased perceived social support from peers, but increased attendance was also associated with negative family effects in connection with greater personal strain and more difficult familial/social relationships (Krauss, Upshur, Shonkoff, & Hauser-Cram, 1993). Moreover, interviews of parents suggested that participation in these types of groups can indeed increase stress and related problems. The fact that parent groups tend to be rated fairly low in comparison with other components of the early intervention service system (Upshur, 1991) further argues for the importance of developing a sound rationale for anticipating outcomes of specific intervention components.

A careful consideration of family needs, history, and related characteristics is especially warranted for the EIRI studies on the issue of parent group participation. That parents attended less than 50% of the meetings in the study by Innocenti et al. (this issue) also suggests possible difficulties with the group experience. The fact that an already existing early intervention program did not have a parent component in place (until arranged by EIRI) may also indicate a lack of need. In fact, many families may have participated in birth-to-three parent groups and thus experienced a relatively low level of need for groups for their preschool-age child, having developed well-established supports or networks by this time. The child's chronological age, parent need for support, history of participation in parent groups, and the specific purposes of these groups are only some of the factors that must be considered when evaluating a single program feature within the framework of second generation research. When this occurs, we may well be in an ideal position to optimize services for families.

Conclusion

This important series of carefully designed and implemented studies examined three types of early intervention program features to determine whether they yield benefits beyond those achieved through prevailing levels of early intervention services and supports. Overall, results indicated an absence of or only modest positive effects for the features of age of start, program intensity, and parent participation. Yet, as has been discussed, the general pattern of negative findings underscores quite clearly that benefits to specific groups of children and families above and beyond those services and supports currently available will require novel and perhaps unusually comprehensive, intensive, or focused interventions.

But the results of these studies carry other more specific and positive implications for future research. In particular, these studies suggest that additional benefits not only will be difficult to achieve, but also will not likely be found in the form of primarily didactic, child-centered, or narrow-band approaches to curricula. Perhaps well-developed, family-centered approaches will be more effective despite our incomplete understanding of the relationships among interacting factors. In fact, it is sometimes the case that unexpectedly powerful effects can be achieved from even modest interventions if we can identify the proper circumstances in relation to program features, child and family characteristics, and outcomes. As an example, a developmentally oriented family-centered approach for low-birthweight, premature children can have substantial and quite remarkable short-term (Rauh, Achenbach, Nurcombe, Howell, & Teti, 1988) and long-term effects (Achenbach, Howell, Aoki, & Rauh, 1993; Achenbach, Phares, Howell, Rauh, & Nurcombe, 1990). In any event, consideration of the pathways found within a

thoughtful developmental framework, and within the context of the matrix presented in Figure 1, may well be essential for organizing and guiding interventions that can optimize developmental outcomes and family well-being.

This series of studies also suggests that relatively small increments in program intensity are not likely to be sufficient to produce more effective outcomes for children and families. Furthermore, it is apparent that intensity is a complex program feature that is not easily separated from comprehensiveness, approaches to curricula, or the type of developmental/educational model. We can also expect intensity to interact with specific child and family characteristics. In general, multisite studies, generating a sufficiently large sample, will be needed in the future to permit subgroup analyses and to evaluate the moderating effects of program features that are so essential to our understanding of second-generation efficacy research.

Finally, the EIRI program of studies has been conducted in the spirit of gathering sound scientific information that might best assist our field to focus its efforts and allocate limited resources. Their findings reveal, unequivocally, that a main effects model cannot advance our understanding of the field any further, and they have provided directions for future research consistent with the concept of specificity. In particular, the EIRI findings suggest that our resources will be allocated most effectively and efficiently if, through future research, we can identify children and families who are at greatest risk of not responding to the prevailing levels of early intervention services and supports and those families for whom only modest forms of intervention are necessary. Once this has been accomplished, it will be possible to develop and organize a system of services carefully adjusted to those unique patterns of risk. Some of the conditions that place children and families at greater risk are well known. These include the severity of the child's disability and unusual behavior patterns, the family's need for social support and information, attitudinal factors, and the quality of parent–child interactions.

But of course much more remains to be determined. As our appreciation, knowledge, and understanding of biosocial and psychosocial influences on development increase within the framework of second generation efficacy research, so will our ability to establish the most effective and supportive system of early intervention services. Our field owes the Utah State Early Intervention Research Institute an enormous debt of gratitude for advancing our understanding of these influences and establishing a research agenda for the future.

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Due to space limitations, responses to the commentaries and indices for Volume 4 (1993) will appear in the January 1994 issue of *Early Education and Development.*