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Shouming Li, Jules M. Marquart and Craig Zercher

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Conceptual Issues and Analytic Strategies in Mixed-Method Studies of Preschool Inclusion

SHOUMING LI
University of Maryland

JULES M. MARQUART
Vanderbilt University

CRAIG ZERCHER
San Francisco State University

Mixed-method designs increasingly are being used to investigate multi-faceted educational phenomena, but many conceptual and practical challenges remain in combining qualitative and quantitative methods. This paper addresses the conceptual issues by illustrating how 2 analytic approaches were used for different mixed-method purposes in the study of preschool inclusion. Using family and classroom studies as examples, the paper describes practical strategies for conducting mixed-method data analysis in terms of data reduction, transformation, comparison, and interpretation.

Although the quantitative and qualitative dichotomy is still very much in place, a discernible trend toward the use of mixed-method approaches in educational evaluation and research has emerged (House, 1990; Odom & Shuster, 1986). In recent years, an increased number of mixed-method studies have been conducted to focus on various aspects of early intervention such as (a) family perceptions of services and family experiences (Bernheimer, Gallimore, & Kaufman, 1993; McWilliam et al., 1995), (b) child behavior change (Schwartz & Olswang, 1996), (c) views towards inclusion (Buysse, Wesley, Keyes, & Bailey, 1996; Peck, Carlson, & Helmstetter, 1992), (d) personnel preparation programs (Capone & Divenere, 1996), (e) technical assistance projects (Wesley & Buysse, 1996), and (f) functional assessment of children (Arndorfer, Miltenberger, Woster, Rortvedt, & Gaffaney, 1994). These studies have capitalized on the strengths of quantitative and qualitative methods and in effect demythologized the division of the two.

The trend toward mixed-method approaches reflects a new conceptualization of the relationship between opposing objectivist and interpretivist paradigms. At one extreme have been some researchers who see methods as inherently linked to an inquiry paradigm and believe that the fundamental nature and assumptions of paradigms do not allow mixing paradigms or methods (Guba, 1990; Lincoln & Guba, 1985; Smith, 1983; Smith & Heshusius, 1986). A middle position has been that paradigms may not be mixed, but that methods are independent of paradigms and therefore may be combined in the same study (Kidder & Fine, 1987; Rossman & Wilson, 1985). At the other end is a pragmatic approach that views paradigm attributes as being independent and consequently allows mixing of paradigms and methods according to what is most appropriate to address the questions in any individual study (Miles & Huberman, 1994; Reichardt & Cook, 1979). Such pragmatists believe that research on social phe-

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nomena can actually benefit from the differences in the two methods by adopting multiple perspectives and reaching an enriched understanding of the problem under study (Peck & Furman, 1990). In fact, the increase in mixed-method studies supports the prevalence of the pragmatic attitude and provides testimony to Gage's prediction that it would be possible and even desirable for different approaches to work in harmony (Gage, 1989).

Although numerous researchers have employed mixed methods in their research, Greene, Caracelli, and Graham (1989) were among the first to lay the theoretical foundation for the design and implementation of mixed-method studies. They developed a conceptual framework that identified five common purposes for mixed-method designs: (a) *triangulation,* the convergence, corroboration, and correspondence of results from the different methods; (b) *complementarity,* the elaboration, enhancement, illustration, and clarification of the results from one method with those from the other; (c) *development,* using the results from one method to help develop or inform the other method; (d) *initiation,* the discovery of paradox and contradiction, new perspectives or frameworks, or the recasting of questions or results from one method with questions or results from the other method; and (e) *expansion,* extending the breadth and range of inquiry by using different methods for different inquiry components.

To a great extent, the potential benefits of mixed-method designs depend on how the two types of data are synthesized and integrated and what strategies are used to do so. The purpose of this paper is to show what approaches can be used to analyze mixed data sets and how such approaches are linked to different mixed-method intents or purposes. Specifically, we present two analytic approaches to mixed-method data analysis (parallel tracks and cross-over tracks; J.C. Greene, personal communication, October 15, 1998), and use two examples to illustrate how these approaches were implemented in terms of data reduction, transformation, comparison, and integration. Both examples are part of the ecological systems study conducted by the Early

Childhood Research Institute on Inclusion (ECRII), a consortium of five universities across the nation.

OVERVIEW OF RESEARCH

The ECRII research is made up of 21 studies that focus on classroom, family, and policy issues in preschool inclusion. The foundational ECRII study was an in-depth analysis of the ecological systems of inclusion (see Odom et al., 1999). This study was designed to answer key questions about the goals that families, teachers, program administrators, and policy makers have for inclusion; multiple definitions and ways of implementing inclusion; and barriers to and facilitators of inclusion in various settings. In order to understand the complex nature of the social ecology in inclusive programs, ECRII researchers used a mixed-method design for data collection and analysis. The multiple methods and measures provided a broader perspective and deeper understanding of different levels of the ecological systems and the interactions among different levels than could be achieved by a single-method design.

Participants

The ecological systems study and related research took place in 16 preschool programs in 4 geographic regions of the country. These programs were selected by a purposive sampling procedure (Lincoln & Guba, 1985) so that they represented a variety of inclusive models and a diversity of geography, population density, socio-economic status, ethnicity, language, and culture. In each program, five children with disabilities and two typically developing peers and their families were chosen to participate. Children were selected to represent the range of disabilities served in the program, including two children with a severe developmental delay in each program. The sample for the ecological systems study included a total of 16 programs and 112 children and families.

Data Collection Procedures

The ecological systems study followed a field study approach employing a range of quanti-

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tative and qualitative measures (See Table 1). The quantitative data consisted of six, 30-minute direct observations of each child using an ecobehavioral observational system called the Code for Active Student Participation and Engagement Revised (CASPER II; Brown, Favazza, & Odom, 1995); a peer rating sociometric assessment (Asher, Singleton, Tinsley, & Hymel, 1979); and the Battelle Developmental Inventory (Newborg, Stock, Wnek, Guidubaldi, & Svinicki, 1988). Qualitative data consisted of participant observations; open-ended interviews with professionals, administrators, and family members; a Friendship Survey (Buysse, 1993) completed by teachers and family members; and Post-CASPER notes with specific examples of a child's social interaction pattern.

CASPER II is a direct observational system designed to collect information about preschool environments and behavior of children and adults. It provides information about group arrangement, peer group composition, activity or activity area, initiator of the activity, child behavior, child social behavior, and adult behavior. In our study, data were collected on hand-held computers running the software program Multiple Option Observation System for Experimental Studies (MOOSES; Tapp, Wehby, & Ellis, 1995). Observers watched a target child for 2 seconds and then recorded codes for the seven ecobehavioral variables during the next 28 seconds. Each observation lasted 30 minutes. Altogether, each target child was observed six times (3 hours per child) with observations distributed across different days and different times of the day. No child was observed more than twice on any given day. To ensure the reliability of the CASPER II data, two observers simultaneously but independently collected data on two of the six observation sessions for each child (i.e. a total of 32% of the entire sample). Interobserver agreement scores were calculated using the point-by-point interobserver agreement. The percentage of agreement for each coded category ranged from 93% to 98%.

Post-CASPER notes, a form of qualitative data, were taken immediately following each

Table 1.
Classroom and Family Measures in the Ecological Systems Study

	Quantitative Measures	Qualitative Measures
Classroom	• CASPERII (Code for Active Student Participation and Engagement, Revised): a computerized direct observational measure of preschool environment and child/adult behavior • Peer rating assessment: a sociometric assessment of children's popularity • Battelle Developmental Inventory: a standardized test of children's development	• Participant observation • Post-CASPER notes: supplementary notes taken by each observer • Friendship Survey: Teachers were asked to identify the mutual friends of a child and to speculate how the friendship formed • Interviews with teachers, related service providers, and program administrators • Family interviews
Family	• Telephone survey*	• Friendship Survey: Similar to classroom friendship survey, but administered to parents

*The telephone survey was not originally part of the ecological systems study. But it was based on the ecological systems study and data for the two studies were analyzed together as described in the first example.

observation session. Observers were asked to identify the type of interaction that most represented the child's behavior during the 30-minute observation. Specific examples illustrating the identified interaction were provided. Similar to the CASPER II data collection, interobserver agreement on Post-CASPER notes was obtained on two of the six observations for each child. Differences were resolved immediately through discussions between the observers involved.

For the peer rating assessment, children sorted photographs of classmates based on how much they liked to play with the identified child. Children were taught to place photos of a child they liked to play with "a lot" into a box marked with a happy face, photos of a child they like to play with "a little" into a box marked with a neutral face, and photos of a child they played with "not at all" into a box marked with a sad face. A score of 3 was assigned for the *a lot* rating, 2 for *a little* rating, and 1 for *not at all* rating. Mean scores were calculated for each child. The ranking of a child's score within the class also was determined.

Participant observation occurred in each preschool inclusion program two to three times a week for 6–16 weeks. Participant observers wrote field notes that described the physical environment, classroom participants, activities, and interactions among participants. Observations lasted between 1 and 5 hours.

Interviews with professionals and administrators focused on their roles and responsibilities in the program, relationships among staff and with families, perceptions of barriers and facilitators of inclusion, and program policies and philosophy. Interviews also were conducted with the 112 families to learn about their goals and expectations for their children and the programs, their perceptions of how well the programs met their needs, and their perceptions about their child's social relationships and community integration. Interviews lasted between 60 and 90 minutes, with follow-up interviews as needed. All interviews were audiotaped and transcribed verbatim. To supplement the interviews, research staff reviewed relevant documents such as the child's

IEP and classroom notes. Occasionally, research staff attended IEP meetings or other personnel meetings at the child's program. Other family studies included a telephone survey (described later), a longitudinal study on a sub-sample of the 112 ecological systems children and families, a study of the transition from early intervention to preschool programs, and a study of community inclusion.

Data Analysis

For analyses of the mixed-method data sets we proceeded through the steps of data reduction, transformation, comparison, and integration. *Data reduction* is especially necessary for qualitative data, which typically generates a large volume of interview and field note data. The purpose of **data reduction**, therefore, is to reduce the data set to manageable pieces through thematic coding and pattern discovering. In our study, we used an inductive process whereby working hypotheses were generated based on the content of the data. At the beginning of the process, interviews and field notes were reviewed, and potential patterns or thematic categories, as seen by each individual researcher, were noted. Next, researchers within each site met to review their coding, discuss different interpretations, and develop a common set of categories. Finally, researchers from all sites exchanged and synthesized data across sites via telephone conferences and face-to-face meetings. Quantitative data was reduced initially through the production of descriptive statistics, tables, and graphs.

Although data reduction was applied to all of our data, *data transformation* was performed on only a subset of data. One purpose of data transformation is to present the reduced data in a format that best shows its meanings. For instance, a single paragraph might be sufficient to summarize a number of descriptive statistics printouts, or tables and graphs. Likewise, a well-organized matrix could illustrate a pattern in the data better than a few paragraphs.

Central to mixed-method data analysis is the process of *data comparison*. It is mainly here that Greene et al.'s (1989) conceptual framework for the five purposes of mixed-

method research comes into place. In our study, by comparing data from different sources, we could verify findings, interpret inconsistencies, and discover new meanings. The studies reported below illustrate, in detail, how different purposes of mixed-method research benefited our studies.

The final step in mixed-method data analysis, *data integration* is associated with the production of a finished product, which might be an analytic memo, a summary on emerging themes, or a case study report. With the bulk of the work done during previous steps, data integration is the process that weaves what had been discovered into a coherent piece. In our study, as we drew conclusions, it sometimes became necessary to return to the original data and clarify points or verify interpretations. It also should be emphasized that, throughout our research, at each step in the process, we tried to adhere to standards of rigor (McWilliam, 1991). For example, the CASPER II measurement standards for reliability and analysis decisions regarding category development in interview data were recorded for audit purposes.

The two examples of analytic approaches to mixed-methods data sets are presented below in order of complexity, beginning with a family study and ending with a classroom study.

EXAMPLE 1: PARALLEL TRACKS ANALYSIS

Within the qualitative and quantitative data sets, a parallel tracks analysis proceeds separately through the steps of data reduction and transformation until the point of data comparison and integration. This was a useful way for us to conduct the analysis of data from two separate studies of families' perspectives on inclusion. In one study we conducted face-to-face interviews with 112 families as part of the overall ecological systems study. This qualitative method was an appropriate way of gathering in-depth information on the families' perspectives without imposing our preconceived notions about inclusion. A limitation of the interviews, however, was the small sample of 7 participants from each of the 16

programs purposively selected for program diversity and demographic characteristics.

The second study, a telephone survey, was conducted subsequent to preliminary analyses of the family interviews. Information from the interviews was used to frame the topics and questions for the survey questionnaire. The survey was designed to collect standardized information on a broader and more representative sample of families using the inclusive programs. Hence, the qualitative and quantitative methods were used to counterbalance each other's strengths and weaknesses.

The data analyzed here were from family interview and family telephone survey studies in *one* of the 16 ECRII programs. This program was in a large, county-wide school district that offered preschool inclusion through community-based placements in child care centers and preschools. Special education services were provided through an itinerant collaborative model, an inclusive option being offered for the first time during the school year in which we collected data for the ecological systems study.

Data Collection
Interview data. In-depth, face-to-face interviews were conducted with parents of five children with disabilities and two typically developing children. A semi-structured interview guide was used. The protocol asked about the child, the child's service history, the decision-making process about the program, perceptions of the program as well as the child's social relationships, and participation in family and community activities. The interviews were audiotaped and transcribed. Families were paid $25 for their participation in the interview sessions.

Survey data. The survey questionnaire was administered through a telephone interview conducted with the parent or primary caregiver. The survey instrument consisted primarily of precoded closed-ended questions on the child's current program and services, decision-making about the program and educational goals, sources of support for the family, the child's social relationships and participation in activities outside the school program,

and child and family demographic information.

Families using the inclusive child care centers or preschools were the target population for the survey. The school system facilitated research efforts by mailing the recruitment letter and consent form that was prepared by the researcher project. When a family returned their consent form to the school system, the family's name and contact information was provided to research staff who then contacted the family to schedule the telephone interview. Parents were sent a copy of the questionnaire to preview and follow during the actual interview. Of 68 eligible families using the program at the time (2nd year of the inclusive option), 34 consented to participate and 28 actually completed the telephone interview, resulting in a response rate of 41%. Families were paid $10 for their participation. Later analyses showed that the respondents were representative of the population of families using the program on demographic characteristics (e.g., ethnicity, income, and parent's educational level) and on the range and types of the children's disabilities.

The framework for the parallel tracks analysis of the family interview and survey data is presented in Figure 1. The steps of data reduction and data transformation were conducted separately according to analytical procedures appropriate to the respective qualitative and quantitative methods. These separate tracks were then brought together in a mixed-methods analysis at the data comparison and integration stage. The remainder of this section explains how we conducted the steps of data reduction and transformation and how we integrated the two types of data for interpretation according to the expansion and complementarity purposed defined by Greene et al. (1989).

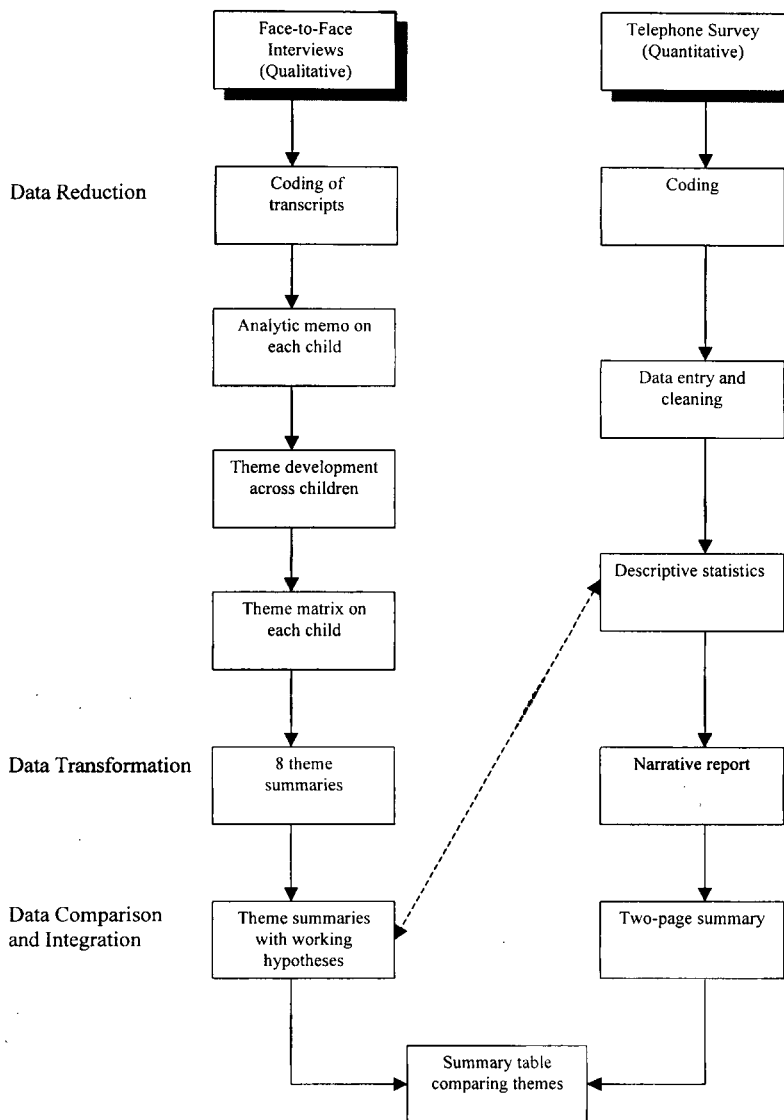## Data Reduction and Transformation

The four members of the site research team took responsibility for separate cases by independently coding different interview transcripts and preparing an analytic memo on each of the seven children in the program (Strauss & Corbin, 1990). These 2–3 page

memos described and began to interpret salient issues related to inclusion for the individual children and families. In discussions over a series of meetings, the research team jointly developed a list of eight major themes for further analysis. The themes were the key constructs across the cases that we used as we continued to organize and interpret data. Eight themes emerged: (a) how and why child was placed in the program, (b) expectations for the child, (c) appropriateness of program for child, (d) family's meaning of inclusion, (e) peer relationships, (f) communication between family and program personnel, (g) helpful and unhelpful providers, and (h) child's participation in community activities. We further reduced the data by preparing a theme matrix on each child (Miles & Huberman, 1994). That is, the team members returned to the transcripts and the analytic memo for each child and displayed information on an eight-theme by one-child summary matrix. This type of data display facilitated comparison and synthesis of individual child information across the seven cases. Analysis of the telephone interview data proceeded through the steps of coding, data entry, and cleaning as well as production of descriptive statistics common to survey research methods. The results were presented in a narrative report with a two-page summary of numerical data for the different variables on the questionnaire.

Data Comparison and Integration

We used the constant-comparative method (Denzin, 1978) to continue analysis of the theme matrices across the seven children and families. We looked for common patterns in the data across cases and began developing interpretations or working hypotheses for each of the eight themes (see example in the Expansion section). Negative case examples were used to refine and sometimes qualify the inferences we were making. We developed a one-page summary with our working hypotheses or assertions for each theme.

At this point, we had summary data for each method in a different form: the eight theme summaries from the interview data and a two-page summary of survey data. To com-

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Face-to-Face                          Telephone Survey
Interviews                            (Quantitative)
(Qualitative)

Data Reduction    Coding of                            Coding
                  transcripts

                  Analytic memo on                     Data entry and
                  each child                           cleaning

                  Theme development
                  across children

                  Theme matrix on                      Descriptive statistics
                  each child

Data Transformation   8 theme                          Narrative report
                      summaries

Data Comparison   Theme summaries                       Two-page summary
and Integration   with working
                  hypotheses

                         Summary table
                         comparing themes
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Figure 1.
Analytic Framework for the Parallel Tracks Analysis.

pare this information more easily, the summary data from both methods were displayed in a table format organized by the eight themes. Table 2 presents a sample of some summary data on four of the themes from the interviews, organized by the theme names.

Having described the analytic process for these two types of family data, we now link these analytic strategies to the purposes of expansion and complementarity from the Greene et al. (1989) framework. Examples of substantive findings are presented for the sake of illustration of methodological issues.

Expansion. Expansion extends the breadth of inquiry by using different methods for different inquiry components. Different methods allowed us to ask different kinds of questions and get different types of information from families. In ECRII it was important to obtain similar quantifiable data on a broader national

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sample of families beyond the 112 families in the ecological systems study. We wanted to determine how important an inclusive program was to families, the extent to which the child received needed special services, and families' satisfaction with the decision making process about the child's educational goals. On surveys it is typical to use Likert-type scales to obtain measures of satisfaction, importance, frequency, and so on. As shown in Table 2 (Theme 2), a high percentage of the families we surveyed said it was very important for their child to be in a program with children without disabilities. A slightly lower percentage indicated their child usually or always received the special services needed and they were satisfied with the way decisions about their child's educational goals were made.

The open-ended interviews, on the other hand, allowed us to understand systems and process interaction variables and underlying reasons for families' perceptions. For example, we explored decision making and program placement for individual families and developed a working hypothesis about the "match or fit" between the child's and family's needs and the program in a successful placement (see Table 2, Themes 1 and 2). When we were able to explain the complexity of this process, the separate pieces of information about family perceptions of what is important in the program, obtained from the interviews and the survey, began to fit together more completely. This iterative process of going back and forth between the two data sets enhanced our ability to build upon and expand the understandings we were developing. It allowed us to incorporate both types of data for a more complete understanding of family choices and satisfaction with an inclusive program.

Complementarity. The use of multiple methods allowed us to measure overlapping but also different facets of inclusion, giving us an enriched, elaborated understanding of the phenomenon. For example, on the survey, one question asked families how helpful different informal and formal sources of support had been to them (see Table 2, Theme 3). In our interviews, families referred to individuals who had been supportive in meeting their children's needs. It was notable who they mentioned (e.g., the bus driver) and who they neglected to mention. For example, families in our small sample never mentioned the related-services therapists who worked with their children, and our classroom observations revealed that children did not receive many related services. The larger survey sample, however, considered the related-services personnel very helpful. We were able to explain that although families overall found the related services personnel helpful, there were conditions under which this was not true. Without information from both the interviews and the survey, we would have drawn different and possibly incorrect conclusions about the role of related-services professionals in this particular program.

From the interviews, we also obtained additional information about characteristics of helpful and unhelpful players to the family (Table 2, Theme 3). Helpful players had a consistent presence in the family's life over time and settings, had a personal investment in the child, provided different types of support, and were a dependable source of information about the child. Unhelpful players were seen as minimizing or disregarding family concerns and engaging in inadequate communication. In turn, these characteristics contributed to our understanding of why families on the survey rated as most helpful other family members, the child's teachers, and other professionals at the program and in the community.

The interview and survey responses about the child's participation in family and community activities also served a complementarity purpose (Table 2, Theme 4). From both methods we obtained similar information about limitations to participation, such as a lack of other young children in the neighborhood, the family's schedule and time constraints, and the child's behavior. From the survey, we learned that the most frequently reported limitation was the child's language skills, which did not arise in our interviews with the small sample of families. From the

Table 2.

Comparison of Information from Interview and Survey Data: Examples of Four of the Eight Themes

Theme	Face-to-face Interviews	Telephone Survey
1. How and why child was placed in program	Two aspects of decision: (1) Community-based "inclusive" option (2) Specific child care center Factors affecting choice: • Visited and liked classroom & teacher • Convenience of location • Flexibility in hours • Good reputation of center • Concern if center would accept child because of behavior	Parents' most important reasons for using program: • Offers special education services or therapies • Provides opportunities for child to learn • Provides opportunities to play with other children
2. Program's appropriateness for child	In successful placement, there is a "match or fit" between child's and family's needs & program. Factors affecting match or fit: • Acceptance by staff & children • Likes activities and routines for child • Child likes program • Sees benefits or specific improvements	• 90% said **very important** for child to be in inclusive program • 80% indicated child **usually or always** receives special services needed • 86% were **satisfied** with way in which child's educational goals were made
3. Helpful and unhelpful players	Characteristics of helpful players: • Consistent presence over time & settings • Personal investment in child • Provides different types of support • Dependable source of information about child Characteristics of unhelpful players: • Minimize or disregard family concerns • Inadequate communication	The **most helpful** supports were: • Other family members at home • Child's teachers • Other professionals in community **and at child's** program
4. Child's participation in family and community activities	Factors that affect participation: • Parent's safety concerns about child • Parent's perception of what is expected of child's behavior • Lack of other young children in immediate neighborhood • Family's own style, schedule, and how it participates in the community	Limitations on participation: • Child's language skills • Family's schedule and time constraints • Attitudes of others towards child's disability • Child's behavior • Lack of other children to play with in neighborhood

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Table 2.
Continued

| Theme	Face-to-face Interviews	Telephone Survey
	• An extended family system was so strong a part of family's culture that family did not need or choose to participate much in the community • Young age of children	

interviews, we learned first-hand that the family's own style and way of participating in the community was perhaps the most important determinant of the child's participation, and that an extended family could meet the family's needs so well they did not need to choose more extensive participation in the community. That type of in-depth information could only be gained through more extensive contact with families that allowed us to understand their preferences and participation in their own contexts.

Summary

This section explained how we analyzed family interview and survey data together for an in-depth understanding of family perceptions of the child's inclusive program. We followed a parallel tracks approach of conducting the steps of data reduction and transformation separately for the two data sets and then bringing them together for synthesis in the interpretation stage. This approach was useful because it allowed us to expand the scope of our inquiry by using different methods for different study components. Likewise, it also allowed us to measure overlapping but different aspects of inclusion, giving us an enriched and elaborated understanding of the phenomenon. Finally, with this approach we could reconcile discrepancies in interpretation that might have occurred had we used only one of the research methods.

EXAMPLE 2: CROSS-OVER TRACKS ANALYSIS

The second example is based entirely on the ecological systems study. As previously mentioned, 16 inclusive programs (four at each geographic location) participated in this comprehensive study. As part of the research plan, we conducted a case study for each of the 16 programs. The purpose of these case studies was to provide an in-depth analysis of inclusion in the programs to determine barriers to and facilitators of inclusion, and to describe idiosyncratic issues. The following sections describe the strategies we employed to analyze and integrate different types of data as

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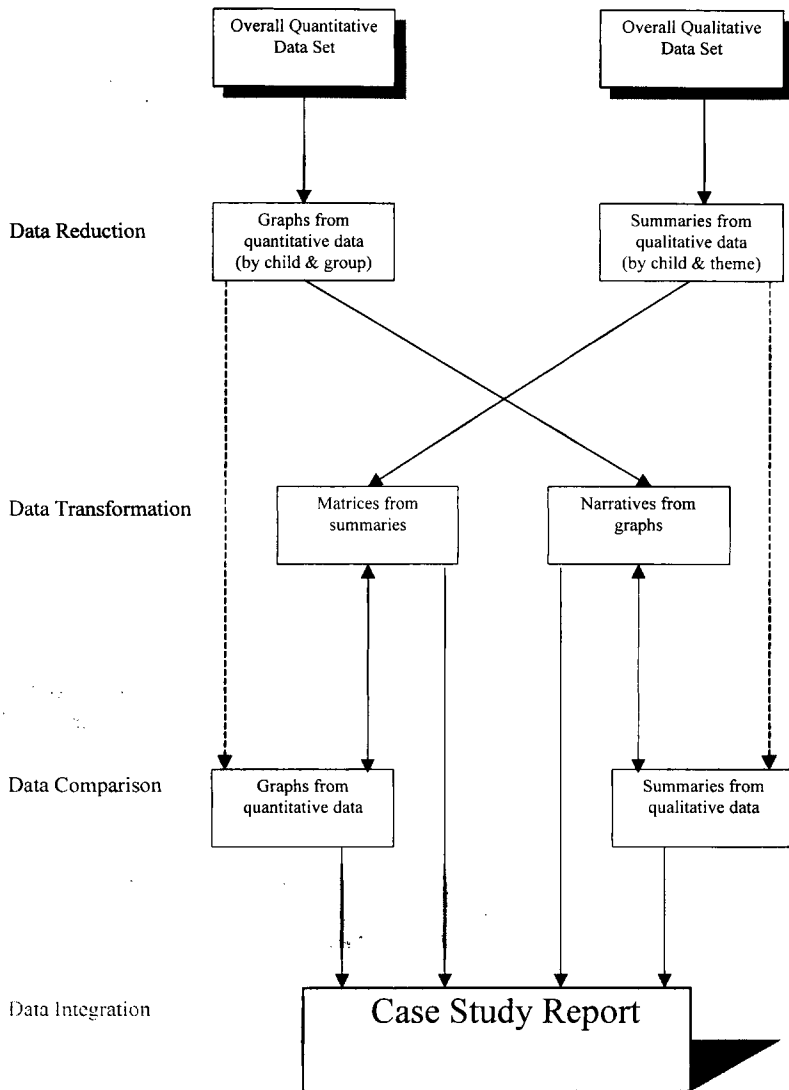
Figure 2.
Analytic Framework for the Cross-Over Tracks Analysis.

we conducted the case study in one program. Figure 2 illustrates the steps in the cross-over tracks analysis for this example.

A cross-over analytic approach is characterized by a concurrent analysis of both qualitative and quantitative data. Data analysis moves back and forth continually between both data sets throughout the stages of data transformation, comparison, and integration.

This approach is appropriate when data from multiple sources are gathered concur-

rently for one single study and both quantitative and qualitative data sets are immediately available for analysis such as was the case in the ecological systems study. It facilitates data comparison, the central stage of mixed-method analysis, by transforming the format of quantitative and qualitative data to make them more comparable. As a result, it is particularly useful for the purpose of triangulation, complementarity, and initiation in mixed method designs (Green et al. 1989) because

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consistency and inconsistencies in data are easily detected.

Data Reduction for Quantitative Data

The quantitative data consisted of CASPER II, a peer rating assessment, and the Battelle Developmental Inventory. For the CASPER II data, we initially ran a frequency tabulation by each of the categories and produced a series of graphs for each child. We then separated the data for typically developing children and children with disabilities so we could investigate the possible differences between the two groups. From the peer rating data, we also generated graphs for each child. In addition, each child's scores from the Battelle Developmental Inventory were displayed in tables. Graphing the quantitative data in the initial stage of data analysis allowed us to visually examine the data and detect any apparent patterns and irregularities.

Data Reduction for Qualitative Data

Data summary. For the post-CASPER notes, we used a predesigned form to highlight the supplementary examples illustrative of each child's behavior pattern during the six CASPER II observations. Findings from the Friendship Survey were reduced to a paragraph-length summary for each child.

Coding. Observation field notes and teacher interview transcripts were entered into Ethnograph 4.0, a computer program designed for the analysis of textual data, and were coded according to a set of thematic categories agreed upon by all the researchers. With the help of computer printouts of thematic coding, we wrote child case summaries regarding his or her participation, peer relationships, adult support, etc.

Vignettes. We found that writing vignettes was a particularly useful strategy in pulling relevant data out of field notes. Participant observations typically yield a large amount of raw textual data of field notes. But as Miles and Huberman (1994) have pointed out, not all data are equal. There are often "rich 'pockets' of especially representative, meaningful data, far short of an interim case summary, that can be pulled together in a focused way

for interim understanding" (p.81). Drawing on such subset of exemplary data, a vignette offered a vivid, story-like portrayal of a particular key event that enhanced our awareness of potentially important issues.

Data Transformation

By now, data reduction had made our data set less overwhelming and more manageable. To pave the way for data comparison and integration, we transformed a selective portion of the data set by converting some quantitative data into narratives and some qualitative data into matrices. This is an example of how we "crossed over" between the two data sets.

Data transformation for quantitative data. Data transformation for quantitative data took the form of written narratives that summarized the most salient points in tables or graphs. Creating such narratives represented an initial attempt to make sense of the data. These narratives reflected portions of the data that were in some way representative and typical of the child being studied. In our study, we used the quantitative data that seemed to set one child apart from the others to generate individual narrative profiles. Such narratives provide the contexts for the numerical data and thus enhance their meanings. The following is an example of a narrative based on peer rating data:

> Mary did not give her ratings of friends because she was unable to understand the instructions. But she received the lowest score of 1.6 from her peers. She was rated 3 (liked by the kids a lot) by Shayla and another boy with disabilities. Her mutual friend Rowland and one other typically developing girl also gave her a rating of 3. She received a total of ten ratings of 1 (not at all liked). She got the only rating of 2 (liked a little) from a typically developing peer.

Data transformation for qualitative data. The post-CASPER observation notes contained specific examples of what an observer saw about a child's positive and negative behavior and her role in adult and peer interactions. These notes, taken right after each CASPER II session, were meant to supplement the numerical data collected by CASPER II. We generated a series of matrices that highlighted the main points in those summaries. The ma-

trices reorganized the data in a new format and made it easier to identify the pattern of the child's social interaction. Moreover, they embedded some numerical information such as the number of positive and negative behaviors. It was therefore possible to make appropriate comparisons between the qualitative and quantitative data sets.

Data Comparison

The next step in our data analysis was to compare the data obtained by quantitative and qualitative measures. Data comparison was done among the two sets of graphs or matrices and summaries for the purposes of triangulation, complementarity, and initiation.

Triangulation. One of the benefits of using a mixed-method design is that research findings are triangulated across multiple data types and sources. As we compared the graphs and summaries, we found considerable convergence and corroboration in our data sets. For instance, a precursor to the understanding of barriers to inclusion is to develop a detailed profile for each participating child. This profile would include a portrait of what a typical day was like for the child, how he or she interacted with peers and adults, and when he or she encountered difficulties. As we worked on this kind of child profile, we tried to make sure that the portrait we painted for each child was accurate and meaningful by triangulating across both data sets. We did this by checking if data from different sources and types gave the similar description.

For instance, Mary, a girl with mental retardation appeared to be the most sociable child in an inclusion program of 30 children. Her gregarious nature was evident in both of the following summary excerpts.

Sample 1: The CASPER II results indicate that Mary is the most sociable and active child among the seven children observed. She interacted positively with adults for 9.2% of the time (the highest of all children), while the average rate for the peers with disabilities was only 3.5%. Her interaction with peers was at 7.5%, which tied her with a typically developing peer. She was the initiator of an activity for a remarkable 25.8% of the time, which was much higher than the average 14.6% main-

tained by the children with disabilities as a whole in her class.

Sample 2: Three girls are sitting in front of the furniture from the house area saying that they are going to church. Again, Mary includes herself in the group by pulling over a rocking chair and saying "I going church". . .She sits there momentarily but then joins another group. After a few minutes, Mary discovers that Tonya has taken over her chair. She tells her to get up. Tonya does, but after Mary sits down, she makes room on her chair for Tonya whom she had just banished. Tonya sits back down on the corner of the chair. In a few minutes, Mary brings over another chair for Tonya. Then Mary starts bringing all the chairs from the house area and puts them in a line. She directs one kid after another to "sit down right here."

The first excerpt is a summary of CASPER II data collected over a period of 3 weeks by 2 observers. The second is part of a vignette based on the field notes taken by a third investigator. The date and time of these observations did not overlap, but both captured the same characteristic of the target child.

Complementarity. Qualitative and quantitative methods have different descriptive strengths (Firestone, 1987). Although numbers can assess empirical reality more precisely, they are less likely to provide details on the process that leads to a certain kind of situation than qualitative data, which are often rich in process-oriented information. Combining the two helps ensure a thorough understanding of the topic under study.

For example, visual analysis of one graph of CASPER II data, singled-out one child with disabilities. This child spent more time than her peers staying by herself outside a group setting. She also spent the least time in circle time, which was the main instructional time each day. Although these numbers told us something about the girl's participation pattern, we also were interested in finding out a reason for her behavior. Going to the qualitative portion of our data set, we examined the matrix made from post-CASPER observation notes and found that all of her six negative behaviors had something to do with her difficulty staying with a group. This suggested that her problem was not confined to circle

time alone but might occur in any of the teacher-directed group activities such as work group, story time, and gym class.

An examination of the field notes and teacher interviews further revealed that the child was actually given tacit permission by the special education teacher to leave the group whenever she wanted. This liberal policy reflected the teacher's educational philosophy that all children should try their best, but if they still could not follow the rules, they should be given time to learn. This special education teacher believed there was no use enforcing rules when a child was not ready. She told us, "I don't judge a child being a model student if they sit with their mouth closed, their legs are folded, and they follow directions. I don't agree with that." The general education teacher, on the other hand, did not share this philosophy. She said, "To me she is not getting what she should get because she is not staying with the group. She doesn't sit down long enough to pick up what we are doing. So if she's not doing that I feel she is not getting what she really needs as far as an education is concerned."

Drawing on different data sources, we were able to identify a unique behavior pattern of a child, and also to understand why she behaved that way and what impact her behavior had on other children. In fact, different philosophies and expectations appeared to be one of the major barriers to inclusion in this program.

Initiation. As might be expected, the two data types did not always corroborate or complement each other. Instead, they sometimes seemed to contradict each other. Whenever this happened, we tried to go beyond the data themselves by looking at their sources, the context under which the data were collected, and the methods by which they were collected. These were likely places where possible explanations for the differences could be found.

In our interview with teachers in one program, three out of four teachers spoke highly of Mary, a girl with mental retardation. They especially loved the way Mary went around hugging her peers each day before she left for home. They thought Mary was the most popular child in the class. The special education teacher even wrote on the Friendship Survey that Mary's disability did not interfere at all with her ability to make friends. But when we looked at the quantitative data in the peer rating graph, we saw almost the exact opposite of what the teachers said. Mary received the lowest score in her class, meaning she was the least popular child.

This apparent disparity was traced to the very source of the data. Our interview data all came from adults, whereas the peer rating data came from children. So the discrepancy was actually between the perceptions of adults and of children. An on-going theme of this preschool was to teach children the value of caring for one another. When Mary hugged others, the teachers perceived her acting out the very values they were trying to instill among the children. The children, however, did not perceive Mary's behavior the same way as their teachers. They thought she was spitting on them because she had a serious drooling problem. In addition, Mary was tall and strong and did not realize her strength. Thus, when she got too close, as she often did, she could easily hurt her peers. Although most of the children did not want to play with Mary, they could tolerate her without outright rejection. That is perhaps one reason why the adults did not realize Mary was not as popular as they thought. This example shows that what adults considered a facilitator of inclusion was actually a barrier for the children. The discrepancy between qualitative and quantitative data led to more complete understanding for the children and the program.

Data Integration

The last step in our mixed-method data analysis was to integrate data from multiple sources in drafting the case study report. In this report, we aggregated and synthesized different types of data to achieve a coherent and holistic understanding of major issues related to preschool inclusion at a particular site.

We implemented data integration at two levels. At the thematic level, we structured the case study report according to a set of major

themes that we came up with as we analyzed the data. These themes were associated with different types and sources of data. Some themes, such as child participation and social relationships, were areas targeted by both quantitative and qualitative measures. Others, such as choice and decision making as well as professional collaboration, emerged mainly in the process of analyzing qualitative data. The case study incorporated findings from both data sources.

Data integration also was done at the interpretive level as we worked on each of the major themes. For themes primarily associated with one data type, we consolidated what we knew by drawing on information from different data sources within the same data type, such as different sociometric measures, or different interviews of teachers, administrators, and family members. For other themes that were best understood by relying on multiple data types, we combined different types of data for a more complete understanding.

The work on data integration was done in a series of regular group discussions among research staff. Each meeting focused on one or two themes. At the meeting, researchers who were responsible for and most familiar with a certain type of data would present the findings to the rest of the group for comments and critique. The process was reciprocal in that certain themes might be revisited and refined across several discussions. Finally, one person took the lead incorporating all the information in a draft of the case study report.

Summary

The cross-over tracks approach started with two sets of data collected for the purpose of a holistic understanding of a specific program. The two tracks crossed each other first at the data transformation stage where some of the quantitative data was turned into qualitative data and vice versa. During data comparison, the focus of analysis shifted back and forth between the two data sets. The process served well the purposes of triangulation, complementarity, and initiation of mixed-method studies. Finally, the two data sets were combined and integrated in the creation of a case study report.

CONCLUSIONS

The purpose of this paper has been to document and disseminate the strategies we used to combine qualitative and quantitative data and methods during the analysis phase in two studies performed by the Early Childhood Research Institute on Inclusion. These strategies were structured according to two frameworks. The first was Greene et al.'s (1989) conceptual framework for mixed-method research. This framework lent clarity to complex research schemes by focusing on the purposes for which the mixed methods were combined. It facilitated decision making regarding what qualitative data and what quantitative data should be collected and how the two types of information could be combined most effectively in the analysis.

Second, we followed a different approach to data analysis for each of the two studies. In the first study, the analysis of each data type proceeded somewhat independently, in parallel tracks, until the data integration and interpretation stage. In the second study, the two types of data were analyzed concurrently, with cross-over between the quantitative and qualitative tracks. The parallel tracks analysis seemed to best serve an expansion purpose, the cross-over analysis was related to triangulation and initiation purposes. Both types of designs supported the purpose of complementarity.

In addition, we brought order and clarity to the data analysis process by dividing it into distinct stages of data reduction, data transformation, data comparison, and data integration. In the data reduction stage, important choices are made about the particular aspects of the data relevant or irrelevant to the research questions. The challenge is to compose a data set that is compact and allows for manageable analysis without losing important aspects of the data. In the data transformation stage, the important decisions revolve around determining the forms of the data that will allow for data comparison (e.g., graphs, narra-

tives, matrices). The challenge involves selecting data of one method type that will mesh with the data selected from the other method type in ways that are appropriate to the research question and the overall purpose for mixed-method designs. The data comparison stage is where the complex and detailed work of interpretation takes place. It is here that the advantages of mixed-method research become apparent. The strengths and weaknesses of each method may be balanced out and a more complete understanding of the phenomena in question may result. Finally at the data integration stage, data from different sources are pieced together to generate a product of some sort for a particular study.

This paper has exemplified how mixed-method designs worked for our research on preschool inclusion. Our research was facilitated by an understanding of different purposes of mixed-method design, the specific analytic approaches, and the division of the analysis into distinct phases. We believe that these frameworks offer great utility and particular advantages in structuring and streamlining data analysis in mixed-method research.

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