A SOCIAL DENSITY MODEL OF CHILD/TEACHER RATIO EFFECTS IN EARLY CHILDHOOD SETTINGS

by

Kenneth Nathan Asher

A Dissertation Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Greensboro
1978

Approved by

Mary Elizabeth Keister
Dissertation Adviser.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of the Graduate School at the University of North Carolina at Greensboro.

Dissertation Adviser Mary Elizabeth Keister

Committee Members [signature]

[signature]

[signature]

[signature]

May 4, 1978
Date of Acceptance by Committee

May 16, 1978
Date of Final Oral Examination

ASHER, KENNETH NATHAN. A Social Density Model of Child/Teacher Ratio Effects in Early Childhood Settings. (1978) Directed by: Dr. Mary Elizabeth Keister. Pp. 185.

Following a review of research in child/teacher ratio, group size, crowding, and density in young children's settings, a model was developed to predict the short-term behavioral effects of variations in child/teacher ratio, based on Freedman's density-intensity hypothesis. In this model, it was proposed that ratio effects on children's behavior are better conceptualized as functions of the two variables, number of children and number of teachers present in a behavior setting. Hypotheses were generated for the relationships between these two independent variables and five a priori dependent variables of children's epistemic behavior. Specifically, it was predicted that as number of children increased: social interaction with peers would drop; interaction with teachers would drop; interaction with the physical environment would not change; solitary behavior would rise; and passive behavior would rise. As number of teachers increased: interaction with peers would not change; interaction with teachers would rise; interaction with the physical environment would not change; solitary behavior would drop; and passive behavior would not change.

In order to test the hypotheses, permission to use data from the National Day Care Study was obtained. Free play behavior records of 1224 3- and 4-year-old children were analyzed. Twenty-six items of the Prescott Child Observation

System were taken from one hour observations made during the Fall, 1976 and Spring, 1977. The observations included records of the number of children and number of teachers present in the rooms at the time.

The original behavioral data were factor-analyzed, enabling reduction of the information on each child to 11 Fall factors and 12 Spring factors. These factors were used to create factor scores, which were treated as dependent variables and correlated with number of children and number of teachers. The factors were also regarded as measures of the a priori variables: a factor either was or was not judged to represent each a priori variable. In this way, a connection was made between the independent variables number of children and number of teachers, and the five a priori variables, through the 26 behavior variables.

The results showed that ten factor score dependent variables were significantly correlated with number of children ($p < .1$), and six were significantly correlated with number of teachers ($p < .1$). The 11 Fall and 12 Spring factors proved to represent the a priori variables well: each a priori variable was matched with between five and fourteen factors, and a sixth category of children's behavior, task involvement, was created from six factors.

The net effects of increasing number of children were drops in interaction with peers, in interaction with teachers, in solitary behavior, and passive behavior, and rises in

interaction with the physical environment and task involvement. Only the hypotheses for interaction with peers and with teachers were accepted.

The net effects of increasing number of teachers were drops in interaction with teachers, in interaction with the physical environment, in solitary behavior, and in passive behavior, and rises in interaction with peers and in task involvement. Only the hypothesis for solitary behavior was accepted. It was concluded that number of children was relatively more important than number of teachers in its effects on preschool children's epistemic behavior, and that smaller group sizes were more beneficial than larger ones. The usefulness of separating child/teacher ratio into number of children and number of teachers was supported, insofar as the confounding of those variables in this study permitted.

ACKNOWLEDGMENTS

By the time a project such as this reaches its final stages, it is practically a social movement. It is certainly much more than a lone graduate student writing in his tiny garret in occasional communication with his advisor. In the present case, Dr. Mary Elizabeth Keister provided inspiration and keen insight over a year and a half fraught with decisions, dilemmas, and deadlines. The dissertation committee, consisting of Drs. J. Allen Watson, Hyman Rodman, Anthony DeCasper, and William Powers, helped make this an enriching and enjoyable, yet also challenging task. Special thanks are due Dr. Powers for his time and tolerance over the past six months and for his special gift of an education in research statistics and design. A sixth individual, Dr. Marilyn T. Erickson, has been a model of problem-solving skills, professional behavior, dedication, and moral support over at least three years. She has been my "professor without portfolio" during much of that time, but has been appreciated nevertheless.

This particular project could not have been conducted without the National Day Care Study. I thank Mr. Allen Smith of the Administration for Children, Youth and Families, Department of Health, Education, and Welfare, for his permission to use a portion of the data from the NDCS, and his associate, Dr. Carol Spence, for her kind assistance. I owe a similar debt of gratitude to Drs. Richard Ruopp, Jeffrey

Travers, and David Connell, as well as the rest of the NDCS staff at Abt Associates.

Finally, three individuals have provided special encouragement and love over the four years leading up to this degree. These have been Dr. Mary Elizabeth Kelly--my partner and co-visionary in thought and deed--and my parents, of whose enormous spiritual and material investment I hope to prove worthy.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued) Page

LIST OF TABLES

LIST OF TABLES (continued) Page

Table

LIST OF TABLES (continued)

LIST OF TABLES (continued) Page

Table

LIST OF TABLES (continued) Page

Table

CHAPTER I

INTRODUCTION AND THEORETICAL DISCUSSION OF RATIO, GROUP SIZE, AND DENSITY

Despite the great interest manifested in young children's behavior and development in group environments, relatively little research has been devoted to the role of quantitative, directly manageable dimensions which describe such environments. These would include the number of children of different developmental levels present, number and roles of adults present, the amount and organization of space, and the availability of various resources. Manageable here means not only manipulable, but also able to be regulated to meet widely agreed-upon criteria.

This paper is concerned with the social stimulation variables of child/teacher ratio and group size in early childhood settings. The paucity of empirical research on these topics is doubly ironic, since research in contrived and natural settings along related lines of crowding and density has been mounting since the mid-1960's, accompanied more recently by rudimentary attempts to construct a theory of social-environmental stimulation. Thus in addition to covering pertinent research and some others' discussions of group environments, this review will attempt to expand one existing quasi-theoretical approach to cover child/teacher ratio and group size effects, and propose a model to explain

and predict their influences on a selected subset of young children's behavior in group settings: epistemic or information-getting and -giving behavior.

Some of the most persuasive empirically-based support for changing or retaining existing practices has consisted of concept and review papers, policy statements, and professional reflections by individuals with substantial backgrounds in designing and managing young children's programs. Thus much of our current knowledge of the effects of the previously mentioned "manageable variables" comes from associating commonly observed levels of these variables from various programs with different patterns of children's behavior and other outcome variables. It is the rare study which has ensured before hand a reasonable range of variation in the manageable (independent) variables and then sought effects on children's behavior, development, and other indicators of program outcomes.

In this initial chapter, effects of children's group environments on participants' behavior will be approached along a gradient beginning with an intuitive, a priori discussion of ratio and group size. The body of literature consisting of general review and concept papers in ratio and group size will then be covered, followed by the introduction of the notion of density/crowding as a way to organize ratio and group size phenomena. The chapter concludes with a specific proposal to analyze children's behavioral data,

gathered with group size and ratio questions in mind, in terms of density.

Intuitive Discussion of Ratio, Group Size, and Related Variables' Effects

Several effects are to be expected as the ratio of children to teachers rises, as the size of the children's group increases, and as other factors vary. These intuitive hypotheses are based chiefly on numerological reasoning; that is, the frequency of behaviors expected from a group is related to the number of individuals or basic units multiplied by the individual rate of such behaviors.

The simplest behavioral effects expected are those due to straightforward variations in size-of-group. As the number of children increases, the number of interactions any particular child encounters with other children should also rise. Children in larger group sizes should spend relatively more time interacting with one another than with themselves or the physical environment. This should be true of both positively- and negatively valued behaviors. Also, as the number of children present increases, the complexity of interactions should increase. Less direct effects of larger group size should include aimless or passive activity intended to block out stimulation ("wipe outs"), and more frequent intrusions into ongoing activity.

If child/teacher ratio is defined so that it increases as the number of children increase per adult (i.e., literally),

then some ratio effects (those involving self or peers) would be the same as the group size effects discussed above. The important feature to consider in child/teacher ratio, however, is the effect of the teacher. Thus as ratio increases, children's contact with the teacher or caregiver should drop, since more children are competing for a finite resource. At the same time, the demand on the staff is increasing, and their levels of interaction with the children should rise. A more subtle means of coping with the heavier loads might be an increase in structured, teacher-centered activities. High-ratio staff might also be expected to overload and "burn out", especially later in the day.

Variations in the amount of play space and material resources can serve as mediators for group size effects. At constant levels of group size, decreasing the amount of play space should enhance the likelihood of children interacting with one another, especially negatively. This enhancement should be reduced in play areas which are more organized than others, with special areas set off for art, blocks, and large-motor activities, for example. Similarly, increasing the amount of material resources such as toys, books, and easels should reduce the number of child-peer interactions, with an increase in children's activities directed at the environment.

Longer-range predictions of the effects of the above factors, that is, those projecting beyond the immediate

program setting, are of great interest. Despite their importance to basic and applied research, program-planning, and policy-making, however, such hypotheses regarding development and extended behavior change can reasonably only be based on the expected short-range effects suggested above. The most confidence can be placed in the impact of factors which act powerfully, pervasively, and continually in the short range.

Relatively strong effects are expected for ratio and other factors closely related to the influence of teachers and caregivers. In the realm of social behavior and development, sanguine (i.e., low) ratios and "high quality" professional behavior are most likely to highlight teachers as positive models, give them time to solve problems and interact with children individually, and provide coherence and control when needed. By similar reasoning, learning and cognitive development are most likely to show relationships to variations in these factors. Additionally, teachers' use of more mature verbal and symbolic forms of expression, and the creative and appropriate utilization of the classroom environment lend support to ratio and other manageable environmental variables' value in predicting long-term effects.

Group size would not be expected to have great effects felt beyond the immediate day care or preschool environment simply because its short-term influence chiefly originates in the peer environment. The strongest effect of variations in

group size should be that between none versus some (i.e., no peers versus one or two), with differences in sheer amount of stimulation small. Larger groups will, however, be more likely to provide a greater diversity of social experiences to its members.

Conventional Analysis of the Early Childhood Environment

The "numerological" approach to generating intuitive hypotheses for the effects of group size, child/teacher ratio, and other environmental dimensions constitutes a first approximation to estimating the quantity and quality of stimulation experienced by participants in these settings. Many terms are used by researchers, practitioners, and developers of policy to refer to what amounts to a few constructs, with clarity and consistency frequently the victims.

No better examples of this confusion exist than child/teacher ratio and group size. These two variables are manageable, readily intervened-upon dimensions of early childhood programs which bear great promise of being related to environmental and developmental quality. Yet for each of them there are two or three definitions, each bearing somewhat different implications from the rest. An extensive and consistent research literature does not exist for any of them to allow confident decisions to be made regarding the best definitions. Group size can simply refer to the number of children assigned to a room, the number of adults assigned to a group at a certain child/teacher ratio, or the density of children

and adults (i.e., number of people in a given amount of space); any of these definitions can be justified. Similarly, child/teacher ratio takes on somewhat different specific meanings if "children" refers to those permanently enrolled, in the room during an observation, or the result of some algorithm. Defining "teachers" also entails deciding between all staff available in a program, all those in a classroom throughout the day, only those present during the observation, or some other representation, possibly assigning weights to different levels of responsibility.

Despite the paucity of applied or program-applicable basic research with children in social environmental variables (ratio, group size, room space, density), and the near non-existence in such research of long-term effects, greatest interest remains of course in developmental outcomes associated with variations in these variables. A large amount of conventional wisdom, professional experience, and indirect deduction from programs in which ratio comprised only some of the environmental differences have substituted for empirical support for hypotheses and decisions affecting not only millions of children but also the clarity of constructs of a major area of developmental psychology. In such overviews, psychometric indices of early competence (D.Q.) and intelligence (I.Q.) have been the most popular dependent measures of development in different group environments, to the exclusion of other intellectual and social variables, and indicators

of physical activity, growth, and biological processes. (This is in partial contrast with "laboratory" studies of variations in stimulation, such as those of McGraw (1935), Rheingold (1956), Brossard and Decarie (1971), and Gesell (1954), and field experiments in early intervention, stimulation, and day care, such as those of Skeels (1966), Keister (1970), Caldwell et al. (1970), and Robinson and Robinson (1971). In these examples much information was sought on development in a broader sense than D.Q./I.Q.)

Fowler (1975) defends D.Q./I.Q. as the index of choice in studying environmental effects on development, arguing that it is a construct which is reliable, standardized, and as valid as can be expected for a measure which covers so broad a range of abilities. He says that ratio does have an important developmental impact on infants in the direction expected by intuition: Low ratio (1-2 children per adult) conditions are much more likely to be associated with favorable development than high ratio conditions (8 or more children per adult). Evidence is given for this in the enhancement of low or maintenance of high D.Q./I.Q. scores, or a combination of both, in the former conditions over the latter. The middle range of ratio effects (3-7 children per adult) is seen to provide a continuity of effects between the low and high ratio extremes--neither very beneficial nor very harmful.

Because no studies reviewed by Fowler isolate ratio or density as the sole source of variation, other than possibly

the Skeels data (Skeels, 1942, 1966; Skeels & Dye, 1939), he was forced to compare outcomes of programs with extremely low (i.e., good) ratios against those from different ones with extremely high ratios, confounded by numerous other variables. Primary effects were not attributed to child/teacher ratio per se, but rather to the increase in individualization and sheer amount of flexible, personal attention made possible as caregivers had fewer children to care for. Fowler also cited disturbances in language, social, and personality development in settings with extremely poor ratios, but with little elaboration. It is critical to note, however, that a major difference between most extremely high ratio settings studied, and most extremely low ones is that the high settings were residential, institutional facilities in which the children had little or no contact with their parents. The low ratio settings were generally specially-funded and -designed daytime facilities for children who lived at home with at least one parent. This difference itself forces suspension of any certain judgment regarding the effects of child/teacher ratios on young children's development, despite the intuitive reasonableness of such a notion.

That child/teacher ratio indeed does not operate very directly on developmental processes is suggested by the weak effects noted by Fowler (1975) and others in the middle range of ratios for day care intervention programs. In a very general sense, outcomes for these environments do fall between

the positive effects found in low ratio programs and negative effects for high ratio ones: Children's D.Q./I.Q.s remain at or above expected levels for their population categories with virtually no harmful effects reported. One can also interpret the lack of differences attributable to ratio as an indication that it actually is not that important in determining development over an extended period of time. That is, even if immediate or short-lived behavioral variations were to be found, children would proceed to grow normally, possibly reflecting their daytime environments in other ways but not in classic measures of development. The results from these middle-ratio programs deserve special attention, both because they are more representative of ratios and environments found in day care and early education settings in the United States today, and because the highest ratio in this range--8 children per adult--is still more than double the lowest ratio.

Other workers (Mathematika, 1977; Meyer, 1977; Ricciuti, 1976; Willis & Ricciuti, 1975) refer to the same body of literature that Fowler does, plus a variety of additional work dealing with dependent variables other than I.Q. They also agree that low ratios can at best increase the likelihood of individualized, stimulating environments, but that the existence of such positive settings depends on other factors, most of which are related to the way caregivers and teachers structure their activity. Meyer, especially, in his

detailed review of staffing characteristics and early childhood programs, points out that children exposed to low child/teacher ratios are quieter, less aggressive, and test higher. He adds, however, that group size, freedom to form natural clusters based on caregiver and child characteristics, program characteristics and philosophy, and other classroom and staff attributes play as important and sometimes more direct roles in child outcomes.

Children's Group Environments Conceived in Terms of Density and Crowding

Group size and, to a great extent, child/teacher ratio are approached most closely by investigations of crowding and density of individuals in a given area. Ratio can also be discussed in terms of the degree of structure and control in a classroom. Both of these concerns (crowding-density, structure-control) can be conceived as problems in environmental stimulation--its sources, dimensions, optimum levels for certain outcomes, and implications over relatively long periods of time (Wohlwill, 1966).

The majority of the limited amount of research available has been devoted to the effects of crowding and density. While at first thought, crowding appears synonymous with high density (many individuals per unit area), various writers argue that a more complex distinction would be helpful (Lee, 1973; Rapoport, 1975; Stokols, 1972). The drift of their reasoning is that density should describe objective levels

in numbers of individuals present in a given space, or at most be proportional to the amount of socially-originated stimulation available (Rapoport, 1975). Crowding refers to the phenomenal state associated with high levels of socially-related stimulation. While high density is generally identified as the basic cause of the sensation of crowding, it is quite possible to create highly stimulating situations with relatively few people present, and conversely to diminish the intensity of stimulation in high-density settings. It is along this path from density to the phenomenal affective state that the organization of the stimulating environment operates. Such agents as the architectural design and features of the setting, activities of the participants, their needs-states and prior experiences, and amount and form of organization such as that provided by an adult over a group of children mediate density's action.

Crowding, then, can be seen as one of a range of possible psychological effects of variations in density and related environmental dimensions. Crowding of course is a rather unpleasant sensation, and possibly harmful if experienced over extended periods. High-density situations might, however, be experienced as pleasant under certain conditions: A group may feel solidarity and security, for example. In an early childhood setting variations in density might be associated with feelings of comfort or distress, frustration or satisfaction, attention or distraction, interest or apathy,

amiability or hostility, concern for others or selfishness, and many other alternative states for which students of child development have devised means of observation and assessment.

Density can be manipulated both by varying the number of individuals present or the amount of space available. Social density has come to mean the operational variable present when people are added or removed; spatial density is the operational variable brought into play by reducing or increasing the area. Judging from qualitatively different effects in several experiments with children and adults in which social and spatial density can be compared, the two methods are evidently not fully equivalent (Asher & Erickson, 1977; Ginsburg & Pollman, 1975; Hutt & Vaizey, 1966; Loo, 1972, 1976; Loo & Kennelly, 1977; Loo & Smetana, 1977; McGrew, 1970; Nogami, 1972). The overview from these experiments is that social density affects people's behavior more strongly in more cases than spatial density.

Desirable-, neutral-, and non-effects of varying density are more than mere possibilities in the research literature. As will be discussed in greater depth in the next chapter, undesirable effects (e.g., aggressive behavior, discomfort, poor task performance) of increasing density are not the norm. Typical results of varying density alone (i.e., main effects) include changes in social interaction, in activity level, and in proximity to others in the room (Loo, 1972; Rohe & Patterson, 1974; McGrew, 1970, respectively), which might

be described as process variables with no particular positive or negative values attached to them.

Freedman (1975) has been involved in a variety of crowding and density studies employing demographic, survey-interview, and controlled laboratory methods. He discusses the evidence that density is not consistently associated with negative outcomes at great length, and proposes a mechanism (the "density-intensity" theory) to account for this. Basing most of his thinking on a number of laboratory experiments with adult subjects (with much secondary support from demographic and "special situation" research such as submarine and space capsule training), he suggests that density or crowding per se does not change people's behavior, but rather serves to intensify their typical reactions to a situation. That is, variations in density itself do not create changes in hostility, social interaction, task performance, stress, or other psychological dependent variables used in this research. Effects of factors which already account for some differences, whether within- or between settings (some examples are sex, individual personal space styles, participants' familiarity, comfort of the furniture) will be magnified, however, by increasing density. Freedman's hypothesis makes intuitive sense, and is supported by several examples which he cites.

Loo and Kennelly (1977) use data from their factorial study of social density, sex, and personal space style to

test Freedman's density-intensity hypothesis. They found that it helped explain some but not all of their experimental effects (chiefly those due to sex), and also refer to other density research for which Freedman's hypothesis is deficient. Their conclusion is that density intensifies or interacts with (for that is the statistical translation of the theory) only some variables, which presumably must be determined empirically.

Loo and Kennelly's discussion is particularly important here, because it is based on carefully-conducted research, with children as subjects, and concerned with natural behavior and reactions to density. Their criticism suggests a final point to be made about density-intensity and a modification which may lend itself to analyzing child/teacher ratio effects. This is that its strongest support comes from spatial density research. All the research which Freedman conducted to demonstrate his hypothesis (Freedman, Heshka, & Levy, in Freedman, 1975; Freedman, Heshka, Levy, Buchanan, & Price, 1972; Freedman, Katz, & Kinder, 1972; Freedman, Klevansky, & Ehrlich, 1971; Freedman & Staff, in Freedman, 1975) holds group size constant while varying space, and it is significant that Loo and Kennelly's experiment and several others which do find main density effects (weakening Freedman's hypothesis) are of social density.

It may indeed be the case that varying spatial density intensifies other variables' influence on behavior without

exerting its own specific effect. Whatever is happening with a particular group due to its members happens more strongly, sooner, more often, et cetera, the nearer they are to one another. Varying the size of the group while holding area constant is not necessarily equivalent to varying spatial density, as was briefly noted previously. Two possible differences are those due to novelty and intra-group diversity. As group size increases, it takes longer to get to know each member. Furthermore, the number of ways in which the members can vary expands with increasing group size. These and other differences between social and spatial density can only serve to make the former a more complicated phenomenon than the latter.

There are many ways in which the members of a group can differ among one another, some of the more ubiquitous being personality type, cultural identity, sex, cognitive style, and developmental level. An extreme form of the last case is that of a group composed of very young and relatively old individuals, such as in a school or day care center. This suggests that the simplest (least confounded) and most supportable (from the existing literature) way to analyze the effects of the social environment on children's behavior is not to use child/teacher ratio as a variable, but rather to maintain separate variables for number of children and number of teachers. Thus, separate sub-group sizes or sub-densities would be created for each division of the total group. The

effect of any particular one of these subdivisions must be determined empirically; determination of their independence is a theoretical problem.

There are several advantages in considering children and staff as separate factors. First, as discussed above, the diversity of types of group members is preserved, while counting both children and adults as members with equal empirical status. Second, a major benefit of this scheme is that the statistical interaction between children and teachers can be computed and discussed more satisfyingly than the ratio x group size interaction, since "number of children" and "number of teachers" are of the same units (namely, people). The second point is tied to a third one, which is that separating children and teachers to permit computation of their interaction may actually reflect environmental differences most realistically. A ratio x group size analysis would yield the same statistical information while not being expressed in terms of the sources of the stimulation.

Hypotheses for the Present Investigation

In the present study, a portion of the observational data from a large-scale investigation of preschool day care in the United States will be subjected to an analysis based on the above model. Variations in 3- and 4-year-old children's learning and overt cognitive activity will be inspected as functions of the number of teachers and number of children in classrooms during free play periods. It is expected that

these two independent variables will have qualitatively and quantitatively different effects on children's epistemic behavior. The qualitative distinctions refer to different naturally-occurring types of activity. While it is difficult to specify these activities a priori, it is anticipated that they will vary on dimensions related to the level of a child's activity and the extent of his involvement with others.

In particular, it is proposed that relationships exist and can be predicted between the number of children and number of teachers in a preschool day care setting, and the children's epistemic (information-giving and -receiving) interactions with the social and physical environment. These interactions will be identified by grouping specific behaviors empirically (see Loo's research in the next chapter).

The first hypothesis is that the types of activities identified will differ along dimensions of amount of children's activity, extent of involvement with others, and objects of their interactions (peers, adults, physical environment). This is, in a sense, a conservative prediction. It means that from many different specific behaviors and objects of interaction in the early childhood setting, a simpler pattern will emerge which will be related to the traditional ways in which children's behavior has been described.

The second (concerning number of children) and third (concerning number of teachers) sets of hypotheses together simultaneously express child/teacher ratio as an example of

social density, and test the distinction made in the previous section between social density and spatial density. These are that increasing number of children and number of teachers will have different patterns of effects on the dependent variables. While this seems to be a fairly safe route to take, some specific relationships can be predicted.

With more children in the room, interactions with peers on epistemic behaviors will drop (a generally supported trend in the literature for "desirable" behavior). Interactions with teachers will also drop for each child (see Asher & Erickson, Tizard et al.). Interactions with the physical environment will not be affected (despite suggestions of a negative relationship).

With more teachers in the room, interactions with peers and with the physical environment will not change (see Asher & Erickson for the former). Interactions with teachers will rise. A more detailed context for these hypotheses will be developed in the next chapter, which reviews research on child/teacher ratio, group size, and density.

CHAPTER II

RESEARCH IN CHILD/TEACHER RATIO, GROUP SIZE, AND DENSITY

In this review, a major distinction will be made between research with animals and human adults on the one hand, and with children on the other. In the former, animal studies will be given extremely short shrift, and adult research will only be covered which demonstrates Freedman's density-intensity theory, or which is directly pertinent to older people's behavior in children's settings. Most space will be devoted to research with children.

The particular methods used to study density and its relatives have become confounded with the different populations of interest. Animals have generally been studied for their biological and long-term behavioral adjustments to especially intensely crowded conditions. Adults have been studied chiefly on their task performance and verbal response to questions in structured situations varying in density, sometimes to very high levels but rarely under unpleasant conditions. Children have also been observed in conditions of varying, but rarely extremely crowded densities, with their natural social behavior in such situations being the main domain assessed. A reasonable development in density research with children, then, would simply be the utilization of the types of measures commonly found in research with other

populations, namely biological variables (e.g., heartrate, EEG, skin resistance) and more standardized or structured psychological variables (e.g., amount of material learned, attitudes toward situation, performance of task). Complementary points can also be made regarding research with adults. (See Loo (1973), Loo & Kennelly (1977), and Loo & Smetana (1977).)

Social Environmental Studies with Animals and Human Adults

While there have by this time been many studies of density, crowding, and overpopulation with animals and human adults, they will not be reviewed at great length here. Basically, animal studies have shown that as conditions become increasingly crowded beyond normal densities, pathological behavior increases while overall balance in social functioning declines (e.g., Altman, 1975; Calhoun, 1962, 1966).

In one field experiment (Bernstein & Draper, 1964) which may be construed as informative to questions of child/teacher ratio in humans, a group of young rhesus monkeys was observed alone (i.e., the group alone) and in the presence of an adult (male). With the adult present, the group exhibited a more mature set of behaviors, inhibiting play and assuming aggressive postures during a greater number of observations than with the adult absent. This can be argued to be a structural difference at the group level, of the general sort that might be sought as child/teacher ratio varies.

Most studies of high density with human adults have not found great impacts on the dependent variables chosen, which have mostly been individual task performance, attitude and mood questionnaires, and other obtrusive measures (rarely "natural" functions; see Webb, Campbell, Schwartz, & Sechrest, 1966; Willems & Raush, 1969). Generally, such subjects show an awareness of high density but do not respond differently because of density per se.

Almost all of the experiments which Freedman (1975) cites in support of the density-intensity hypothesis consist of laboratory studies of spatial density with adults, assessing their task performance, mood, and attitude through paper-and-pencil and structured-situation tests. It is possible to summarize Freedman's research without going into detail for each experiment. Subjects ranging from college- to middle-age were placed in same-sex or mixed-sex groups of between four and nine individuals, although group size was always held constant in particular experiments. Reciprocal densities (an easier way of representing density) varied from about 3 to 25 square feet/person, with average levels roughly 15 sq. ft./person.

The procedure for the spatial density experiments usually began with personal introductions and 30 to 60 minutes of discussion, followed by a number of tasks, and ending with mood and attitude questionnaires. Examples of the tasks were anagrams, algebra problems, Prisoner's Dilemma, mock jury

duty, and criticizing or praising others' speeches. Freedman reported no effects for density alone, but interactions between density and sex, pleasantness of task, and difficulty of task (pleasantness and difficulty were experimenter-manipulated variables). The interactions all took the form of increasing differences between conditions at higher than lower density levels. The experiments from which this summary is drawn are Freedman, Heshka, and Levy (reported in Freedman (1975), Freedman, Heshka, Levy, Buchanan, and Price (1972), Freedman, Katz, and Kinder (1972), Freedman, Klevansky, and Ehrlich (1971), Freedman and Staff (in Freedman, 1975), and Griffitt and Veitch (1971).

Four studies were found in which adults' natural behavior in early childhood settings was observed or otherwise assessed as a function of some density dimension (Asher & Erickson, 1977; Crayton, Scoble, Hogan, & Fiene, 1977; Prescott & Jones, 1972; Tizard, Cooperman, Joseph, & Tizard, 1972). Many of the issues relating the description of children's social and physical environments to prediction of program quality have been raised in an ecological framework by Elizabeth Prescott and her associates (Prescott & Jones, 1972). A survey, using both observational and interview methods, at 40 day care centers (out of a field of 380) in Los Angeles is pertinent to the present topic of social environmental effects on teachers' behavior. Information was sought on behavior regarded to be communicative or uncommunicative, the

apparent purposes of the teachers' behavior, and the amount of teachers' behavior judged to encourage verbal skills in children.

In this study designed to be sensitive to complexity, complex relationships were found. Children in the 40 programs were observed in activity settings embodying ratios ranging from 5-14 children/teacher, engaged in both "essential" activities (lunch, snack, cleanup/toileting, nap) and "optional" activities (free play, free choice, teacher-directed group activity, teacher-directed individual activity). Teachers' communicative activity rose, then fell around a total group size of about 19 children. The lower range of group sizes (5-9 children) was associated with most of the instances of free choice given children by the teachers. Overall, however, factors such as the organization of space, program format, and deployment of teachers were regarded to be more important than child/teacher ratio and group size. The structural ecology of a program was discussed in terms of forcing choices for teachers or giving them flexibility.

Tizard et al. (1972) visited 13 children's residential nurseries in Britain, which differed from one another on several structural dimensions: child/staff ratio, autonomy of the staff and group, stability of the staff, and the age-distribution of the group (overall range 24-59 months). Since these measures were highly correlated within sites, each

group was given a composite score in which higher scores represented "better" nursery environments. Forty-six children were given several cognitive and verbal standardized tests, while 85 children and their caretaking staff were observed on several measures of verbalization, staff activity, and staff verbalization. Relationships were then sought between nursery quality (of which child/staff ratio formed an important element), children's test performance, and child and staff behavior.

Staff activity was broken down into housework, physical child care, supervision, and reading and other play and social activities; staff verbalization consisted of informative talk, negative control, positive control, pleasure and affection, displeasure and anger, presentation of choices, and supervisory talk. The following were positively related to nursery structure (i.e., better or lower ratios): amount of social and child-active play, informative talk, commands accompanied by explanations, staff remarks answered by children and children's remarks answered by staff members. Negative commands by staff were negatively correlated with nursery composite scores. While no significant effects were observed on staff talking for increasing the number of children (in the range of one to six children) with one nurse present, increasing the number of staff present in this low range (thereby improving the child/staff ratio) actually had the result of decreasing staff interaction with children by

about 40%, with a parallel rise in staff interaction with other staff. Results of this study for the children's behavior and test scores will be discussed in the section on children's ratio effects.

The last study concerning density effects on adults' behavior in early childhood settings is Asher and Erickson's (1977) field experiment with the toddler group of a private day care center (mean age 19.2 months). Sixteen children and their two caregivers were observed in three ratio conditions (4-, 8-, 12 children/1 adult) and two group size conditions (8/1, 16/2) during the morning free play sessions. Of ten adult behaviors recorded, five increased as the ratio increased: number of vocalizations to children; touching children positively; bringing body to children's level; moving about the room; and number of children within three feet of the caregiver. Only touching children positively changed significantly with larger group size (increasing). These results were interpreted as reflecting the increase in demand and work load experienced by the caregivers as child/teacher ratio increased. Results of this study for children will also be discussed later.

One extra experiment reports the effects on day care caregivers' and toddlers' activities as functions of the ratio of preschool-age children (range 3-5-years-old) to toddlers (range 18-30 months) and of play structure (Crayton et al., 1977). Three adults were observed with twelve

children in three preschooler/toddler ratios (0/12, 6/6, 9/3) and two play situations (free, structured), always maintaining a child/adult ratio of 3/1. As preschooler/toddler ratio increased, caregivers used fewer commands and more questions. They also participated less and engaged in more not-directly-appropriate activities (e.g., looking on, cleaning up) in free than in structured play. This study is offered as being pertinent to questions of density and child/teacher ratio, because it also provides a means of varying the work load on teachers/caregivers. Its child-related findings will be discussed in the next section.

In sum, one experimental and two correlational studies in actual early childhood settings yielded quantitatively dissimilar but not necessarily contradictory effects of increasing child/teacher ratio on adults' behavior. Asher and Erickson (1977) observed rises in simple verbal and motor measures of day care teachers' activity at higher ratios. Prescott and Jones (1972) also found increases in communicative activity as the magnitude of teachers' responsibilities rose, up to about 19 children; teachers were more likely to provide flexible, open styles at lower ratios, however. In the Tizard et al. (1972) observations, measures of desirable teacher activity declined as ratio increased, while negative behavior rose. It is also interesting in this last study to note that staff interaction with children dropped when ratio was reduced by adding teachers. Crayton

et al.'s (1977) findings, that a higher proportion of older children reduced teachers' authoritarian style, may also be tentatively extended to child/teacher ratio effects.

Social Environmental Studies with Children

In all, 30 empirical studies were selected as being pertinent in some fashion to understanding ratio, group size, and density effects on young children (10-year-old and younger). Of these, only two were concerned with variations in I.Q. or other psychometrically-based measures of intellectual competence (Skeels, 1966; Tizard et al., 1972). Nine investigations sought effects on short-term measures of learning, problem-solving, or linguistic competence (Brownell & Smith, 1973; Dawe, 1934; Parten, 1933; Prescott, 1973; Rohe & Patterson, 1974; Shapiro, 1975; Tizard et al., 1972; Williams & Mattson, 1942). Virtually all the rest (and some of those already cited) assessed ratio, group size, and density effects on various measures of social behavior, including social play and communication (Arnote, 1969; Asher & Erickson, 1977; Bates, 1972; Crayton et al., 1977; Ginsburg & Pollman, 1975; Hutt & Vaizey, 1966; Loo, 1972, 1976; Loo & Kennelly, 1977; Loo & Smetana, 1977; McGrew, 1970; O'Connor, 1975; Prescott, 1973; Reuter & Yunik, 1973; Rohe & Patterson, 1974; Shapiro, 1975; Vandell & Mueller, 1977).

None of the numerous investigations of personal space in children (e.g., Desor, 1972; Guardo, 1969; King, 1966;

Little, 1965; Pederson, 1973) have been included here. Although this topic is conceptually related to density, its methods and actual findings are not as easily extended.

This review is primarily organized, however, around an analysis of the social environmental dimensions of child/teacher ratio, group size, and density. As such, separate subsections will deal with each of these areas, yet the distinctions are not entirely natural: Child/teacher effects are partly a function of group size, and both of those depend not only on numbers of people of all ages present, but also on the amount of space available. Research on the organization of space and resources in early childhood programs is highly relevant, and will be covered briefly in Appendix A.

Child/Teacher Ratio

Shapiro (1975) and Prescott (1973) made extensive observations into many aspects of nursery school and day care classrooms, including group size, child/teacher ratio, and uses of space. Shapiro visited 17 half-day classrooms with 274 4-year-olds, in order to examine the relationship between class size and individualization, the influence of space on children's involvement in activities, and the impact of various activity areas on children's and teachers' behavior. The findings on class size and child/teacher ratio indicated that the number of contacts experienced by the children increased with ratio up to 8 children/teacher, then declined from 8-11/1.

Differences were also found as a function of class size, i.e., total number of children, in that less complex interactions (undefined) occurred with class size below 16 children. With class size above 20 children, the number of personal contacts experienced by a child alone was no longer related to child/teacher ratio.

Prescott's (1973) study in Los Angeles County day care centers is also a natural experiment into a number of settings, in which the inevitable confounding of ratio with age of children and types of programs is partly balanced by high ecological validity. In addition to closed format (teacher-centered group and individual activity, occasional free play, activity transitions administered at group level) and open format (child-control led choice making, child-structured play, transitions and choices initiated by children) program types, observations were made in family day care and nursery-home settings. The spectrum of child/teacher ratios was parsed into seven regions (1/1, 2-3/1, 4-5/1, 6-7/1, 8-10/1, 11-15/1, 16+/1), which were highly confounded with type of care; home-based care was overrepresented from 1-5/1, center-based care above 5/1, and closed format centers almost exclusively above 11/1. Lower ratios (1-5/1) were associated with more individualized, child-initiated behavior, which were more likely to receive adult attention and feedback, greater amounts of active rejection of bids, requests and receptions of help, awareness of cognitive constraints,

discovery of patterns, exploration, attention directed to adults, and giving orders and information, with smaller amounts of looking, obeying, stereotyped responses, attention directed to children, and awareness of social constraints, than higher ratios. Higher ratios (6-16+/1) were associated with more attention directed to the group, responding to questions, tentative behavior, and mutual social interaction. While the methodological problems in this study ultimately limit its generalizability, its attempt to integrate several aspects of the day care environment make it a model to be improved upon rather than cited and discarded.

Two other natural experiments (O'Connor, 1975; Reuter & Yunik, 1973) measured changes in preschoolers' social behavior as dimensions such as child/teacher ratio, age-mix, and sex and program type (in the Reuter and Yunik article) varied. The independent variables in these two studies were also seriously confounded, but their findings are worth mentioning. Reuter and Yunik found that in their higher-ratio program, children interacted more frequently and longer with peers, while spending less time in social interactions with adults and in activities incompatible with social interactions. O'Connor found that in her higher-ratio program, children showed greater amounts of proximity, social exchange, and interest and positive attention to peers, less social exchange with, proximity to, and seeking reassurance from adults, and social exchange with and interest in the group. Most of the

results from these two studies follow the pattern that as child/teacher ratio increases, children spend more time in various types of contact with other children and less with adults. Their lack of control and scope, however, makes them only suggestive.

Before discussing the experimental studies of child/teacher ratio, it is worthwhile here to mention the child-effects in Tizard et al. (1972). Recall from the section on adult effects that Tizard and her associates visited 13 young children's residential nurseries, observing 85 children and testing 46 of them on various social, linguistic, and intellectual measures. Since the dimensions describing the nurseries (child/teacher ratio, autonomy of groups and nurseries, staff stability, age-distribution) could not be isolated from one another, composite scores of nursery group quality were assigned. On this dimension high child/teacher ratios were associated with poor quality and thus low composite scores.

Observations were made of children's talking (whether a child spoke, to whom he spoke, whether he received an answer, and other verbal stimulation). The children were also tested on the Reynell Developmental Language scales (assessing language comprehension and expression) and on the nonverbal section of the Minnesota Preschool Scale. Correlational analysis revealed that as the nurseries' composite scores rose (as child/teacher ratio decreased), the number of children's remarks answered by the staff also rose. A positive relationship was also found between the nursery score and the

Reynell measure of language functioning. The Tizard et al. investigation is one of the very few available which seeks effects of variations in early learning environments through children's ongoing behavior, test scores which are relevant to the hypotheses of interest, and behavior of caregiving staff.

In all, four studies were found which could qualify as true experiments of child/teacher ratio effects on young children. The first, by any standard one of the most far-reaching and original studies in child development (yet for all that, devoid of any strong theoretical identification), is Skeels' intervention into the lives of 13 institutionalized mentally retarded infants (mean I.Q. 64.3) during the mid-1930's (Skeels, 1942, 1966; Skeels & Dye, 1939). Before any of them reached 30 months (mean age of intervention was 19.4 months) each infant was removed from the nursery, described as a setting which provided adequate physical care while being overcrowded, understaffed, and understimulating, and placed in cottages of older and somewhat brighter girls. In addition to being surrounded by roughly 30 young women inmates and staff who provided affection, gifts, and personal attention, and much higher levels of general stimulation, 11 of the 13 infants were "adopted" after a fashion by a patient or attendant. The children were tested periodically, and each child was returned to his/her orphan peer group or placed in adoption when her I.Q. reached a level judged to be normal.

This period ranged from 6 to 52 months, with an average stay with the older inmates of 2½ years.

Of the 13 children who had been exposed to the special environment as infants, 11 were adopted immediately following their experience. All 13 were retested approximately 33 months after leaving the young women's cottages. The whole group's mean I.Q. at this time was 95.5, while the mean I.Q. of the 11 adopted children was 101.4. When the investigator visited these 13 children as adults, around 1960, all were found to be self-supporting and occupationally independent or married to someone who was. The group's mean level of education was twelfth grade, with several having completed college. In short, they were indistinguishable from most residents of a middle class community in the Midwest.

During the period of special placement for the experimental group described above, another group of children was identified and followed in order to provide a contrast. These 12 children (average I.Q. at first testing 86.7, mean age 16.6 months) remained in the orphans' nursery until about 24 months, when they were transferred to similarly crowded, understaffed, and regulated cottages. They began the institution's formal school program at 6 years, geared to the level of the orphanage children--many of whom possessed subnormal intelligence. When they were retested at equivalent ages to the last testing of the experimental children, the contrast group's mean I.Q. had declined to 66.1.

None of the contrast children was adopted, and thus all remained in the state institution at least until early adulthood. When they were visited as adults, one had already died and four still resided in institutions. Of the 11 living, their mean educational attainment was below third grade, and almost all were unemployed or rated low on an occupational scale. One contrast individual, who had been identified to be promising as a child, was married and successfully employed as a compositor and typesetter for a printing firm, while no others were married at the time of the followup.

Skeels' intervention into the early environment of his experimental group children must be regarded as a drastic improvement in the ratio of children to adults (from roughly 15/1 to 1/30), compounded by several other environmental changes which doubtless enhanced the experimental effect: special treatment for the children; a change of physical setting; pseudo-adoption by particular women, etc. Such divergence from a pure, well-controlled study can actually be argued to embody the deeper meaning of improving child/adult ratio conditions in early childhood settings: more mature levels of general stimulation; varied roles for adults; and more individual treatment for each child. Despite the many ways in which this moving experiment differs from manipulation on day care environments, e.g., in population studied, percentage of each day in setting, and exact nature of changes in environment, its dramatic effects on the

young children's competence over several (and many) months' time--enough to get most of them placed in adoption--must be recognized for its implications for day care and other early childhood program environments. Skeels' experiment is considered in further detail in Meyer's (1977), Mathematika's (1977), and Fowler's (1975) reviews on young children's environments.

While no controlled experiments have directly assessed the effects of child/teacher ratio or group size on intelligence using standardized psychometric tests, two were found which examined such variables' immediate effects on language and educational performance. Dawe (1934) measured the amount each kindergarten child retained of a story read by the teacher and the degree of each child's participation in discussion over new material, as functions of group size and children's distance from the teacher. Dawe found that story retention was not affected by changes in group size (child/teacher ratio) or distance from the teacher. The percent of children engaging in discussion, the total amount of discussion, and the average number of remarks dropped for children as they sat farther away from the teacher. This study is included as a ratio experiment because the presence and activity of the teacher is directly related to the dependent variables in question--the teacher is an active element in the children's learning environment.

In another, more recent experiment concerned with young children's communication, Brownell and Smith (1973) created

groupings of one, two, or three children, and a group of three children in which the teacher remained inactive. Four-year-olds' speech was recorded during a discussion of the uses of a set of familiar objects, and analyzed for their mean length of verbalizations, and the mean verbalization length less mean number of repetitions. The only significant ratio-relevant findings were that both dependent variables were smaller in the one child/teacher group than in the three children/teacher group. No differences were found in the structural properties of the children's communications.

An exploratory study conducted by Asher and Erickson (1977) varied the child/teacher ratio in a proprietary day care center, in order to observe changes in common behaviors of the children and teachers. Sixteen toddlers (mean age 19.2 months) were placed in groupings of 4, 8, and 12 children/teacher for periods of a little over an hour (a group size manipulation will be discussed in the following subsection). As child/teacher ratio increased, three out of four children's behaviors involving the presence or proximity of the teacher decreased in level: vocalizing to teacher; touching teacher positively; and remaining within three feet of the teacher. On the other hand, none of the six children's behaviors not involving the teacher's presence--involving the child alone or with a peer--rose or fell with changes in ratio. The authors concluded that the effects on teacher-related children's behavior were to be expected simply as a

result of increasing inaccessibility as more children competed for her attention. It would not be expected, however, that their solitary or peer-related behaviors would be immune to ratio changes, because the particular manipulations employed consisted of adding more and more children to the group, and thus increasing the likelihood of children's contacts with one another of various sorts. That such increases did not occur suggests that the children were acting to maintain a comfortable behavioral profile despite actual variation in peer social density.

The Crayton et al. (1977) study reviewed in the previous section was primarily concerned with the effects of preschooler/toddler ratio and play structure on three toddlers between 18 and 30 months old. When this ratio increased from 0/12, through 6/6, to 9/3, children's inappropriate behavior and vocalization rose, then fell. Inappropriate behavior and vocalization were also higher in free than structured play.

Any summary of child/teacher ratio effects on children's behavior and development is dominated by the Skeels (1966) and Tizard et al. (1972) studies, despite their problems of control. Both of these investigations reported benefits in young children's standardized test performance associated with improved child/teacher ratio, accompanied in the Tizard study by more high-quality verbal interaction. Several other investigations (O'Connor, 1975; Prescott, 1973; Reuter & Yunik, 1973; Shapiro, 1975) confounded child/teacher ratio,

group size, and other important factors in various ways. Their results can also be interpreted as showing that as ratio increases, interaction with peers rises along with adult-structured and controlled behavior, while individualized interaction and sheer contact with adults declines. The two experimental studies of verbal behavior in structured situations gave somewhat contradictory results: Dawe (1934) found children's participation in class discussion falling off as a function of their distance from the teacher; Brownell and Smith (1973) recorded less conversation when one child was paired with an adult than when three children were assigned to an adult. The latter finding may be due to the nature of the groups' task--to talk about a set of familiar objects--in that two people can be much more direct and efficient than four. Finally, Asher and Erickson (1977) observed that only teacher-related behaviors were affected (negatively) by increases in child/teacher ratio. These results were taken to be indicative of ratio as a measure of teacher accessibility, while the absence of child-related effects was tentatively thought to reflect a rudimentary system of social self-regulation.

Group Size

Research on the effects of group size on children's behavior and development is not much more consistent and direct than that on child/teacher ratios, even though group size is a simpler and more general concept. Group size should

be considered closely related to density, which will be discussed in the subsection following this one.

Of nine group size studies reviewed, seven can be considered true experiments; the other two are nonmanipulative observation studies. Three studies deal chiefly with learning or language behavior (Brownell & Smith, 1973; Dawe, 1934; Torrance, 1970), four with social and interpersonal behavior (Asher & Erickson, 1977; Parten, 1933; Vandell & Mueller, 1977; Wolfe, 1975), and two overlap cognitive and social domains (Shapiro, 1975; Williams & Mattson, 1942). None of these studies assesses anything but immediate behavior, although sometimes the children observed have been in a particular setting for many months.

Play group size was one of several activity variables recorded by Parten (1933) in her observations of 34 children between 2 and 5 years old. In this naturalistic study, the children's choice of playmates, types of toys and activities, degree of leadership, and the "social value" of their play were also recorded. Social value, or degree of participation, was a rather ordinal dimension created by Parten which has achieved lasting descriptive value in child development research. In this study, the participation-in-play dimension consisted of six modes of an individual's activity: unoccupied, solitary, and onlooker play activities, which are self-defining; parallel play, in which two or more children engage in solitary play close to one another, without any

real exchange but aware of one another nevertheless; associative play, in which two or more children are doing the same thing, but without interchange or organization; and cooperative or organized play, identified by the mutual discussion and assignment of separate roles to create a truly joint activity (some of these definitions are found in Stone and Church, 1973).

Group size in Parten's study ranged from 2 to 15 children, with the modal configuration two children, regardless of age. However, larger groups were increasingly likely to be composed of older children. This fact, combined with the observations that older children were the ones found at higher levels of participation and in more complex games involving numerous children, implies that play group size was positively associated with sophistication of social activity. In this case, of course, number of playmates and activity were both determined by the children themselves, and not specified as an independent or classification variable by the investigator. The point can be made (and has been recently in communication with Edward Mueller) that the number of associates and the level of participation chosen by a child are both expressions of the amount of social information and interactive complexity which he can handle--a sort of behavioral carrying capacity. The relationship between children's self-selected play group size and total group size is not known at present, but may be partly inferred in the proposed study.

Shapiro's observational survey of 4-year-olds in nursery school classrooms was discussed earlier (in the child/teacher ratio section). It should be sufficient to repeat her results that so-called complex child contacts increased as total group size rose above 16 children, and that the ratio effects no longer held at the larger group sizes.

Williams and Mattson (1942) grouped and regrouped six 3½-year-olds in various play configurations (one child alone, one, two, or three children with the investigator) in order to observe their speech and communication patterns. (This study was rather arbitrarily placed in the group size rather than child/teacher ratio category because the investigator's presence in three of the conditions was not judged to be like that of an active, participating teacher.) Language was classified in four ways: completeness and size of sentence; parts of speech used; social usage of verbal response; and degree of egocentricity (in the Piagetian sense). The findings of interest here were that two children with the observer engaged in more talk, friendlier and less egocentric intercourse, and used more words per sentence than any other group size configuration.

Of the three group size studies devoted to learning and language development, two were discussed in the child/teacher ratio section. In review, Dawe (1942) found that kindergarteners' distance from teacher (which may be interpreted as a group size measure) reduced only the percentage of

children participating, the total amount of discussion, and the average number of remarks per child. Brownell and Smith (1973) observed that two children with their teacher verbalized longer than one child with the teacher. Torrance (1970) assigned pre-primary children to groups of 4, 6, 12, or 24 members, and administered his "Ask and Guess Test" (a divergent thinking exercise). He found that the number of questions which children asked concerning curious stimuli decreased as group size rose, while the number of repetitive questions rose with group size. Torrance also concluded that young children may have trouble controlling themselves and delaying their responses in larger groups.

In an interesting experiment with children assigned to a residential psychiatric facility, Wolfe (1975) varied young patients' (8-16 years) room sizes and the number of children in each room more or less independently. He was primarily interested in the extent to which the bedrooms were used and in what activities their occupants were engaged. Three of his findings related to group size were as follows: as the number of children assigned to a particular room increased, the likelihood that the bedroom would be occupied rose; the actual number of children present also rose with number assigned; and an occupant was more likely to have a visitor and be conversing with that visitor if no other roommates were present. There were many other results of Wolfe's experiment, which actually dealt more directly with the notion of privacy.

Two recent experiments with toddlers examined changes in children's social behaviors with varying group sizes, using different methods. In the Asher and Erickson (1977) study, described twice previously, 16 toddlers were observed in their actual classroom in two group sizes at the same ratio (8 children/1 teacher, 16 children/2 teachers). Of ten child and ten teacher behaviors observed, none of the former and only one of the latter (teacher touching child positively) differed significantly as a function of group size (although a multiple analysis of variance revealed an overall significant teacher effect).

The second recent group size experiment recorded toddlers' (age range 16-22 months) social activity in either dyads or small groups (4-6 children) (Vandell & Mueller, 1977). The children, who were enrolled during the six months of the study in a play group, were also watched for increasing familiarity with one another, as measured by a number of indexes of "socially directed behaviors" (SDB's). First, group size was found to interact with familiarity in that several SDB's increased over time in the dyad, but not in the small group. Second, the ratio of dyad level/group level for each SDB increased over time, and over the whole study the dyad levels were greater than the group levels. Finally, there were no dyad vs. group size differences in the complexity of SDB's (sequences or coordinations of simple SDB's).

Few firm conclusions are possible from the group size literature. As group size increases, young children either

verbalize more (Brownell & Smith, 1973; Shapiro, 1975), less (Vandell & Mueller, 1977), both more and less (Torrance, 1970; Williams & Mattson, 1942), or neither (Asher & Erickson, 1977; Dawe, 1934). Only the Asher and Erickson and Vandell and Mueller experiments were set up to measure differences in stimulation from the natural environment of peers. Neither study supported the intuitive hypothesis that amount of stimulation from other children should be proportional to size of group. The results of the former study were taken as supporting a social regulatory mechanism, while those of the latter were interpreted in terms of toddlers' limited capacity for social interaction--admittedly similar concepts.

Density

Due to the growth of interest over the past decade in crowding and natural group behavior, research in density (number of individuals in a given area) has begun to subsume that in group size. The notion of density lends an especially useful point of view to organize social and physical sources of stimulation in children's programs. Studies of social density, which vary the group size within a constant area, are discussed in this subsection; studies of spatial density are covered in the next subsection. An overall summarization of density effects will follow the latter.

Social density. Five research studies were located in which social density was inspected as a factor in children's behavior. Four out of these five were experimental in design.

In the earliest one of these, Hutt and Vaizey (1966) varied the number of autistic, brain-damaged, and normal (i.e., not hospitalized for psychiatric reasons) children between 3 and 8 years old, in a hospital playroom 472.5 square feet in area. Three group sizes were used: small (less than 7 children, reciprocal density greater than 78.5 sq. ft./child) medium (between 7 and 11 children, reciprocal density between 67.5 and 43.0 sq. ft./child); and large (more than 11 children, reciprocal density less than 39.5 sq. ft./child). Other children were used to fill out the groups. Each child was observed for the amount of aggressive/destructive behavior he initiated, the amount of social interaction, and the amount of time spent on the boundary of the room. Results for the normal children showed that as density rose (i.e., group size rose), aggressive/destructive behavior rose significantly, social interaction fell, and no significant effect was found for boundary time.

The operational distinction between social and spatial density was explored by McGrew's (1970) experiment, in which the density of a 4-year-olds' classroom was varied both by adding and subtracting children and by expanding and shrinking the space. Four density conditions were created by placing about 9 or 19 children in either the entire room or with 80% of the space available (actual reciprocal densities were 89, 77, 51, and 39 sq. ft./child). The dependent variables were a series of categories of interpersonal

distance: contact; close proximity (other children within 3 feet); intermediate proximity (other children between 3 and 8 feet away); and solitary (no children closer than 8 feet). When social density was increased (children added to group), children spent less time in intermediate proximity and solitary. As spatial density increased (space reduced), the children spent more time in close proximity, and less in intermediate proximity and solitary. Since it was expected that density increases should lead to more contact and close proximity, McGrew concluded that the young children in her study were able to deal with changes in density fairly well, maintaining their comfortable interpersonal distances. They did seem to adjust better, however, to changes in social rather than spatial density.

A nonmanipulative observational study by Bates (1972) would seem to shed light on many of the present concerns. A group of 3½-year-old children were observed during morning and afternoon free play in their regular nursery school classroom. As the number of children varied naturally between 10 and 30 children, reciprocal social density ranged from about 57 sq. ft./child, to 34 sq. ft./child, to 27 sq. ft./child. Observers recorded a number of children's behaviors, including time spent on the boundary of the room, time at center of the room, time alone or with one, two, or three peers, conflicts, disruptive or cooperative social interaction, and locomotion. As density increased (group size increased):

girls spent more time alone, in small groups with other girls, in room center, and in conflict; boys reduced their locomotion, played in larger groups, and also increased conflicts. Bates mentions that as density increased, boys' behavior began to change at lower levels of middle densities and stabilized at lower levels of high densities than girls' behavior.

The group size dimension of Asher and Erickson's (1977) experiment can be directly translated into a social density one. The day care classroom, which was about 750 sq. ft., was occupied by either 8 or 16 toddlers with one or two teachers, respectively. This gave reciprocal densities of about 94 or 47 sq. ft./child, and presumably one reason that density/group size was not a factor was because there was such a great amount of area.

Loo has provided some of the most carefully-conducted and richly yet reliably descriptive research on density as a factor in children's behavior and social perceptions. Three of these will be reported in the spatial density subsection which follows. One of her spatial density experiments (Loo & Smetana, 1977) and the social density experiment to be discussed next (Loo & Kennelly, 1977) are the first and only controlled studies of the social-physical environment which combine children's natural behaviors and subjective impressions to uncover patterns or systems of effects (using multivariate statistical analysis techniques).

Loo and Kennelly (1977) exposed 72 5-year-old boys and girls to low (four children, 32.7 sq. ft./child) or high (eight children, 16.35 sq. ft./child) density conditions, during 54-minute free play sessions. The children were assessed on several dimensions (social behavior, activity level, body position, emotional reactions, coping strategies, play quality, and interaction quality) as operationalized in nearly 30 behavioral and interview items. When the data were factor-analyzed, five factors consisting of 22 variables emerged: activity-aggression-anger; negative feeling; avoidance; social interaction; and distress-fear. A multiple analysis of variance with the five factors as dependent variables found significant effects for social density and sex, but not for a third independent variable, personal space (an individual difference classification), nor for any statistical interactions. Separate analyses of variance on each factor-as-dependent variable found that as density increased, activity-aggression-anger, negative feeling, and distress-fear rose while social interaction fell. Some sex differences were also found.

Spatial density. Seven of the eight spatial density investigations to be reported here also included aggressive or socially undesirable behavior as important dependent variables. It does seem that in density research the practitioners' intuition (i.e., that amount of space per child governs negatively-valued behavior) has been heeded.

In the McGrew (1970) experiment described in the previous subsection, the effects of varying the size of the room between 100% and 80% of its normal area were that the preschool children spent less time in intermediate proximity and solitary, and more time in close proximity. McGrew's conclusion, due to the last item, that her children were less able to adjust to manipulations of spatial density than social density, provides some support into other researchers' intuition that aggressiveness would be particularly affected by spatial density.

Shapiro's (1975) observations of class size, child/teacher ratio, activity areas, and play space led her to a three-way classification of 4-year-olds' "non-involved" behavior (onlooking, random, and deviant). Deviant behavior was observed at its highest levels in classrooms with less than 30 sq. ft./child; random behavior was highest where each child had at least 50 sq. ft. The optimum range of areas, between 30 and 50 sq. ft./ child, had the lowest levels of all three non-involved behaviors.

Although differences certainly exist between interior and exterior behavior settings, few studies of children's outdoor activities exist which are primarily concerned with both amount of space and numbers of people, and none were found comparing indoor with outdoor settings. Ginsburg and Pollman (1975) observed the amount of fighting which occurred when they varied playground space available to a group of

about 30 elementary school boys. The children played in either a 12,000 sq. ft. or a 2,100 sq. ft. playground (reciprocal densities of 400 or 70 sq. ft./child) with the same amount of play equipment in both. The authors observed more fighting, but of briefer duration, in the smaller play space. Further, fights in the larger area tended to involve only two boys, while more participants were involved in each fight in the small playground. The hypotheses suggested for this set of findings were, first, that flight from hostility was more of an option in the large space than in the small; second, children were more likely to be recruited to help a friend in distress in the small area, so the fights ended sooner. Thus, helping behavior of an important but infrequently-studied type increased as density increased, as well as aggression.

Five experiments in spatial density stand out in their design and potential for application to actual day care and nursery school settings. Arnote (1969) visited two day care centers and varied the amount of play space in a room in each, among three levels (350, 225, and 140 sq. ft.). With seven preschool children (age range 2½-5 years) in each play group, her reciprocal density levels were 50, 35, and 20 sq. ft./child, respectively. Arnote recorded all aggressive acts during free play and grouptime periods in both centers. She found an increase in aggressiveness as spatial density rose, but no differences between the activity periods.

In two of Loo's experiments (1972, 1976), effects were sought for density, sex, and their interaction. As density increased in her first study (from reciprocal densities of 44.2 to 15 sq. ft./child), aggression and number of social interactions dropped. Also, boys interacted with more children, were more aggressive, were interrupted less often, and were less nurturant than girls; boys diminished their aggression significantly more than girls, as density increased (girls' aggression was quite low in both conditions). In Loo's second study, as density increased (from reciprocal densities of 43.4 to 21.8 sq. ft./child) the children became more aggressive, passive, avoidant, and unstable in their activities, while also engaging in less self-involved behavior. Boys were more aggressive and interactive, less nurturant, and interrupted less than girls. Interactions were also found between the independent variables.

Loo's third spatial density experiment (Loo & Smetana, 1977) parallels the sophistication and richness in description of child variables found in Loo and Kennelly (1977). Here, 80 10-year-old boys played for 60 minutes in well-stocked playgroups of five children each, in low density rooms of 260.5 sq. ft. (reciprocal density 52.1 sq. ft./person) or high density rooms of 68 sq. ft. (reciprocal density 13.6 sq. ft./person). Two additional independent variables were personal space (an individual difference dimension denoting a person's relative comfortable approach distance), and degree

of acquaintance with playmates (absolute strangers or familiar classmates). Once again, dimensions described by approximately 30 separate variables were inspected: children's perceptions and emotional reactions; motoric levels and activity types; play quality; interaction quality; and coping strategies.

When their data were factor-analyzed, Loo and Smetana found that most of the variables loaded onto five factors: discomfort-dislike of room; activity-play; avoidance; positive group interaction; and anger-aggression. A multiple analysis of variance revealed significant effects for density, degree of acquaintance, personal space style, personal space x acquaintance, and density x personal space x acquaintance interactions. Analyses of variance on the factors-as-dependent variables showed that as density increased, discomfort-dislike of room, activity-play, and avoidance rose. Various complex implications were also identified for personal space style and degree of acquaintance, most notably that effects due to those variables were most pronounced in the low density condition. An important discovery upon inspecting the correlations between elementary variables as a function of density was that rough play (an observation item) was associated with other types of play only at low density; with less space available rough play led to aggression more often.

The notion of density forces consideration of the social and physical factors of the environment in concert,

yet the two dimensions along which density is manipulated--social and spatial--are rooted in separate domains. Social density (varying group size) is naturally associated with other interpersonal sources of stimulation, such as teacher behavior, developmental range of children in the group, and familiarity of the children with one another. Spatial density (varying available) falls in a class with architectural and sensory properties of a setting, children's familiarity with the setting, and number and variety of resources in the space. In fact, the availability of resources is normally tied to the size of a setting, and changes in the two might be expected to yield similar results in children's behavior.

In an experiment conducted by Rohe and Paterson (1974), spatial density and material resources were varied independently of one another. Twelve preschool boys and girls (average age 46 months) played with a teacher present under two room sizes (576 and 288 sq. ft., reciprocal densities 48 and 24 sq. ft./ child, respectively), and two resource levels (the high resource condition gave the children twice as many toys and other materials as the low resource condition). Observers recorded behaviors in social interaction (unoccupied, solitary, parallel, associative, aggressive), participation (relevant, irrelevant), constructiveness (constructive, destructive), and area in use (blocks, kitchen, jungle gym, art, puzzles) categories. As density increased (less space), aggressiveness, destructiveness, and unoccupied

behavior increased, while relevant and constructive activity diminished. Children also played more in the kitchen, less in the art and puzzle areas. As resources decreased, cooperative, relevant, and constructive behavior dropped, while irrelevant activity rose. Children played more on the jungle gym in this condition. Boys were more aggressive and destructive than girls, and were observed less frequently in unoccupied roles. High density and low resource conditions were typified as being highest in negative behaviors, and lowest in the positive ones. The authors discussed their findings in terms of designing physical settings to fit program needs.

One can draw two general conclusions regarding the effects of increasing density from these studies. First, aggressive behavior rises. Most of this research has been at least partly concerned with negative social consequences of changes in density. This "popularity" has been accompanied by a wide variety of rigor and range in definition. Arnote (1969) and Shapiro (1975), for example, employed global, on-the-spot criteria, while Hutt and Vaizey (1966) and Loo (1972) remained with a few distinct and narrowly-defined ones. The technique found in Loo's more recent experiments (Loo, 1976; Loo & Kennelly, 1977; Loo & Smetana, 1977) and applicable to Rohe and Patterson's (1974), of specifying several aggression- and quasi-aggression variables precisely, and then seeing whether and what kinds of patterns emerge empirically, seems to preserve the flexibility and present-ness of the first

examples with the detail and reliability of the second. It should be noted that sex and individual differences exist in aggression at different density levels, and that other behaviors such as "helping distress," "number of interruptions," "passivity," and "rough play" are not necessarily highly correlated with aggression.

The second conclusion regarding effects of increasing density is that social interactions either drop absolutely (Bates, 1972; Hutt & Vaizey, 1966; Loo & Kennelly, 1977; Loo & Smetana, 1977; Rohe & Patterson, 1974) or remain unchanged when they would be expected to rise (Asher & Erickson, 1977; McGrew, 1970). Once again, methods and definitions are important, and certain variables and special categories can probably be identified which rise with density.

In their discussion, Loo and Kennelly address themselves to the discrepancy between the Loo (1972) result that aggression decreased with increasing spatial density and the result of other studies with children (yet few with adults) which found rises in aggression. Taking into account differences between social and spatial density, amounts of material resources, and artifacts of repeated measures designs, these authors suggest the strong possibility of a curvilinear relationship between density and aggression. They urge conceptualization of density effects in absolute terms of area/person rather than in relative terms of high and low density. This need not be restricted to aggression, since social and epistemic processes

are just as important in young children's group environments. Finally, the availability of multivariate analysis techniques argue for employing numerous precisely-defined dependent variables which may be conceptually related to one another, over a few broad categories.

Implications for the Present Study

In the introductory chapter preceding this one, an analytic model was proposed in which child/teacher ratio and group size would be treated as multi-factor density phenomena. It was suggested that each separate subpopulation of a group, and in particular the children and adults in an early childhood setting, represent an independent variable with potentially separate and unique effects on participants' behavior. An investigation was proposed to test the utility of this model, with the argument that it represented a closer approximation to the existing research literature than one with child/teacher ratio and group size as primary variables. The next chapter describes the methods to be used in this investigation.

CHAPTER III

METHOD

The Problem

To review the conclusions of the preceding two chapters, little of the child/teacher ratio and group size research to date has been guided by deductions from any theory, and no basic research has been extrapolated to social-environmental factors in natural children's environments. The body of literature in crowding and density was surveyed, and a discrepancy between spatial and social density effects on behavior was hypothesized to be due to greater variability between types of people in the latter. It was proposed that treating number of children and number of teachers as separate independent variables constituted a test of this hypothesis, as well as of the applicability of a social density model to child/teacher ratio phenomena.

Observations which were made by the National Day Care Study (see the next section) on children's behavior in day care programs throughout the United States have been made available to test the predictions of this investigation. Unfortunately, due to the large number of dependent variables specified by the National Day Care Study, and the fact that its goals are quite different from those of this one, two steps were proposed to make the data more useful and

interpretable for the purpose of this paper. First, only behaviors judged to be related to the processes of learning in the classroom, i.e., epistemic behaviors, were used. These made up roughly one-third of the total child-behaviors defined for observation. Second, since there were still many types of behaviors observed (26), statistical techniques were used to form aggregates of those behaviors which were "naturally" (i.e., empirically) associated. It was these natural groups of behaviors which were intended to serve as the dependent measures with respect to the independent variables: number of children and number of teachers. It was hoped that each aggregate would be characterizable by its elements' common quality, and also that there would be far fewer such groups than original behaviors.

While the actual dependent variables employed depended on an initial data analysis, which was conducted subsequent to this chapter's writing, it was possible to state a set of experimental hypotheses which could take this step into account.

H1: The total set of children's behaviors recorded in all conditions can be broken down (by factor analysis) into subgroups or aggregates whose elements vary together. These aggregates are differentiated along dimensions of the object of the target child's interaction (peers, adults, physical environment), his/her activity level (totally passive and

unoccupied to very active, animated, and participating), and the extent of his/her involvement with others (alone and uninvolved to integral member of group process).

H2a: As the number of children in the room increases (an independent variable), behavior aggregates involving interaction with peers drop in frequency.

H2b: As number of children increases, interaction with teachers drops.

H2c: As number of children increases, interaction with the physical environment does not change.

H2d: As number of children increases, solitary behavior rises.

H2e: As number of children increases, passive behavior rises.

H3a: As number of teachers in the room increases (an independent variable), interaction with peers does not change.

H3b: As number of teachers increases, interaction with teachers rises.

H3c: As number of teachers increases, interaction with the physical environment does not change.

H3d: As number of teachers increases, solitary behavior drops.

H3e: As number of teachers increases, passive behavior does not change.

The National Day Care Study

The data to test the predictions for number of children and number of teachers came from the third phase of the National Day Care Study (NDCS). This three-year applied research project was conducted for the Department of Health, Education, and Welfare by Abt Associates, Inc., of Cambridge, Massachusetts, to document the relationships between several regulable program variables, day care quality, and day care cost. In particular, the effects of three "policy variables"--child/teacher ratio, group size, and teachers' professionalism--were measured on a very large number of child and adult behaviors, standardized test scores, staff and parent attitudes, and other classroom, center, and program variables. The information from this project is to be used to revise the existing Federal Interagency Day Care Requirements (U. S. Government Printing Office, 1975) and to help formulate policy for young children's programs from a more empirical basis than has been possible until now. The first public reports were expected by mid-1978.

Phase I of the NDCS consisted of field-testing a large number of instruments and selecting the most useful and reliable ones. Phase II applied those instruments in a nonmanipulative study of 64 day care centers in Atlanta, Georgia, Detroit, Michigan, and Seattle, Washington, and served in effect as a pilot study for Phase III. In the third phase, 49 day care centers representing nearly the

entire range of child/teacher ratios and group sizes were selected for further study. Most importantly, 14 of the relatively high-ratio centers were provided the means to increase their staff complement and thus decrease ratio in the classrooms being observed. The intervention took place two to four weeks prior to the initial Phase III observations.

Thus a key question asked by the NDCS was whether the quality and cost patterns of these "artificially improved" day care centers more closely resembled those of the higher-ratio centers from which they were initially drawn, or the lower-ratio ones. While this was not of primary interest in the present paper, the manipulation of adding teachers was directly pertinent to the number-of-teacher predictions, and this comparison could be included in the analysis.

Of the many dependent measures used in the NDCS, only a portion of the children's behavioral observations were used here. The instrument used to observe the children was the "Child Focus Inventory," developed by Elizabeth Prescott and her associates at Pacific Oaks College (Stanford Research Institute, 1974). The Child Focus Inventory consists of over 50 basic behavioral items describing a broad range of preschool children's activity, each coded further for the object of the child's action (adult, peers, or physical environment). In all, there are nearly 200 distinct codes for describing each child at each sample point.

Children were observed in several natural and contrived situations between Fall 1976 and Spring 1977. In addition

to free play, which was the only one studied here, their behavior in teacher-directed individual and group activity, transitional activity, "unclassifiable" activity, and specially constructed situations was also recorded. (Unless otherwise cited, information for this summary comes from the two volumes of Abt Associates, Inc., 1976, first reports on the NDCS, and from personal communication with staff members of that organization.)

Subjects and Settings

The children who participated in this study were selected on the basis of several individual characteristics, in addition to the factors governing the inclusion of their day care centers (Abt Associates, Inc., 1976). Each child had to be 3 or 4 years old, enrolled in year-round full-day day care, and be primarily English-speaking. The cooperating centers were at least one year old, located in urban areas, serving or eligible to serve federally-subsidized children, providing year-round full-day day care, serving 3 and 4 year olds for full-day sessions, with enrollments of 25 or more principally English-speaking children. The above criteria were used to focus an admittedly diverse universe of data sources upon the center, family, and child populations most likely to be affected by changes in the Federal Interagency Day Care Requirements. For example, 3 and 4 year olds comprise between 40 and 50% of the day care population (UNCO, 1975).

In all, between 1100 and 1500 3 and 4 year old boys and girls were observed and tested during the Fall, 1976 and Spring, 1977 subphases. These children were enrolled in 20 Atlanta, 13 Detroit, and 16 Seattle day care centers. The exact size of this sample, as well as its distribution by site, age, sex, and observation subphase, was not known until the data had been obtained and analyzed.

Specific setting descriptions, especially classroom sizes, were not available for each day care center. By virtue of being licensed, however, their reciprocal densities ranged between 35 and 50 sq. ft./child in the three states involved--all relatively uncrowded levels.

Information Taken from the Prescott Child Focus Inventory

Two kinds of information were used in this study: number of children and number of teachers present during each observation; and ongoing children's behavior recorded by the observers.

Twenty-six separate behaviors were treated as initial dependent variables in the current analysis (prior to subjection to data-reduction techniques). These behaviors were selected from the entire list observed on the Child Focus Inventory. Each was chosen because it described a child's information-seeking or giving activity in some way.

The behaviors selected were: monitors environment; maintains passive-attentive activity; maintains open-ended, expressive activity; maintains closed, structured activity;

asks for assistance with task; quits activity after difficulty; reacts angrily to difficulty; considers, contemplates, tinkers; adds new prop or idea; sees pattern, gives structure, solves problem; shares, helps; participates in group with passive attention; participates in group with open, expressive activity; participates in group with closed, structured activity; does nothing, wanders; moves with purpose; selects activity alone; selects activity with others, suggests new activity, or asks to join; asks for information; asks for permission to share materials, asks for turn; gives opinions, preferences, information, comments; receives requests to play, help, or share; receives information or help in task; receives praise; receives rules; and receives threats. These behaviors are defined in Appendix B.

Observer Training and Reliability

(Unless otherwise cited, all of this section is based on the Stanford Research Institute, 1977, report which describes in detail the actual selection and training of observers, and on personal communication with Dr. Jane Stallings and Ms. Rusty Booth of that organization.)

Observers were recruited in each city several weeks prior to training, through public notices and contact with a wide variety of community organizations. On-site coordinators interviewed every applicant, and based their selections on the following criteria:

1. race--attempt made to hire equal numbers of Black and White observers;
2. education--college education desirable but not essential;
3. residence--members of local community, not affiliated in any other way with participating centers or NDCS;
4. experience--previous experience working with children, especially preschool-age children;
5. ability and aptitude--ability to learn rapidly and retain information, professional attitude toward data collection effort, maintaining objectivity and confidentiality.

Of 89 individuals interviewed to be classroom observers of children's behavior, 47 were actually hired and completed training: 26 in Atlanta, 14 in Detroit, and 8 in Seattle; all were female.

Each observer-in-training received a home study kit several days before meeting as a group. Training lasted seven days. Behavior and situation codes were defined, rehearsed, and discussed by observers and instructors. Next, vignettes of children's activities were read to and coded by the trainees. Third, videotapes of actual behavior, increasing in complexity and pace, were played and coded. Fourth, observers spent three mornings training with supervision in day care centers, followed by further discussions of problems

encountered. Finally and post-finally, observers were given two examinations from standard child-behavior videotapes (of actual activities in day care centers) in order to ascertain that their observation skills reached acceptable criteria of judgement and reliability: the first examination was given at the end of training and before actual data-gathering; the second examination was given following two weeks in the field.

The first post-test for reliability consisted of 115 examples of children's behavior; the second had 97 examples taken from the first test. The method developed at Stanford Research Institute to train large numbers of observers in different locations to comparable proficiency levels culminated in computation of reliability scores. This was simply the percentage of actual events present on the standard videotape coded by an observer (Stallings & Giesen, 1977). The minimum observer reliability considered acceptable (a priori) was 75%, which was attained by all 47 trainees. On the first post-test, the median observer-videotape reliability was 89% (range 76-96%), while on the second it was 94% (range 84-99%).

Procedure

Observers were instructed to record the behavior of each eligible child during morning free play three separate times (days) for both observation periods (Fall, 1976, Spring, 1977). Free play was defined as a period in which

the children could decide which activities in which to engage (see Prescott, 1974). At the end of each observation, the observer noted whether the entire period could be typified as free play (alternatives were teacher-directed play, transitional activity, or "unclassifiable" activity).

Before an observation period, the assigned child was located and identified on the recording form, followed by notations of the number of children and adults present, and the time the observations began. Each child's behavior was recorded by one observer, every 12 seconds for 20 minutes (making 100 separate samples). Typically, between two and four children were observed during a morning's free play session.

For each sample, the child's behavior code was the first item entered in an optical-scan booklet, then the object of the behavior, a code denoting the estimated duration of the activity, and finally any of several special codes (e.g., sulks, temper tantrum, unclear behavior, language other than English, negative behavior), if applicable. The duration and special codes are not of interest here. An example of a behavior sample recording form is provided in Appendix C.

(Virtually all of the information in the above section comes from the Stanford Research Institute (1976) child observers' manual, or from personal communication with Ms. Rusty Booth of SRI and Dr. David Connell of AAI.)

Design and Proposed Analysis

With the exception of adding teaching staff to 14 classrooms, this was a naturalistic, nonexperimental investigation. It is argued, however, that the particular characteristics of this data set and these methods more than outweigh the potential benefits of the fully manipulative, random-assignment experiment which would be conducted as the alternative.

The most important attribute of the present data was without doubt its large sample size--roughly 1000 children. Other than virtually assuring significance for even relatively modest effects (*F*'s of about 3.85 yielded significance at $p < .05$), in this case the availability of so many subjects permitted taking into account (and generalizing across) several variables (sex and race of child, number of observations, classroom, center, city, and possibly others). This of course increased confidence in applicability of the findings to the child-population represented by this sample.

More briefly, other strengths included the use of many dependent measures (allowing richer description of children's activities) and the nonartificiality of the conditions (children were observed in their familiar classrooms, and variations were not brought about by abrupt, short-term environmental changes). These strengthened some aspects of the validity of this study.

The first element of the design, included as such because of the first hypothesis, was the selection of a diverse set

of dependent variables. Presumably, qualitative distinctions in children's epistemic activity was reflected by groupings of the children's behaviors.

The main elements of the design were the inclusion of children number and teacher number (per classroom) as independent variables. These two variables were continuous measures (approximate ranges 5-30 children and 1-5 teachers, respectively). A third potential independent variable, the product of teacher number and children number, represented their statistical interaction.

It was proposed to apply multiple regression analysis to these data, for the purposes of answering the research questions. Furthermore, it was proposed that the initial set of children's behaviors be factor-analyzed, and their factor scores be the dependent variables used in the regression equation. This reduced a large amount of information to a more meaningful and manageable package. Conversely, by choosing the regression method rather than standard analysis of variance, the independent variables did not have to be transformed from continuous to categorical dimensions, and explanatory information was thereby retained.

Two other types of analysis could be conducted, but were not formally proposed here. First, the "other variables" could be included as covariables with the present model to account for as much variance as possible. Second, the range of the two independent variables could be restricted so that

only the combinations of children number and teacher number for which sufficient data exist would be represented, thus simulating a factorial design. For example, it may be that data exist for all combinations of 6-20 children and 2-4 teachers in a room. It remains to be seen if much statistical power could have been gained from this tactic.

In sum, the first step of the analysis using the above design called for factor analysis of the dependent behaviors; the second step utilized the resulting factor scores as dependent variables for a regression with number of children and number of teachers, separately, and together with children x teachers. The linear model for this last analysis is expressed as:

$$Y = b_0 + b_1C + b_2T + b_3CT + \underline{e}.$$

In this model, Y is the vector of factor scores, C is number of children, T is number of teachers, CT is their product, $b_0 \ldots b_3$ are constants, and $\underline{e}$ is unexplained variance.

CHAPTER IV

RESULTS

Descriptive Statistics

Table 1 shows simple descriptive statistics for the two predictor variables, number of children present and number of teachers present, and the 26 behaviors observed for each child. Separate analyses were conducted on each set of observations, which were made approximately six months apart (Fall, 1976 and Spring, 1977). This was done because essentially different children were observed during the two observation periods. Although a total of 1224 children were observed during some portion of these periods, complete information for the variables investigated was available for only 873 children in the first period, and 733 children in the second. Data for each child at each period consist of recordings from 300 12-second samples, gathered in 20-minute sessions on three separate days. The behavioral results are expressed as percentages, or 100% x number of samples in which behavior occurred/300 samples. Thus, if a behavior was recorded in three samples over the hour of one child's observation, its value was 100% x 3/300, or 1%; if it was recorded 45 times, its value was 100% x 45/300, or 15%.

Table 1

Descriptive Statistics for Ecological and Children's Behavioral Variables

Variable	Fall, 1976[a] Mean	SD	Spring, 1977[b] Mean	SD
Number of children	15.93	7.44	18.31	8.66
Number of teachers	2.16	1.19	2.14	1.15
Monitors environment	12.6%	10.0%	9.8%	7.6%
Passive-attentive activity	.1	.5	.2	1.6
Open-ended, expressive activity	4.9	7.8	4.3	7.2
Closed, structured activity	2.3	5.0	1.7	4.4
Asks for assistance	.2	.5	.1	.3
Gives up	<.1	.2	<.1	.1
Reacts angrily to difficulty	<.1	.1	<.1	<.1
Considers, tinkers	1.7	3.0	1.9	3.0
Adds new prop or idea	4.6	4.2	3.2	3.5
Sees pattern, solves problem	.3	.7	.2	.5
Shares, helps	.8	1.5	.7	1.1
Participates in group, passive activity	1.7	6.2	1.6	6.1
Participates in group, open activity	20.1	14.9	22.6	15.6
Participates in group, closed activity	10.9	12.5	10.9	13.6
Does nothing, wanders	3.8	6.0	6.1	7.1
Moves with purpose	3.1	3.0	4.5	3.9
Selects activity alone	.6	.8	.5	.8
Selects activity with others	1.0	1.2	.9	1.2
Asks for information	.6	1.0	.5	1.0
Asks for permission	.4	.8	.4	.8
Gives opinion	8.8	6.0	9.7	5.9
Receives request	.7	1.1	.6	.9
Receives information, help	2.4	2.8	2.7	2.9
Receives praise	.3	.5	.2	.5
Receives rules	.6	1.0	.5	.8
Receives threats	.3	.9	.2	1.0

Note. Each behavioral variable is expressed as the percentage of 300 samples in which behavior occurred.

[a] $\underline{n} = 884$

[b] $\underline{n} = 733$

Children and Teachers--Fall

For the Fall observations, the mean number of children present for each 20-minute session was 15.93 (range = 2-48, s.d. = 7.44), and the mean number of teachers present was 2.16 (range = 1-8, s.d. = 1.19). The three most frequently-recorded children's behaviors were participates in group with open, expressive activity (mean = 20.1%, s.d. = 14.9%), monitors environment (mean = 12.6%, s.d. = 10.0%), and participates in group with closed, structured activity (mean = 10.9%, s.d. = 12.5%). The three least-frequently recorded behaviors were passive-attentive activity (mean = 0.1%, s.d. = 0.5%), gives up (mean <0.1%, s.d. = 0.3%), and reacts angrily to difficulty (mean <0.1%, s.d. = 0.1%). In no instance were all of the 26 behaviors observed in one child, but eight were manifested in at least 50% of some children's sessions (gives opinions, does nothing or wanders, closed-structured activity, open ended-expressive activity, participates in group with passive activity, participates in group with open activity, monitors environment, participates in group with closed activity). The latter four were recorded in about 80% of the 300 samples of some children.

Children and Teachers--Spring

The mean number of children present during the Spring observations was 18.31 (range = 1-54, s.d. = 8.66), while the mean number of teachers was 2.14 (range = 0-9, s.d. = 1.15). The three most frequently-noted children's behaviors were

once again participates in group with open, expressive activity (mean = 22.6%, s.d. = 15.6%), participates in group with closed, structured activity (mean = 10.9%, s.d. = 13.6%), and monitors environment (mean = 9.8%, s.d. = 7.6%). The three least frequent behaviors were asks for assistance (mean = 0.1%, s.d. = 0.3%), gives up (mean <0.1%, s.d. = 0.3%), and reacts angrily to difficulty (mean <0.1%, s.d. = 0.1%). During this period as well, not all behaviors were observed in every child; however, eight behaviors were found at least 49% of the time in some children (moves with purpose, open ended-expressive activity, closed-structured activity, monitors environment, participates in group with passive activity, does nothing or wanders, participates in group with open-expressive activity, and participates in group with closed-structured activity). The last three occurred in more than 84% of some children's samples.

Factor Analyses

Factor analyses were conducted on the 26 children's behaviors separately for the Fall and Spring observation periods, using the principal axis method with a varimax rotation. The results reported here were based on 884 children and 734 children, respectively (sample sizes were slightly lower for the means reported previously and the regression analyses to follow, due to the occasional failure to report the number of children or number of teachers present). Guidance and documentation for these analyses came from

Kerlinger and Pedhazur's (1973) textbook, and the user's manuals for the Statistical Analysis System (Barr, Goodnight, Sall, & Hellwig, 1976) and the Statistical Package for the Social Sciences (Nie, Hull, Jenkins, Steinbrenner, & Bent, 1975).

Tables 8-18 in Appendix E present the makeup for each of the 11 factors generated from the Fall data, in succession. Loadings of each of 26 variables are listed, with those variables underlined whose loadings were great enough (0.40 < absolute value of loading) to be considered in naming that factor. Factors were retained whose individual eigenvalues (which is directly related to explained variance) exceeded 1.00. The eigenvalues and variances represented by the factors are provided at the bottom of their respective factor loading tables; the cumulative percentage of the total variance explained by the 11 factors chosen was 57.9%.

Naming each factor was a subjective process of collecting the variables for that factor whose loadings exceeded +0.40 or were below -0.40, and deciding what word or phrase aptly described a person whose only attributes were extremes of those variables indicated by the loadings (a person whose behavior is very much variables "x", "y", and "z"). Note that for several factors (in the Fall set, factors 4, 5, 6, 9, and 10; in the Spring set, factors 1, 7, and 9) it was easier to name the factors by the opposites of their largest loadings, and simply attach the suffix "low". While the

names chosen might not always have been ideal, they helped to characterize the children's behavior during these observations. Furthermore, the factor scores used as dependent variables in the multiple regression analyses in the next section utilized factor loadings of all the variables as coefficients, and thus did not suffer any bias due to elimination of "less important" variables. The names given each factor in the Fall data are summarized below for convenience, along with their constituent variables and factor loadings:

1. Individualism--open ended, expressive activity (.77); selects activity alone (.73);
2. Productive-Stationary--adds new prop or idea (.61); does nothing, wanders (-.69); moves with purpose (-.48);
3. Teacher as Resource--asks for assistance (.47); receives information or help (.75);
4. Questioning and Expressing-Low--asks for information (-.72); gives opinions (-.68);
5. Problem Solving-Low--considers, tinkers (-.77); sees pattern, solves problem (-.81);
6. Needs Rules-Low--asks for permission (-.43); receives rules (-.75); receives threats (-.53);
7. Extravert--reacts angrily to difficulty (.66); shares, helps (.61);
8. Closed Group Participation--participates in group with open ended activity (-.57); participates in group with closed activity (.76); selects activity with others (-.58);

9. Uninvolved-Low--monitors environment (-.66); passive-attentive activity (-.56);
10. Working Alone-Low--closed, structured activity (-.47); gives up (-.69);
11. Receives Requests--receives requests (.60).

Tables 19-30 present the 12 factors generated from the Spring data, in succession. Once again, loadings for all 26 variables are listed, with the "more important" (0.40 < absolute value of loading) variables underlined. The cumulative percentage of the total variance of the 12 factors chosen by the statistical procedure was 62.0%. The names given each factor in the Spring observations are summarized below, with their constituent variables and loadings:

1. Problem Solving-Low--considers, tinkers (-.80); adds new prop or idea (-.54); sees pattern, solves problem (-.77);
2. Closed Group Participation--participates in group with open ended activities (-.83); participates in group with closed activities (.76); receives information, help (.44);
3. Individualism--open ended, expressive activities (.83); selects activity alone (.56);
4. Solicits Others--asks for information (.68); asks for permission (.61);
5. Uninvolved--monitors environment (.69); does nothing, wanders (.63); gives opinions (-.54);

6. Frustration--gives up (.74); reacts angrily to difficulty (.77);
7. Needs Rules-Low--receives rules (-.63); receives threats (-.79);
8. Prosocial--shares, helps (.76); receives requests (.51);
9. Solitary Work-Study-Low--passive-attentive activity (-.79); closed, structured activity (-.66);
10. Initiative--moves with purpose (.59); selects activity with others (.70);
11. Seldom Participates in Group with Passive Activity--participates in group with passive activity (-.92);
12. Reliance on Others--asks for assistance (.69); receives praise (.47).

The imperfect overlap between the Fall and Spring factor analyses are discussed in Chapter VI.

Regression Analyses

Factor score dependent variables were created for each child observed--11 factor scores for the Fall data and 12 factor scores for the Spring data. A subject's factor scores were the product of the 11- or 12-row x 26-column factor score coefficient matrix with his 26-row data vector, yielding a smaller, 11- or 12-row vector. Each factor score (the elements of the last vector) was then treated as the dependent variable in a multiple regression analysis, with number of children, number of teachers, and product of children and teachers as independent variables.

Tables 2 and 3 provide the results of the regression analyses which are most relevant to answering the present research questions (see pages 59-60). For each factor score dependent variable in the Fall (Table 2) and in the Spring (Table 3) are listed its correlation ($\underline{r}$) with number of children, and with number of teachers. Following each of these columns are the corresponding regression coefficients ($\underline{r}^2$) and significance levels ($\underline{p}$). The last two columns list the multiple regression coefficients ($\underline{R}^2$) and significance levels for the prediction of the factor score variables by the complete model--number of children, number of teachers, and children x teachers.

Appendix D presents results and discussion concerning the usefulness of the "complete model" (number of children, number of teachers, and children x teachers) in predicting the 23 factor score dependent variables. This was regarded to be of peripheral interest to the present hypotheses.

Tables 31-53 in Appendix F give more detailed information than Tables 2 and 3 on the regression analyses. Each table there dwells on one factor score dependent variable, providing analysis-of-variance and multiple regression results.

Number of Children

Five Fall factor score dependent variables showed effects of variations in number of children which were significant

Table 2

Main and Overall Model Effects of
Fall, 1976 Factor Score Dependent Variables

Factor score variable	Number of children			Number of teachers			Total model[a]	
	r	r^2	$p <$	r	r	$p <$	R^2	$p <$
1. Individualism	-.05	.003	.09	.02	.001	.49	.003	.40
2. Productive-stationary	.17	.028	.0001	-.12	.015	.0002	.030	.0001
3. Teacher as resource	.05	.003	.14	-.05	.002	.15	.010	.02
4. Questioning and expressing low	.13	.018	.0001	.09	.008	.007	.021	.0005
5. Problem solving low	.02	<.001	.60	.05	.003	.11	.008	.053
6. Needs rules low	-.07	.005	.03	.03	<.001	.40	.009	.056
7. Extravert	-.01	<.001	.69	.02	<.001	.59	.001	.75
8. Closed group participation	-.05	.003	.13	.12	.013	.0007	.014	.006
9. Uninvolved low	-.04	.002	.22	.01	<.001	.87	.003	.45
10. Working alone low	-.04	.002	.21	-.03	.001	.32	.011	.03
11. Receives requests	-.06	.003	.09	-.05	.003	.14	.005	.22

Note. n = 873 for the Fall, 1976 data.

[a]Total model incorporates independent variables, number of children, number of teachers, and children x teachers, to predict factor score dependent variables.

Table 3

Main and Overall Model Effects of
Spring, 1977 Factor Score Dependent Variables

Factor score variable	Number of children			Number of teachers			Total model[a]	
	r	r^2	$p <$	r	r^2	$p <$	R^2	$p <$
1. Problem solving low	-.12	.015	.0009	.04	.001	.33	.018	.005
2. Closed group participation	-.07	.004	.08	-.05	.002	.19	.009	.09
3. Individualism	-.10	.009	.009	-.09	.008	.02	.011	.05
4. Solicits others	-.05	.002	.22	-.02	<.001	.68	.003	.57
5. Uninvolved	-.18	.031	.0001	<.01	<.001	.97	.051	.0001
6. Frustration	.02	<.001	.65	-.01	<.001	.89	.001	.91
7. Needs rules low	.06	.003	.13	<-.01	<.001	.92	.005	.31
8. Prosocial	.02	<.001	.68	-.06	.004	.11	.005	.33
9. Solitary work-study low	<.01	<.001	.95	-.03	<.001	.48	.002	.77
10. Initiative	.09	.009	.01	.11	.012	.003	.014	.02
11. Seldom participates in group with passive activity	.02	<.001	.52	.05	.002	.28	.002	.74
12. Reliance on others	.06	.003	.14	-.07	.005	.07	.005	.29

Note. n = 733 for the Spring, 1977 data.

[a]Total model incorporates independent variables, number of children, number of teachers, and children x teachers, to predict factor score dependent variables.

at $p < .1$, of which three were significant at $p < .05$. Productive-Stationary ($r = .17$, $p < .0001$) and Questioning and Expressing-Low ($r = .13$, $p < .0001$) rose with increases in children, while Individualism ($r = -.05$, $p < .09$), Needs Rules-Low ($r = -.07$, $p < .03$), and Receives Requests ($r = -.06$, $p < .09$) dropped as children increased.

Five Spring factor score dependent variables were significantly correlated with number of children at $p < .1$, of which four were significant at $p < .05$. Initiative ($r = .09$, $p < .01$) rose, while Closed Group Participation ($r = -.07$, $p < .08$), Individualism ($r = -.10$, $p < .009$), and Uninvolved ($r = -.18$, $p < .0001$) all fell.

Number of Teachers

As number of teachers increased in the Fall observations, Productive-Stationary fell ($r = -.12$, $p < .0002$), while Questioning and Expressing-Low ($r = .09$, $p < .07$) and Closed Group Participation ($r = .12$, $p < .0007$) rose. The Spring data showed Individualism ($r = .09$, $p < .02$) and Reliance on Others ($r = -.07$, $p < .07$) dropping, while Initiative ($r = .11$, $p < .003$) rose with more teachers present.

CHAPTER V

ACCOMMODATING THE RESULTS TO THE HYPOTHESES

The hypotheses presented in Chapter I (see pages 18-19) and repeated in Chapter III (pages 59-60) were constructed prior to knowledge of the actual structure of the children's behavior. It was cautiously predicted that empirical aggregates of observed variables would emerge which would resemble traditional descriptions of young children's behavior in preschool settings. Thus the first hypothesis (H1) was that factors would be found differing along dimensions of the object of the target child's interaction (peers, teachers, physical environment), his/her activity level (totally passive and unoccupied to very active, animated, and participating), and the extent to which he/she was involved with others (uninvolved and alone to integral member of the group).

The next two sets of hypotheses concerned relationships between the above types of behaviors (called the "a priori" variables) and two conceptually independent ecological variables, number of children and number of adults present. It was expected that as number of children increased: interaction with peers would drop (H2a); interaction with teachers would drop (H2b); interaction with the physical environment would not change (H2c); solitary behavior would rise (H2d);

and passive behavior would rise (H2e). Next it was expected that as number of teachers increased: children's interaction with peers would not change (H3a); interaction with teachers would rise (H3b); interaction with the physical environment would not change (H3c); solitary behavior would drop (H3d); and passive behavior would not change (H3e). The three sets of hypotheses (structure of behavior, effects of variations in number of children, effects of variations in number of teachers) will be discussed in separate sections to follow. As a general rule of thumb, however, unfavorable outcomes were expected for increases in number of children, while favorable outcomes were expected for increases in number of teachers.

Characterization of the Factors

Although the factor scores used in the regression analyses embodied the contributions of all 26 behavior variables, it was much easier to think about the factors when they were identified by their most prominent (i.e., heavily loaded elements) (see pages 77-79 in the preceding chapter and Appendix E). The next task was to see how well they fit into the categories proposed to test the hypotheses involving number of children and number of teachers. In other words, were the factors reasonable measures of the five a priori variables?

The five categories of children's behavior which were hypothesized to show functional relationships to number of

children and number of teachers (i.e., the a priori variables) were matched with each of the 23 factors obtained, in terms of their chief defining characteristics. Tables 4 and 5 depict these matches in the form of matrices, with a priori variables (interaction with peers, teachers, and physical env ronment, solitary behavior, and passive behavior) forming the columns, and factor score dependent variables forming the rows. Each time that a factor score dependent variable was considered to be a measure of an a priori variable, an entry was placed in that cell. The entries were in the form "C" and "T" so that information concerning the effects of number of children and teachers could be distinguished. If a factor measured the conceptual opposite of the a priori variable (e.g., Initiative from Spring data is the inverse of passivity, and children scoring high on that factor would be regarded as very non-passive), minus signs ("-") were attached as prefixes to the C and T entries. This was an interpretation of the way in which a factor represented an a priori variable. There were no limits on the number of factors (between 0 and 23) considered to measure each a priori variable--indeed this was the test of the first hypothesis.

Upon inspection of the 23 factors from both observation periods, several appeared to describe a category of children's behavior which had not been hypothesized previously. It was decided to regard Problem Solving-Low, Closed Group Participation, and Working Alone-Low (from Fall), and Problem Solving-Low, Closed Group Participation, and Initiative (from Spring)

Table 4

Matches Between A Priori Children's Behavior Variables (and Task Involvement) and Fall, 1976 Factor Score Dependent Variables, with Relationships to Variations in Number of Children and Number of Teachers

Factor score variables	A priori variables: Interaction with peers		Interaction with teachers		Interaction with physical envt.		Solitary behavior		Passive behavior		Task involve.	
1. Individualism							C±	T	-C*	-T		
2. Productive-stationary					C**	T±*			-C**	-T±*		
3. Teacher as resource			C	T								
4. Questioning and expressing low	-C**	-T**	-C**	-T**								
5. Problem solving low					-C	-T					-C	-T
6. Needs rules low			-C±*	-T								
7. Extravert	C	T	C	T					-C	-T		
8. Closed group participation	C	T**							-C	-T**	C	T**
9. Uninvolved low							-C	-T	-C	-T		
10. Working alone low					-C	-T					-C	-T
11. Receives requests	C±	T	C±	T								

Note 1. "C" or "T" indicate match between factor score variable and a priori variable for independent variable no. of children or no. of teachers, respectively.

Note 2. Minus sign ("-") prefix indicates that factor score variable measures opposite of a priori variable: high factor score = low a priori variable level, and vice versa.

Note 3. Suffixes denote correlation between factor score variable and independent variable: "*" means $.1 < p < .05$; "**" means $p < .05$; underlined asterisk means significant negative correlation.

Table 5

Matches Between A Priori Children's Behavior Variables (and Task Involvement) and Spring, 1977 Factor Score Dependent Variables, with Relationships to Variations in Number of Children and Number of Teachers

Factor score variables	A priori variables: Interaction with peers	Interaction with teachers	Interaction with physical envt.	Solitary behavior	Passive behavior	Task involve.
1. Problem solving low			-C*-T			-C*-T
2. Closed group participation	C* T	C* T				C* T
3. Individualism				C* T*	-C* -T*	
4. Solicits others	C T	C T			-C -T	
5. Uninvolved				C* T	C* T	
6. Frustration			C T		-C -T	
7. Needs rules low		-C -T				
8. Prosocial	C T	C T			-C -T	
9. Solitary work-study low				C T	-C -T	
10. Initiative	C** T**				-C**-T**	C** T**
11. Seldom participates in group with passive activity	-C -T				-C -T	
12. Reliance on others		C T*			C T*	

Note 1. "C" or "T" indicate match between factor score variable and a priori variable for independent variable no. of children or no. of teachers, respectively.

Note 2. Minus sign ("-") prefix indicates that factor score variable measures opposite of a priori variable: high factor score = low a priori variable level, and vice versa.

Note 3. Suffixes denote correlation between factor score variable and independent variable: "*" means $.1 < p < .05$; "**" means $p < .05$; underlined asterisk means significant negative correlation.

as measures of the involvement of the children in tasks or focused activity. Thus the new category, task involvement, was included with the five a priori variables whenever the effects of number of children and number of adults were considered. It was treated as an a priori variable due to its conceptual similarity to the original five, with the understanding that in actuality it was an a posteriori category of behavior. Null hypotheses were assumed to hold for its relationships to variations in number of children and number of teachers. Task involvement is included as a sixth variable with the five original a priori variables in Tables 4 and 5.

There were 138 possible combinations of the six a priori variables (including task involvement) and 23 factors from both observation periods, of which 49 turned out to be meaningful. It was evident that there existed considerable redundancy, with several factors qualifying as measures of each variable.

With so many factors over both observation periods, one would expect four or five for each proposed dependent variable, but only interaction with the physical environment and solitary behavior were represented by five factors; interaction with peers was represented by nine factors; interaction with teachers by ten; passive behavior by fourteen; and task involvement by six. The chief explanation for this redundancy was the multidimensional nature of the factors. While

each factor was an empirical entity created by children's behaviors varying together in some systematic fashion, that factor was usually definable in two or three ways simultaneously. Thus the same factor could serve as a measure of more than one a priori dependent variable (and task involvement).

The redundancy was a mixed blessing. It was first of all a stark affirmation of the post hoc nature of the dependent variables used in this study (as distinguished from most other contemporary child development research), in that the structural description of the children's behavior was not possible until the records were available for analysis. It was surprising and a bit dismaying to find that 23 factors were necessary to cover 60% of the variability in the observed variables. On the other hand, several factor score dependent variables for each a priori variable allowed several tests of each functional hypothesis--each one a different perspective on that type of behavior. Thus the validity of the constructs to be tested was greater than if there were one-to-one correspondences between factors and a priori variables (and task involvement).

Variations in Number of Children and Number of Teachers

Predicted effects of variations in number of children and teachers present in the preschool classroom were considered in succession. The judgments entailed simultaneous

inspection of the match between an a priori variable and each of its constituent factor score dependent variables, and the correlation between each factor score variable and the independent variable of interest. This information is given in Tables 4 and 5, but the final connections between the independent variables and the a priori variables (and task involvement) are stated at length below and summarized in Tables 6 (for the effects of number of children) and 7 (for the effects of number of teachers). In those tables, the number of empirical tests of each a priori variable and task involvement that were significantly positively related, not significantly related, and significantly negatively related to the respective independent variables are shown. In addition, Tables 6 and 7 show the net effects((+1) x number of positive correlations + (0) x number of non-significant correlations + (-1) x number of negative correlations), direction of the predicted relationships for each category of children's behavior, and conclusions regarding each hypothesis.

Number of Children

Interaction with peers was hypothesized to drop as number of children increased. During the Fall observations, Questioning and Expressing-Low was found to rise significantly, meaning that questioning and expressing (the high end of the dimension) dropped, and Receives Requests dropped marginally significantly. Looking at the Spring observations, Closed

Table 6

Number of Significant Relationships Between
A Priori Variables and Number of Children

A priori variables	n[b]	Relationship with number of children[c] positive	not significant	negative	sum	predicted	Conclusion
Interaction with peers	9	1	5	3	-2	negative	accept H2a
Interaction with teachers	10	1	6	3	-2	negative	accept H2b
Interaction with physical environment	5	2	3	0	+2	none	reject H2c
Solitary behavior	5	0	2	3	-3	positive	reject H2d
Passive behavior	14	2	9	3	-1	positive	reject H2e
Task involvement[a]	6	2	3	1	+1	(none)	

Note. Significant correlations are those for which $p < .1$.

[a]Task involvement is included as an a priori variable without a functional hypothesis.

[b]"n" indicates number of tests of each a priori variable, i.e., the number of factors measuring it.

[c]"positive" and "negative" refer to statistically significant correlations.

Table 7

Number of Significant Relationships Between
A Priori Variables and Number of Teachers

A priori variables	n[b]	Relationship with number of teachers[c]					
		positive	not significant	negative	sum	predicted	Conclusion
Interaction with peers	9	2	6	1	+1	none	reject H3a
Interaction with teachers	10	0	8	2	-2	positive	reject H3b
Interaction with physical environment	5	0	4	1	-1	none	reject H3c
Solitary behavior	5	0	5	1	-1	negative	accept H3d
Passive behavior	14	2	9	3	-1	none	reject H3e
Task involvement[a]	6	2	4	0	+2	(none)	

Note. Significant correlations are those for which p .1.

[a]Task involvement is included as an a priori variable without a functional hypothesis.

[b]"n" indicates number of tests of each a priori variable, i.e., the number of factors measuring it.

[c]"positive" and "negative" refer to statistically significant correlations.

Group Participation scores dropped marginally significantly, while Initiative rose. Thus of nine tests of this hypothesis (H2a), three were in the predicted direction, one was opposite the prediction, and five were not significantly related (Table 6).

Interaction with teachers was hypothesized to drop with increasing number of children. In the Fall observation period, Questioning and Expressing-Low rose, meaning questioning and expressing dropped significantly; Needs Rules-Low dropped, meaning needs rules rose significantly; and Receives Requests dropped significantly. In the Spring period, Closed Group Participation dropped marginally significantly. Of ten tests of Hypothesis 2b, three were as predicted, one ran counter, and six were not significant in either direction (Table 6).

Interaction with the physical environment was not expected to be related to variations in number of children. From the Fall data, only Productive-Stationary rose significantly. In the Spring data, only a drop in Problem Solving-Low was significant, meaning high scores for problem solving rose. Thus two out of five tests of H2c indicated a positive relationship between number of children and interaction with the physical environment, while three confirmed its null prediction (Table 6).

Solitary behavior was expected to rise with increasing number of children. In the Fall, however, Individualism fell marginally significantly. In the Spring Individualism and

Uninvolved both fell significantly. Thus three of five tests of H2d ran opposite the prediction, and two showed no relationship (Table 6).

Passive behavior was expected to rise with increasing number of children. During the Spring period, Individualism fell marginally significantly, meaning that the passive opposite end of that dimension rose, and Productive-Stationary, another converse measure of passivity, rose significantly, also indicating a drop in passive behavior. In the Spring, Individualism dropped significantly, indicating a rise in passive behavior; Uninvolved fell, and Initiative (another opposite of passive behavior) rose, signaling a drop in passive behavior. Of fourteen tests of H2e, two were in the predicted direction, three ran opposite, and nine were not significantly related (Table 6).

The hypotheses predicted no relationship between behavior constituting involvement with a task and variations in number of children. In the Fall observations, none of the three factors considered to measure task involvement (Problem Solving-Low, Closed Group Participation, and Working Alone-Low) were found to be significantly related to number of children. In the Spring, however, Problem Solving-Low fell significantly, meaning a rise in problem solving; Closed Group Participation fell marginally; and Initiative rose significantly. Thus two of six tests (of a null hypothesis) showed a positive relationship between number of children and task involvement, one showed a negative relationship, and three showed none (Table 6).

Number of Teachers

Interaction with peers was hypothesized to remain unchanged by increasing number of teachers. For the Fall data, Questioning and Expressing-Low scores rose significantly, meaning a drop in questioning and expressing; and Closed Group Participation dropped significantly. In the Spring Initiative scores rose significantly. In all, one test of Hypothesis 3a showed a positive relationship, two showed a negative relationship, and six showed none, as predicted (Table 7).

Interaction with teachers was hypothesized to rise with increasing number of teachers. For the Fall observations, Questioning and Expressing-Low rose, meaning a decline in questioning and expressing. In the Spring data, Reliance on Others dropped marginally. Overall, two tests of H3b showed negative relationships (opposite the predicted direction), while eight showed no relationship (Table 7).

Interaction with the physical environment was hypothesized not to change with increases in number of teachers. Data from the Fall observations showed a drop in Productive-Stationary as the only significant effect. Problem Solving-Low, Working Alone-Low from the Fall, and Problem Solving-Low and Frustration from the Spring all remained unchanged. Thus of five tests of H3c, one ran counter and four confirmed the prediction (Table 7).

Solitary behavior was expected to drop with increasing number of teachers. Only Individualism (in the Spring) was significantly (negatively) correlated (Table 7). Thus, Hypothesis H3d was not supported.

Passive behavior was not expected to change with increasing number of teachers. In the Fall data, Productive-Stationary scores fell significantly, while Closed Group Participation rose. From the Spring observations, Individualism fell significantly, Initiative rose, and Reliance on Others fell marginally. In all, two tests of H3e showed a positive correlation, three were negative, and nine confirmed its null prediction (Table 7).

Finally, the null hypothesis was assumed for task involvement and number of teachers. Closed Group Participation in the Fall and Initiative in the Spring rose significantly. Four other factor score dependent variables (Problem Solving-Low and Working Alone-Low in the Fall, Problem Solving-Low and Closed Group Participation in the Spring) remained unchanged (Table 7).

CHAPTER VI

SUMMARY AND CONCLUSIONS

Sources of the Data

For the purposes of this study, over 1200 3- and 4-year-old children were observed in 49 day care settings over three days for a total of 60 minutes. Only children for whom there were complete records of number of children and number of teachers, as well as their activities, were selected for the present study; records of over 700 children qualified for analysis for each period. The mean children's group size increased between the two periods from about 16 to more than 18 children (with standard deviations of slightly less than half the magnitude of each), while the number of teachers remained very stable at a little above 2 in each group (standard deviation slightly more than half their magnitudes); the classes ranged from the very small to the very large on both measures. Their size and range supported the choice of this data set as representative of preschool day care classrooms in the United States during the mid-1970's.

Overview of the Findings

Observed Behavior

The spectrum of children's behavior was varied and complex enough to convince anyone of its naturalism. Mean percentages

of 300 samples (60 minutes) in which the 26 behaviors were recorded for each child ranged from slightly over 20% to less than .1%. Fully 13 behaviors were recorded in fewer than 1% of the 12-second samples, or a mean of less than three per hour of observation: shares or helps; receives request; selects activity alone; asks for information; receives rules; asks for permission; sees pattern or solves problem; receives praise; receives threats; asks for assistance; passive-attentive activity; gives up; and reacts angrily to difficulty (see Table 1).

Thought was given to dropping the very infrequent behaviors from further analysis, since they were quite unrepresentative of the children's activities. Two related points, however, led to their retention. First, since this was in many respects an exploratory study, there was interest in tracing each variable as far along the analysis as possible. Second, the influence of each variable was roughly proportional to its relative frequency. The factor score dependent variables were generated using a regression-type model (Kerlinger & Pedhazur, 1973), in which variables not possessing a high amount of explained variability (one reason being low frequency of occurrence) were given relatively low weighting. The names for the factors, also, were subjectively created with greater attention to the more frequent highly loaded variables. In future studies of similar design, infrequent variables might be excluded from further analysis after this

stage, or selected for special analyses intended for such rare events.

Factor Representation of the A Priori Variables

Factor analyses of the data from each observation period allowed simplification of the behaviors into 11 separate dimensions for the Fall and 12 dimensions for the Spring. Five factors were similar enough to be labeled identically (or identical-but-opposite) in both periods: Individualism, Problem-Solving-Low, Needs Rules-Low, Closed Group Participation, and Uninvolve d (-Low).

Despite the differences between the remaining six Fall and seven Spring factors, the fact that each a priori variable could be measured with approximately the same number of factors in the two observation periods helped make a case for their essential equivalence. That is, the number of factors chosen to measure each a priori variable and task involvement (with one exception) in the Fall was never more than one different than the number chosen in the Spring; passive behavior was represented by five Fall and nine Spring factors. It was not possible to conclude that the children in the two periods differed in the frequencies of behaviors--(this was not tested), but inspection of the means in Table 1 showed only small differences. Even the fact that passive behavior was constituted by more factors in the Spring than in the Fall meant only that hypotheses in which it was involved could be tested more often.

Thus, the separation of the Fall and Spring data for the initial analyses was defended on the grounds that the same classrooms were occupied by essentially different samples. The merging of the results afterward was justified because the a priori variables and task involvement were measured about as well by both sets of factors. If the six categories of children's behavior could not have been tested comparably well by both sets, then merging would have been much less advisable. For example, it could have turned out that there were far fewer factors in the Fall than in the Spring, or that the Fall factors could not serve as measures of the a priori variables in the same way that the Spring factors could. Fortunately, this was not a problem. A second important reason that the Fall and Spring results could be merged (should be) was that their differences were not of interest to this study. There were no hypotheses concerned with changes over time, for example. The initial separation was merely one of computational convenience dictated by the data-collection scheme.

In this study, the ways by which preschool children acquire and deal with information (their epistemic activity) was categorized by the six variables: interaction with peers; interaction with teachers; interaction with the physical environment; solitary behavior; passive behavior, and task involvement. These were aptly if not parsimoniously represented by the factors emerging from the data. The relationships between

the behavior categories and the independent variables, number of children and number of teachers, were tested indirectly by determining the magnitudes and directions of the correlations between the independent variables and the factor score variables serving as measures of the behavior categories. Before discussing the support for the experimental hypotheses, it would be helpful to attempt to describe the behavior of all these children in all those classrooms.

Effects of the Independent Variables

It turned out that as one examined the classrooms with more children present (see Table 6), four behavior categories diminished (interaction with peers, with teachers, solitary behavior, and passive behavior). Only interaction with the physical environment and task involvement showed net rises. The picture here was one of busy rooms (as children increased), where children were less likely to be doing nothing or sitting alone, but also where their more frequent activities were not social in nature. The group size effect did not enhance true social interaction, merely producing social proximity while children "did their own thing."

There was a slightly different pattern as the classrooms were examined for increases in teachers (see Table 7). There, interaction with teachers dropped, as did interaction with the physical environment, solitary behavior, and passive behavior. Net rises were found in interaction with peers and task involvement. In this case, the image was one of teachers'

facilitation of two desirable categories of behavior, and dissuasion of less desirable categories. More teachers "got things moving," but at the expense of teacher-child contacts.

While the patterns of net significant effects of the two independent variables were very similar, their total numbers of significant effects (number of significant positive correlations + number of significant negative correlations) were quite different. Of 49 tests of the effects of number of children on the six behavior categories, 20 were significant in one direction or the other at $p < .1$. Of the same number of tests of number of teachers, only 13 were significant. This suggested in a crude way that the ecological variable, number of children, was more effectively related to preschool children's epistemic behavior than number of teachers.

Verifying the Hypotheses

Most of the experimental hypotheses (other than H1 regarding the natural diversity to be found in the factors) were rejected. Tables 6 and 7 show that only the predicted declines in interaction with peers and interaction with teachers as number of children increased, and the drop in solitary behavior as number of teachers increased, were supported. It was somewhat heartening that the hypothesized effects on social interaction of variations in number of children had the most widespread support in the literature; most of the

other hypotheses were the result of extrapolations from less solid previous research. The ad hoc explanations given in the preceding section (that as number of children increases children become more active but not more social, while as number of teachers increases the classroom becomes a busier place) were as reasonable as the hypothesized explanations.

It also turned out--contrary to the underlying assumption that child/teacher ratio effects could better be conceptualized as separate effects of number of children and number of teachers--that variations in these two social variables did not influence children's behavior markedly differently. One important reason for this was that for 11 of the 12 categories of dependent variables (five a priori variables and task involvement as functions of number of children and number of teachers) the modal relationship was no significant relationship; the only exception was the set of tests of solitary behavior as a function of number of children, where the mode was three significant negative correlations (see Tables 6 and 7).

Nevertheless, when the net effects of the independent variables for each a priori variable and task involvement were compared (e.g., net effects of number of children versus number of teachers on interaction with peers), the direction of the relationships was the same for every one except interaction with peers and interaction with the physical environment. Interaction with teachers, passive behavior, and

solitary behavior all decline, and task involvement rose with increases in number of children and number of teachers. Interaction with the physical environment showed an overall rise with increasing number of children, and a drop with increasing number of teachers; interaction with peers showed a net drop as children increased, and rose with more teachers present.

Two explanations were possible for the similarity in direction of effects of varying number of children and teachers on four of the global dependent variable categories. The first, more pessimistic one, was that for each of these four categories the independent variables were so strongly confounded that any differences in effects between them could not be discerned. Only in the cases of interaction with peers and with the physical environment could they be separated. There was support for this explanation in the fact that the correlation between number of children and number of teachers was .55 in the Fall and .61 in the Spring--both statistically significant.

The second possibility was that the separate effects of variations in number of children and teachers were indeed similar for each category of dependent variable, with the exceptions of interaction with the physical environment and solitary behavior noted above. This would support the hypothesis that variations in sheer numbers of people are more important than the types of people being varied, and would lead to rejection of Freedman's density-intensity hypothesis.

While the second explanation was more attractive from the standpoint of justifying the present study, the first remained more likely, at least until further research can achieve greater independence of number of children and teachers. The strongest feasible conclusion was that as children or teachers increase, levels of interaction with teachers, solitary behavior, and passive behavior decline, while task involvement rises. It may be stated with greater certainty that interaction with the physical environment rises with increases in children, and drops with increases in teachers. Interaction with peers, on the other hand, is affected conversely with increases in the two independent variables.

Strengths and Limitations of the National Day Care Study Behavioral Data

The National Day Care Study (NDCS) was the largest, most thorough and policy-relevant day care research project ever conducted in the United States and probably in the world. In addition to its sheer size, measured in terms of numbers of children and staff, numbers of day care centers and types of centers, and geographic locations, it qualifies as an innovative research endeavor in two major ways. First, traditional social and behavioral science research methods were combined and integrated with econometric and management analyses. Second, for one of the first times in a large-scale applied study, naturalistic observations of children's behavior were joined with a variety of standardized test

measures of intelligence and other individual difference dimensions. While such information had been reported before, the scope of behaviors and test measures in this project permitted relationships to be drawn between natural behavior and psychometric ability not previously possible.

More pertinently to the present study than the points made above, the NDCS observational procedures were ecologically very rich and reflected the extensive background and sensitivity of their designers. The one major class of omissions, which might have been avoided if the project had been designed with a more ethological perspective, was detailed information from each observation session on the physical behavioral setting: size and layout of the room; types and quantities of toys and learning materials; and other environmental factors. Some of these data were the subject of inventories taken at each center, but not in a form or at a time useful to the children's behavioral observations.

The major criticism of the NDCS, which pertains to both its own goals and the uses made of the data in the present study, is actually that the behavioral observation scheme is too detailed and rich for the design of the study. The inclusion of 50 or more basic behavioral variables usually means that the frequency that any one variable in particular is recorded remains relatively low, until many samples have been collected. In a study with 10 or even 25 behavior variables, 300 samples over 60 minutes are usually sufficient to

find patterns and relationships which are both statistically significant and powerful. If the Prescott-Stanford Research Institute Child Observation System were being used (or one with similar parameters), several hours' worth of data on each child would be advised.

The preceding criticism was made chiefly on the basis of empirical deficiencies of the Prescott-SRI Child Observation System. The same point can be made when one considers the intended uses of an observational scheme. The purpose of the NDCS was to assess factors and costs related to preschool day care quality; that of the present study was the testing of one ecological model impinging on young children's epistemic behavior. Both purposes could have been better met by a much simpler "time, activity, and object" system, with a few special categories of behavior. It is suggested that the hour spent observing each of roughly 1500 children in the study would have yielded much more pertinent and statistically accountable data.

The Prescott-SRI system would actually be more useful as a clinical assessment instrument. That is, it is very good at drawing rich descriptions of individual children, which are not very applicable to large-scale research projects but could be invaluable at typifying the members of one or two groups of children in observations made over the course of weeks or even months.

The last criticism concerns the design of the last phase of the NDCS (i.e., the Fall and Spring observations), but is

prejudiced a bit by the frustrated needs of this study. This is that despite the range of independent variables and covariables of interest in the larger study, the sample of children, classrooms, and day care centers was not utilized to answer questions regarding ratio and group size (or number of children and number of teachers) as powerfully and efficiently as possible. A study with far fewer cases (of the order of 300) could have provided data to reasonably test the hypotheses and questions. The remaining cases and effort tied up in them could then have been spent evolving and refining a series of research designs to pursue important questions as far as possible.

Possibilities for Further Research

It remains to suggest directions to be taken from this study. Two are essentially methodological, while a third is based on the actual findings.

The first notable step to be taken from the present study is in the direction of simplicity. There could be fewer dependent variables, and fewer covariables (such as day care auspices). There should be fewer children observed, with greater limitations on the range of independent variables.

The second change to be implemented in subsequent research would be in greater control over the independent variables. It was necessary that these data originated from actual day care settings in operation; however, the tremendous confounding

of the critical independent variables could be avoided, or at least diluted to a great extent.

The third suggestion is actually several suggestions arising from these results. This study provided further support for the phenomenon of individuals' "turning off" to high levels of social stimulation. Do the activities to which these children turn compensate for lowered social interaction? What are the implications for reduced teacher-child contact when more teachers are present (due to larger group sizes)? Are changes or variations in children's intellectual performance, as measured by standardized tests, related to their behavior patterns under different ecological conditions?

Some of the answers to the last set of questions for further study can be found, at least to a certain degree, in the larger set of the NDCS data but for others new research must be initiated. It is to the credit of those responsible for conducting that project (at all levels) that its applicability is not mitigated by the questions and ideas it has generated.

BIBLIOGRAPHY

Abt Associates, Inc. National Day Care Study--First Annual Report, 1974-1975. Vols. I and II. Cambridge, Mass.: Author, 1976.

Altman, I. The environment and social behavior. Monterey, California: Brooks/Cole, 1975.

Arnote, T. E. Variations in amount of indoor play space as associated with certain physical aggressive contacts of young children in group settings. Unpublished doctoral dissertation, University of North Carolina at Greensboro, 1969.

Asher, K. N., & Erickson, M. T. Effects of varying social density on day care children's and teachers' behavior. Manuscript submitted for publication, 1977.

Barr, A. J., Goodnight, J. H., Sall, J. P., & Helwig, J. T. A user's guide to statistical analysis system. Raleigh, N. C.: Sparks Press, 1976.

Bates, B. C. Effects of social density on the behavior of nursery school children. Eugene, Oregon: Center for Environmental Research, University of Oregon, 1972.

Bernstein, I. S., & Draper, W. A. The behavior of juvenile rhesus monkeys in groups. Animal Behavior, 1964, 12, 84-91.

Blood, R. O., & Livant, W. P. The use of space within the cabin group. Journal of Social Issues, 1957, 13, 47-53.

Bowerman, W. R. Ambulatory velocity in crowded and uncrowded conditions. Perceptual and Motor Skills, 1973, 36, 107-111.

Brossard, M., & Gouin-Decarie, T. The effects of three kinds of perceptual social stimulation on the development of institutionalized infants. Early Child Development and Care, 1971, 1, 111-130.

Brownell, W., & Smith, D. R. Communication patterns, sex, and length of verbalizations in speech of four-year-old children. Speech Monographs, 1973, 40, 310-316.

Bruner, J. Nature and uses of immaturity. American Psychologist, 1972, 27, 1-27.

Caldwell, B. M. The effects of infant care. In M. C. Hoffman & L. W. Hoffman (Eds.), Review of child development research, Vol. 1. New York: Russell Sage, 1964.

Caldwell, B. M., Wright, C. M., & Tannenbaum, J. Infant day care and attachment. American Journal of Orthopsychiatry, 1970, 40, 397-412.

Calhoun, J. B. Population density and social pathology. Scientific American, 1962, 206, 139-148.

Calhoun, J. B. The role of space in animal sociology. Journal of Social Issues, 1966, 22, 46-59.

Clark, A. H., Wyon, S. M., & Richards, M. P. Free play in nursery school children. Journal of Child Psychology and Psychiatry, 1968, 10, 206-216.

Crayton, L., Scoble, A., Hogan, J., & Fiene, R. Varying adult-child ratios with infants, toddlers, and preschoolers in group care. Unpublished manuscript, Bureau of Child Development, Pennsylvania Dept. of Public Welfare, Harrisburg, Pa., 1977.

Dawe, H. C. The influence of size of kindergarten group upon performance. Child Development, 1934, 5, 295-303.

Desor, J. A. Toward a psychological theory of crowding. Journal of Personality and Social Psychology, 1972, 21(1), 79-83.

Fein, G. G., & Clarke-Stewart, A. Day care in context. New York: Wiley, 1973.

Fiene, R. J. The differential structural characteristics of sentences formed by preschool children in family and group day care centers. Research in Education, November, 1974.

Fishbein, H. D. Evolution, development, and children's learning. Pacific Palisades, Cal.: Goodyear, 1976.

Fowler, W. How adult/child ratios influence infant development. Interchange, 1975, 6, 17-31.

Freedman, J. L. Crowding and behavior. New York: Viking, 1975.

Freedman, J. L., Klevansky, S., & Ehrlich, P. I. The effect of crowding on human task performance. Journal of Applied Social Psychology, 1971, 1, 7-26.

Freedman, J. L., Levy, A. S., Buchanan, R. W., & Price, J. Crowding and human aggressiveness. Journal of Experimental Social Psychology, 1972, 8, 528-548.

Gesell, A. The ontogenesis of infant behavior. In L. Carmichael (Ed.), Manual of child psychology. New York: Wiley, 1954.

Ginsburg, H. J., & Pollman, V. A. Variation of aggressive interaction among male elementary school children as a function of changes in spatial density. Presented at Meetings of the Society for Research in Child Development, Denver, Colorado, 1975.

Griffitt, W., & Veitch, R. Hot and crowded: Influence of population density and temperature on interpersonal affective behavior. Journal of Personality and Social Psychology, 1971, 17, 92-98.

Guardo, C. J. Personal space in children. Child Development, 1969, 40, 143-151.

Hunt, J. McV., Mohandissi, K., Mehrl, G., & Akiyama, M. The psychological development of orphanage-reared infants: Intervention with outcomes. Genetic Psychology Monographs, 1976, 84, 177-226.

Hutt, C., & Vaizey, M. J. Differential effects of group density on social behaviors. Nature, 1966, 209, 1371-2.

Johnson, M. W. The effect on behavior of variation in the amount of play equipment. Child Development, 1935, 6, 56-68.

Keister, M. E. A demonstration project: Group care for infants and toddlers. Final report. University of North Carolina at Greensboro, June, 1970.

Kerlinger, F. N., & Pedhazur, E. J. Multiple regression in behavioral research. New York: Holt, Rinehart, & Winston, 1973.

King, M. G. Interpersonal relationships in children and average approximate distance. Journal of Genetic Psychology, 1966, 109, 109-116.

Kritchevsky, S., & Prescott, E. Planning environments for young children: Physical space. Washington, D.C.: NAEYC, 1969.

Lay, M. Z., & Meyer, W. J. Effects of early day care experience on subsequent observed program behaviors. Unpublished manuscript, Syracuse University, undated.

Little, K. B. Personal space. Journal of Experimental Social Psychology, 1965, 1, 237-247.

Loo, C. M. The effects of spatial density on the social behavior of children. Journal of Applied Social Psychology, 1972, 2, 372-381.

Loo, C. M. Important issues in researching the effects of crowding on humans. Representative Research in Social Psychology, 1973, 4, 219-226.

Loo, C. M., & Smetana, J. The effects of crowding on the behavior and perceptions of 10-year-old boys. Unpublished manuscript, University of California at Santa Cruz, 1977.

Loo, C. M. The effects of spatial density on behavior of children. Paper presented at Meetings of American Psychological Association, Washington, D. C., 1976.

Loo, C. M., & Kennelly, D. Consequences of crowding on the behaviors and perceptions of children. Unpublished manuscript, University of California at Santa Cruz, 1977.

Mathematika Policy Research, Inc. Impact of the FIDCR on children, families, and caregivers. FIDCR Appropriateness Study, Assistant Secretary for Planning and Evaluation, Department of Health, Education, and Welfare: Washington, D. C., 1977.

McGraw, M. Growth: A study of Johnny and Jimmy. New York: Appleton-Century-Crofts, 1935.

McGrew, P. L. Social and spatial density effects on spacing behavior in preschool children. Journal of Child Psychology and Psychiatry, 1970, 11, 197-205.

McGrew, P. L., & McGrew, W. C. Changes in children's spacing behavior with nursery school experience. Human Development, 1972, 15, 359-372.

Melson, G. F. Sex differences in use of indoor space by preschool children. Perceptual and Motor Skills, 1977, 44, 207-213.

Meyer, W. J. Staffing characteristics and child outcomes. Concept paper for FIDCR Appropriateness Report, Washington, D.C.: Department of Health, Education, and Welfare, 1977.

Nie, N. H., Hull, C. H., Jenkins, J. G., Steinbrenner, K., & Bent, D. H. Statistical package for the social sciences (2nd edition). New York: McGraw-Hill, 1975.

Nogami, G. Y. Crowding: Effects of group size, room size, or density. Journal of Applied Social Psychology, 1972, 6, 105-125.

O'Connor, M. The nursery school environment. Developmental Psychology, 1975, 11, 556-561.

Parten, M. B. Social play among preschool childre . Journal of Abnormal and Social Psychology, 1933, 28, 136-147.

Pederson, D. M. Developmental trends in personal space. Journal of Psychology, 1973, 83, 3-9.

Prescott, E. Assessment of child-rearing environments: An ecological approach. Status Report for OCD Grant No. R219-C6, February, 1973.

Prescott, E. Approaches to quality in early childhood programs. Childhood Education, January 1974, 125-131.

Prescott, E., & Jones, E. Day care as a child-rearing environment. Washington, D.C.: NAEYC, 1972.

Raph, J. B., Thomas, A., Chess, S., & Korn, S. J. The influence of nursery school on social interactions. American Journal of Orthopsychiatry, 1968, 38, 144-152.

Rapoport, A. Toward a redefinition of density. Environment and Behavior, June 1975, 7(2), 133-158.

Reuter, J., & Yunik, G. Social interaction in nursery schools. Developmental Psychology, 1973, 9, 319-325.

Rheingold, H. L. The modification of social responses in institutional babies. Monographs of the Society for Research in Child Development, 1956, 21, (No. 63).

Ricciuti, H. N. Effects of infant day care experience on behaviors and development: Research and implications for social policy. Concept paper for FIDCR Appropriateness Report, Washington, D.C.: Department of Health, Education, and Welfare, 1976.

Robinson, H. B., & Robinson, N. M. Longitudinal development of very young children in a comprehensive day care program: The first two years. Child Development, 1971, 42, 1673-1683.

Rohe, W., & Patterson, S. W. The effects of varied levels of resources and density on behavior in a day care setting. In Man-environment interactions, Part 3, D. Carson (Ed.). Stroudsberg, Penn.: Darden, Hutchinson, and Ross, 1974.

Schak, D. C. Determinants of children's play patterns in a Chinese city: The interplay of space and values. Urban Anthropology, 1972, 1(2), 195-204.

Scholtz, G., & Ellis, M. Repeated exposure to objects and peers in a play setting. Journal of Experimental Child Psychology, 1975, 19, 448-455.

Shapiro, S. Some classroom ABC's: Research takes a closer look. Elementary School Journal, 1975, 75, 436-441.

Shure, M. B. Psychological ecology of a nursery school. Child Development, 1963, 34, 979-992.

Skeels, H. M. A study of the effects of differential stimulation on mentally retarded children: A follow-up study. American Journal of Mental Deficiency, 1942, 46, 340-350.

Skeels, H. M. Adult status of children with contrasting early life experiences. Monographs of the Society for Research in Child Development, 1966, 31, (No. 105).

Skeels, H. M., & Dye, H. B. A study of the effects of differential stimulation on mentally retarded children. Proceedings and Addresses of the American Association of Mental Deficiency, 1939, 44, 114-138.

Stallings, J. A., & Giesen, P. A. The study of reliability in observational data. Phi Delta Kappa Occasional Paper No. 19. Bloomington, Ind.: 1977.

Stanford Research Institute. Observer's Manual: Prescott-Child Focus Inventory. Menlo Park, Calif.: Author, 1976.

Stanford Research Institute. Final Report--National Day Care Cost-Effects Study: Spring 1977 (Phase III) Data Collection. Menlo Park, Calif.: Author, 1977.

Stokols, D. On the distinction between density and crowding: Some implications for future research. Psychiatry Review, 1972, 79(3), 275-277.

Stone, L. J., & Church, J. Childhood and Adolescence. New York: Random House, 1973.

Swift, J. M. Effects of early group experience: The nursery school and day nursery. In M. L. Hoffman & L. W. Hoffman (Eds.), Review of child development research, Vol. 1. New York: Russell Sage, 1964.

Tizard, B., Cooperman, D., Joseph, A., & Tizard, A. Environmental effects on language development: A study of young children in long-stay residential nurseries. Child Development, 1972, 43, 337-358.

Torrance, E. P. Group size and question performance of preprimary children. Journal of Psychology, 1970, 74, 71-75.

UNCO, Inc. Presentation of the Initial Results from the National Day Care Consumer Survey. Washington, D.C.: Author, December, 1975.

U. S. Government Printing Office. Federal Interagency Day Care Requirements. (Dept. of HEW Publ. No. (OHD) 76-31081). Washington, D.C.: Author, 1975.

Vandell, D. L., & Mueller, E. C. The effects of group size on toddlers' social interactions with peers. Paper presented at Meetings of the Society for Research in Child Development, New Orleans, Louisiana, 1977.

Webb, E. J., Campbell, D. T., Schwartz, R. D., & Sechrest, L. Unobtrusive measures: Non-reactive research in the social sciences. Chicago, Ill.: Rand McNally, 1966.

Willems, E. P., & Raush, H. L. Naturalistic viewpoints in psychological research. New York: Holt, Rinehart, and Winston, 1969.

Williams, E. P. Planning a rationale for naturalistic research. In E. P. Williams & H. L. Raush (Eds.), Naturalistic viewpoints in psychological research. New York: Holt, Rinehart, and Winston, 1969.

Williams, R. M., & Mattson, M. L. The effect of social groupings upon the language of preschool children. Child Development, 1942, 13, 233-245.

Willis, A., & Ricciuti, H. A good beginning for babies: Guidelines for group care. Washington, D. C.: NAEYC, 1975.

Wohlwill, J. F. The physical environment: A problem for a psychology of stimulation. Journal of Social Issues, 1966, 22, 29-38.

Wolfe, M. Room size, group size, and density: Behavior patterns in a children's psychiatric facility. Environment and Behavior, 1975, 7, 199-224.

APPENDIX A

Equipment and Spatial Organization in the Early Childhood Environment

Child/teacher ratio, group size, and density account for only part of children's program environments. Consideration of their effects on behavior and on program quality must take into account numerous other environmental and experiential factors. While it is not within the scope of this paper to analyze all sources of variation in the day care environment, some research concerning two relevant dimensions will be reported here, which can give perspective to the main variables' influence. These are material resources and play equipment, and spatial organization.

Unfortunately, the body of literature concerned with the effects of day care and preschool experience on behavior and development can not be reviewed in any detail here. For information on this topic, refer to Caldwell (1964), Fein and Clarke-Stewart (1973), Ricciuti (1976), and Swift (1964) for reviews, or to Caldwell, Wright, and Tannenbaum (1970), Keister (1970), Lay and Meyer (1976), McGrew and McGrew (1972), Raph, Thomas, Chess, and Korn (1968) for some actual studies.

Equipment and Resources

The inclusion of equipment and resources--especially toys--as important dimensions can be justified from the programmatic point of view that they reflect the teacher's choices in arranging her professional setting, information no less

important than the teacher's behavior and daily activity plans. For example, in Prescott and Jones's (1972) data regarding a number of day care structural characteristics, the organization of space and program format were considered even more important than child/teacher ratio or group size in accounting for teachers' activities and styles.

In other research by Prescott (1973), she rated the "softness" of four types of day care settings: closed and open centers; and family style and nursery homes. Softness refers to the responsiveness of the environment, especially on a proximal sensual level. Examples of "soft" elements are sand, laps in which to sit, rugs and carpeting, and messy materials. Closed-center settings are typified by teachers' deciding how children will be engaged, teachers' directing both individual and group activity, and activity-to-activity transitions made as a group. In open centers, children's choice-making is encouraged, all activities are available to children, and activity transitions occur when individual children are ready. The average softness ratings of closed centers was much lower than that of open centers (Prescott, 1973, 1974). While softness is at present a notion which is difficult to define precisely, it is representative of a variety of attempts by researchers to assess the potential for positive responsiveness, individualization, and safety-yet-attractiveness of children's settings (e.g., Asher and Erickson's (1977) teacher-at-child-level, or the colloquial "warm lap index").

By far the best time to observe the effects of program differences on amounts and types of materials is during the children's free play. There are several reasons for this. First, preschool children spend very much of their waking time at play. Second, while the teacher's and program's influence over the children may be of ultimate interest, during free play the children are operating more or less under their own volition, selecting toys and occupations without someone else's direct guidance (although the amount of free play varies from program to program). In a sense, children's behavior during free play serves as an evaluative statement of the program's success in fostering independent, decision-making skills. Third, few standardized measures exist which reflect the quality of an early childhood program more validly than the children's actual behavior.

Numerous studies of children's play have been reported in the past forty years, many concerned with the importance of toys, constructive materials, and other equipment. Of four to be mentioned here, two have become traditional child development classics (Johnson, 1935; Parten, 1933), while two recent studies qualify as true experiments (Rohe & Patterson, 1974; Scholtz & Ellis, 1975).

Parten's (1933) naturalistic observations of preschool children between 2 and 5 years old were discussed in the section on group size. Among the many items noted during instances of free play was the specific type of toy and

occupation and the social value of the activity (social value is the location on Parten's participation scale from unoccupied to solitary through organized play).

Of 110 different occupations observed, eight occurred at least 99 times: sandbox (recorded 330 times); family, house, and dolls (178 times); trains (151 times); kiddie-cars (146 times); cutting paper (122 times); clay (119 times); swinging (102 times); and building blocks (99 times). Some of these activities were especially suitable for observing developmental variation, both because children interacted with them differently according to their developmental levels, and because they had varying opportunities to observe one another and thus benefit from social contact. For example, sandbox play was associated with parallel play in younger children, parallel and cooperative play in older children; house and trains also constituted solitary occupations for younger children, cooperative for older; all levels of participation were observed with constructive materials, especially blocks; swings engendered chiefly parallel play (what else?).

Two of the great values of play with toys are that it is interesting for children to both do and to watch, the latter often followed by active exploration and play. Toys are in effect little theaters in which children are both audience and actors, changing roles when the desire and ability hits them. Today as much as earlier, the balance between active involvement and observation which typifies

parallel play is regarded as critical to the formation of peer relationships (Edward Mueller, personal communication), and to the learning of culturally salient skills (Bruner, 1972; Fishbein, 1976). While Parten's participation dimension was not derived from any particular theory, her observations are compatible with several developmental frameworks.

Basing her thinking partly on Parten's observation of toys' effects on social play, Johnson (1935) varied the amount of equipment on young children's (3 to 5 years old) playgrounds. In two related substudies, she either removed or added equipment, after observing children's play with the initial complements. In both substudies, five categories of play were observed: bodily exercise; play with materials; undesirable behavior; games; and contacts with teacher.

When 35 children played on their familiar playground with a reduced amount of equipment, play with remaining materials increased, as did games and peer contacts, while exercise decreased. The effects on 75 other children of adding equipment was also a decrease in exercise, and an increase in play with materials (the children play three times as much with the new equipment as with the old). Social contacts and conflicts also decreased as equipment was added, but not as significantly as the other behavior categories. While Johnson reported her results quite fully, little initial detail was given on the amounts and types of equipment present in the various experiments, pre- and post-change. Also, some

of her effects can now be explained in terms of wariness and curiosity in the face of novel stimuli, as well as criticized because of design problems.

In an experiment described in the spatial density subsection, Rohe and Patterson (1974) varied the amounts of toys and other resources available to 12 preschool children (average age 46 months) in a day care classroom, in addition to their playroom's size. The high resources condition provided twice as many items as the low resources condition. The effects of increasing resources were to raise levels of cooperation, relevant behavior, and constructiveness, while to lower irrelevant behavior; the children also played more on the room's jungle gym. The authors conclude that negative behavior associated with competition for resources can result from decreasing those resources, increasing the spatial density, and by combining those factors.

A final, interesting experiment on the effects of play materials on children's behaviors combined varying amounts of novel, large-motor play equipment with an increasing familiarity dimension for groups of initially unacquainted 4½-year-old children (Scholtz & Ellis, 1975). In both the high and low equipment settings, over the course of 15 play sessions the children's preference for the inanimate materials declined while their preference for these materials was always greater than it was for playmates. The finding of note here, however, was that the material versus peer differential was

much greater in the high rather than the low resource setting, and the convergence of the preferences over time was slower. Thus some effects of increasing the amount of interesting play materials may be to delay and diminish the appearance of social behaviors of various sorts, both desirable and other.

Spatial Organization

Much attention is given by preschool children, day care teachers, and early childhood program managers to the arrangement of the nursery classroom: number and kinds of activity areas; diversity of areas with respect to children's needs and interests; and ease of functioning for adults constituting several major concerns. Despite this great practical interest, little research beyond several observational, non-intervention studies exist in this area. As with the child/teacher ratio and group size topics, the soundest knowledge currently comes from experience and intuition.

Shapiro's (1975) survey of 17 preschools included assessments of children's behavior in qualitatively different spaces. Her category of noninvolved behavior increased in inadequately organized space (i.e., unclear boundaries, activity areas too small, large unfilled spaces). She also observed a disparity between the activity areas preferred by teachers and those most popular with the children. This might be interpreted as an age-difference in certain kinds of values, which may provide one framework for studying the

actual uses of space. Acting as a participant observer, Schak (1972) studied the play values of Oriental working class children, whose families were in transition between lower- and middle-class statuses. He observed that these children played indoors a great deal (similarly to middle-class children), but with neighborhood children (similarly to lower-class children). Here, too, values seem reflected in use of play space and play choices.

Wolfe's (1975) experiment in a residential psychiatric facility may also be mentioned here. In a portion of that study, groups of 8- to 16-year-old boys were assigned to bedrooms appropriate for their group size or larger (e.g., one boy assigned to a one- or two-bed room, two boys assigned to a two- or four-bed room). On several measures of preference and room use, a single-bed room occupied by one boy was found to be the most popular configuration. Wolfe argues from this and other findings that children place a high value on privacy, which they try to attain by arranging the layout of the room to simulate the one-occupant-in-one-room situation (see also Blood & Livant, 1957). Unfortunately, there is extraordinarily little research on privacy, a situation expressed by Altman (1975).

Three rather similar, essentially normative studies sought to describe the ecology of preschool play settings. Shure (1963) observed 4-year-old children in the different areas of the nursery (art, books, dolls, games, and blocks)

on six dimensions: density of children within one area; appropriateness of activity to a locale; mobility of children into and out of an area; quality of emotions and affects; complexity of social participation; and constructiveness with play materials. Clarke, Wyon, and Richards (1969) also recorded preschool children's (average age 45 months) behavior as a function of age, sex, parity, location in room, and other factors. In addition to correlating activities and areas with individual variables, Clarke et al. noted friendship and group patterns in the two classes studied. In the third nonmanipulative preschool environment study, Melson (1977) looked for sex differences in toy selection and movement patterns, with attention given to the area of the room in which the children were located. The consensus of these three investigations regarding arrangement of play space and children's behavior is not very revolutionary: preschool children generally play as they are expected to in particular areas of the classroom. Sex differences do exist in activity preferences and movement patterns: girls prefer art, dolls, and books more than boys do, while boys prefer blocks and large motor games; girls are more likely to be found in solitary activites than boys (girls' social maturity relative to boys' notwithstanding) and seek adults' attention more frequently. Few other specific conclusions can be made from studies such as these.

A natural experiment by Fiene (1974) combined an awareness of the behavioral ecology of preschool settings with well-defined and standardized dependent variables. In two closely related studies, Fiene looked at variations in the frequency and complexity of children's and adults' verbalizations associated with different daytime environments (family day care, center day care, the children's homes) and activity areas (dramatic play, free play, cognitive games, blocks, art). Sixteen children were observed in each type of setting. In the first study, adults and children verbalized more frequently and with greater complexity in the family day care than the home settings, while children in the second study spoke at more sophisticated levels in dramatic and free play areas than in the cognitive games, blocks, and art areas. Combined results for the two day care environments revealed a setting x activity area interaction, in that the activity area effect was greater in center than family day care. One explanation offered by Fiene was that activity areas in center day care were more valid and genuinely specialized ("as-labelled") than those in family day care. Another possibility, drawn from general experience in family and center day care settings, is that child/teacher ratio varies more between activity areas in centers than it does in home-based (i.e., family) day care. Unfortunately, variations in ratio were not included in this report.

The most useful and integrated work on spatial organization of young children's settings is a monograph by Kritchevsky and Prescott (1969), which begins by underscoring the importance of the relationship between physical space and program goals and types. A study was designed to answer several questions regarding the form and quality of center space, the effects of space on children's and teachers' behavior, the best physical settings, and the creation of a general analytic framework. Indoor and outdoor spaces were analyzed into elements: potential units (empty bounded spaces); play units (areas containing something to play with); boundaries; paths; and dead spaces. The spaces were then scored on five dimensions: spatial organization; complexity of equipment; variety of equipment; amount to do per child; and special problems. In spaces given high quality scores, teachers were observed to be friendly and sensitive to children's needs, children interested and involved, with relatively high proportions of lessons in consideration, creativity, and nonroutine encouragement. In low quality spaces, teachers were neutral and insensitive, children uninvolved and uninterested, with lessons characterized by high proportions of guidance, restrictions, and rules. The monograph did not provide details on these observations, as its audience was primarily teachers and program managers.

APPENDIX B

Definitions of Basic Behaviors

(These operational definitions are taken from the Prescott-SRI Child Observation System Training Manual (Stanford Research Institute, 1976).)

Monitors environment (look,, watches)--Focus child's attention is obviously directed at other people or things. Not used for listening. Focus child may be either in or out of activity.

Maintains passive-attentive activity--Focus child is appropriately involved in an activity that requires no visible response from him, but does require concentration or thought. Not shared by other children--he is alone.

Maintains open-ended, expressive activity--Focus child is involved in an activity that has no defined goal, external guidelines, or defined point of completion. Activity structure determined by child. Solitary--not shared by others.

Maintains structured, closed activity--Focus child is involved in an activity which has a goal, clear guidelines for carrying out task, and defined beginning and end. Solitary--not shared with others.

Asks for assistance, help with task--Requests aid from someone else in situation of difficulty or frustration.

Quits activity after difficulty (gives up)--Child terminates his activity after evidencing difficulty or frustration with task.

Reacts with anger to difficulty--Child displays strong negative emotion (anger, crying) resulting from difficulty or frustration with task.

Considers, contemplates, tinkers--Child considers before making selection of materials; tries out an object, looks at it, manipulates it; struggles with problem, attempting to solve it.

Adds a different prop or new idea--Child adds variety to his activity. He uses a different toy or prop than previously in the same activity, or same prop in different way.

Sees pattern, gives structure, solves problem--Child points out a new shape or pattern seen in a familiar object or combination of objects; child perceives object in novel way that is foreign to its normal functioning; child arrives at solution to problem.

Shares, helps, offers affection--Child volunteers assistance; shares possession or materials; gives another a turn; displays affection for another person.

Participates in passive-attention group activity--Child is part of group involved in activity requiring no visible response, but concentration or thought.

Participates in open-ended, expressive group activity--Child participates with others in mutual experience that has no goal, no external guidelines, no defined time limits; structure determined by participants, not materials.

Participates in closed, structured group activity--Focus child and others are involved in activity with goal, clear guidelines for carrying out task, and defined beginning and end.

Does nothing, wanders--Child wanders around room with no apparent purpose, may be sitting or standing.

Moves with purpose--Child goes from one activity to another, or otherwise apparent that there is some goal to his movement.

Selects activity alone--Child begins activity that can not include other children.

Selects activity with others, suggests new activity to others, asks to join or joins--(self-defining).

Asks for information--Child requests factual or instructional information from another.

Asks for permission to share materials, asks for turn--(self-defining).

Gives opinions, preferences, information, comments--Child initiates statements about his own likes, dislikes, or preferences; not necessarily in response to other person.

Receives request or offer to play or share--Child is asked by another person to assist, play with, join in activity, or share; may receive suggestion from adult to participate.

Receives information or help with task--Child receives instruction, materials, or assistance related to his task or solution of problem; includes verbal and nonverbal assistance or demonstration.

Receives praise--Child is praised or commended for his work.

Receives rules, corrections with explanations--Child is given rules of social living or procedure with reasons.

Receives threats, discipline, restraint--Child is threatened with disciplinary measures if he doesn't stop what he is doing; includes withholding or withdrawing privileges and mild physical restraint.

APPENDIX C

Behavior Sample Recording Form: Facsimile and Key

(Taken from SRI child observers' manual (Stanford Research Institute, 1976) and observation booklet.)

The Prescott-SRI Child Observation System records a sample of a child's behavior at 12-second intervals over 20-minute periods. Each sample is recorded using a predefined code in a "frame", for which an example is shown below. Ideally, a 20-minute observation period is made up of 100 frames (samples), but in case of runover due to important ongoing activity or recording error, 107 frames were provided. The recording booklets were designed to be optically scanned for direct computer entry.

Since well over 200 behaviors were possible as combinations of the basic behaviors and objects, in addition to various other bits of information which could be recorded in each frame, the basic behaviors were further defined as combinations themselves of four general types and up to eight "levels" of activity. Each possible behavior was thus memorized by its coded combination of type-with-level. When a behavior was observed, the separate symbols of its components were marked, followed by information concerning the object, then duration and so forth. In this example, only the portion of the frame pertinent to the dependent variables in the present study are shown.

The four types of children's activity are integrates ("I"), thrusts ("T"), receives ("R"), and defends ("D"). The four objects of children's action are adults, one peer, two or more peers, and the non-social environment.

Child Codes					Object
I	1	5	a	Ng	A
T	2	6	b		C
R	3	7	c		E
D	4	8	d		G

I, T, R, and D are the four behavior types.

1, 2, ..., 8 are the levels within each type, a, ..., d are sub-levels, and Ng denotes a negative component to the behavior.

A, C, E, and G are the objects of each behavior.

For example, I2a is the code for "maintains passive-attentive activity"; R5b denotes "receives praise"; R7b (a behavior not included in this study) denotes "receives playfulintrusion"; while R7b-Ng denotes "receives hostile intrusion".

APPENDIX D

Variability Explained Using the Complete Model

Results

For each factor score dependent variable, the portion of total variance explained by number of children, number of teachers, and children x teachers together was expressed by the multiple regression coefficient, R^2. Seven of the Fall and five of the Spring regressions were great enough to be significant at $p < .1$, of which nine from both periods were significant at $p < .05$ (see Tables 2 and 3, and Appendix F).

In the earlier (Fall) observations, relatively large regression coefficients were found for Productive-Stationary ($R^2 = .030$, $p < .0001$), Teacher as Resource ($R^2 = .010$, $p < .02$), Questioning and Expressing-Low ($R^2 = .021$, $p < .0005$), Problem Solving-Low ($R^2 = .008$, $p < .053$), Needs Rules-Low ($R^2 = .009$, $p < .056$), Closed Group Participation ($R^2 = .014$, $p < .006$), and Working Alone-Low ($R^2 = .011$, $p < .03$). In the Spring, sizable coefficients were found for Problem Solving-Low ($R^2 = .018$, $p < .005$), Closed Group Participation ($R^2 = .009$, $p < .09$), Individualism ($R^2 = .011$, $p < .05$), Uninvolved ($R^2 = .051$, $p < .0001$), and Initiative ($R^2 = .014$, $p < .02$).

Discussion: Usefulness of the Overall Model

When the three independent variables (number of children, number of teachers, children x teachers) were included in a regression model, their value became apparent only when

significance levels were inspected. As was reported in Chapter IV (Results), a total of 12 multiple regression coefficients (seven from Fall, five from Spring) were great enough to achieve significance at $p < .1$, of which nine had $p < .05$. Nevertheless, none of the relationships was very powerful: the very strongest regression coefficient was that for Uninvolved in Spring, with the model accounting for 5.1% of that factor's variance ($p < .0001$). A mere coefficient of 1.1% was necessary for significance at $p < .05$ (Individualism, Spring), and even one of .9% (for Closed group participation, Fall) was marginally significant at $p < .09$.

While the actual magnitudes of the regression coefficients were quite small, no specific predictions had been made for the relationship between the overall model and children's behavior. Thus, the fact that over half of them were statistically significant was at least suggestive of the utility of considering these social ecological factors. It was perhaps more than reasonable to be able to explain even 2% or 3% of the factors' variabilities, considering the low degree of experimental control and the wide range of differences among the behavior settings sampled.

APPENDIX E

Tables 8-30

Rotated Factor Loadings, Eigenvalues, Portions of Variance, and Cumulative Portions of Variance for Individual Factors

Table 8

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 1:

Individualism

Variable Name	Loading
Monitors environment	-.12
Passive-attentive activity	.16
Open-ended, expressive activity	.77
Closed, structured activity	.30
Asks for assistance	-.01
Gives up	.09
Reacts angrily to difficulty	.08
Considers, tinkers	.06
Adds new prop or idea	.18
Sees pattern, solves problem	.02
Shares, helps	-.04
Participates in group, passive activity	-.26
Participates in group, open activity	-.32
Participates in group, closed activity	-.06
Does nothing, wanders	.05
Moves with purpose	.00
Selects activity alone	.73
Selects activity with others	.26
Asks for information	.07
Asks for permission	-.06
Gives opinion	-.10
Receives request	-.12
Receives information, help	-.14
Receives praise	.06
Receives rules	-.03
Receives threats	.05

Eigenvalue	Portion of Variance	Cumulative Portion
2.10	.081	.081

Table 9

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 2:

Productive-Stationary

Variable Name	Loading
Monitors environment	-.31
Passive-attentive activity	.14
Open-ended, expressive activity	.19
Closed, structured activity	-.13
Asks for assistance	.07
Gives up	.12
Reacts angrily to difficulty	.08
Considers, tinkers	.07
Adds new prop or idea	.61
Sees pattern, solves problem	.06
Shares, helps	.01
Participates in group, passive activity	.10
Participates in group, open activity	.37
Participates in group, closed activity	-.10
Does nothing, wanders	-.69
Moves with purpose	-.48
Selects activity alone	-.05
Selects activity with others	-.15
Asks for information	.04
Asks for permission	.03
Gives opinion	.03
Receives request	.25
Receives information, help	-.06
Receives praise	.04
Receives rules	.04
Receives threats	.03

Eigenvalue	Portion of Variance	Cumulative Portion
1.84	.071	.152

Table 10

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 3:

Teacher as Resource

Variable Name	Loading
Monitors environment	-.16
Passive-attentive activity	.09
Open-ended, expressive activity	-.09
Closed, structured activity	-.04
Asks for assistance	.47
Gives up	.14
Reacts angrily to difficulty	.14
Considers, tinkers	.05
Adds new prop or idea	.11
Sees pattern, solves problem	.04
Shares, helps	.10
Participates in group, passive activity	-.16
Participates in group, open activity	-.12
Participates in group, closed activity	.12
Does nothing, wanders	.07
Moves with purpose	.02
Selects activity alone	-.01
Selects activity with others	-.03
Asks for information	.15
Asks for permission	.06
Gives opinion	-.11
Receives request	.75
Receives information, help	.70
Receives praise	.02
Receives rules	.06
Receives threats	

Eigenvalue	Portion of Variance	Cumulative Portion
1.71	.066	.217

Table 11

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 4:

Questioning and Expressing-Low

Variable Name	Loading
Monitors environment	.14
Passive-attentive activity	.02
Open-ended, expressive activity	.03
Closed, structured activity	-.13
Asks for assistance	-.03
Gives up	.12
Reacts angrily to difficulty	.00
Considers, tinkers	.09
Adds new prop or idea	.14
Sees pattern, solves problem	-.06
Shares, helps	-.06
Participates in group, passive activity	.12
Participates in group, open activity	.15
Participates in group, closed activity	.17
Does nothing, wanders	.13
Moves with purpose	.11
Selects activity alone	.01
Selects activity with others	.03
Asks for information	-.72
Asks for permission	-.42
Gives opinion	-.68
Receives request	-.15
Receives information, help	-.04
Receives praise	-.02
Receives rules	.00
Receives threats	.12

Eigenvalue	Portion of Variance	Cumulative Portion
1.38	.053	.270

Table 12

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 5:

Problem Solving-Low

Variable Name	Loading
Monitors environment	-.02
Passive-attentive activity	.03
Open-ended, expressive activity	.00
Closed, structured activity	-.21
Asks for assistance	-.07
Gives up	.09
Reacts angrily to difficulty	.07
Considers, tinkers	-.77
Adds new prop or idea	-.16
Sees pattern, solves problem	-.81
Shares, helps	-.03
Participates in group, passive activity	.04
Participates in group, open activity	.13
Participates in group, closed activity	.18
Does nothing, wanders	-.01
Moves with purpose	.03
Selects activity alone	-.07
Selects activity with others	.10
Asks for information	-.05
Asks for permission	.02
Gives opinion	.10
Receives request	-.05
Receives information, help	-.04
Receives praise	-.02
Receives rules	.00
Receives threats	.12

Eigenvalue	Portion of Variance	Cumulative Portion
1.30	.050	.320

Table 13

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 6:

Needs Rules-Low

Variable Name	Loading
Monitors environment	.07
Passive-attentive activity	.04
Open-ended, expressive activity	.11
Closed, structured activity	.17
Asks for assistance	-.17
Gives up	-.03
Reacts angrily to difficulty	-.01
Considers, tinkers	-.17
Adds new prop or idea	.01
Sees pattern, solves problem	.03
Shares, helps	.02
Participates in group, passive activity	-.01
Participates in group, open activity	.18
Participates in group, closed activity	-.18
Does nothing, wanders	.02
Moves with purpose	.13
Selects activity alone	-.08
Selects activity with others	-.28
Asks for information	-.02
Asks for permission	-.43
Gives opinion	.11
Receives request	-.15
Receives information, help	-.01
Receives praise	.00
Receives rules	-.75
Receives threats	-.53

Eigenvalue	Portion of Variance	Cumulative Portion
1.24	.048	.368

Table 14

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 7:

Extravert

Variable Name	Loading
Monitors environment	.15
Passive-attentive activity	-.23
Open-ended, expressive activity	-.03
Closed, structured activity	-.01
Asks for assistance	-.05
Gives up	-.04
Reacts angrily to difficulty	.66
Considers, tinkers	-.03
Adds new prop or idea	.09
Sees pattern, solves problem	-.01
Shares, helps	.61
Participates in group, passive activity	.34
Participates in group, open activity	-.19
Participates in group, closed activity	-.12
Does nothing, wanders	-.06
Moves with purpose	.09
Selects activity alone	.04
Selects activity with others	-.02
Asks for information	.16
Asks for permission	-.08
Gives opinion	-.10
Receives request	-.14
Receives information, help	.02
Receives praise	.00
Receives rules	-.06
Receives threats	.21

Eigenvalue	Portion of Variance	Cumulative Portion
1.20	.046	.414

Table 15

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 8:

Closed Group Participation

Variable Name	Loading
Monitors environment	.02
Passive-attentive activity	-.03
Open-ended, expressive activity	.00
Closed, structured activity	.14
Asks for assistance	-.29
Gives up	-.08
Reacts angrily to difficulty	-.13
Considers, tinkers	-.04
Adds new prop or idea	-.10
Sees pattern, solves problem	.00
Shares, helps	.07
Participates in group, passive activity	.13
Participates in group, open activity	-.57
Participates in group, closed activity	.76
Does nothing, wanders	.01
Moves with purpose	-.15
Selects activity alone	-.14
Selects activity with others	-.58
Asks for information	.02
Asks for permission	-.10
Gives opinion	-.08
Receives request	.02
Receives information, help	.09
Receives praise	.08
Receives rules	.04
Receives threats	.01

Eigenvalue	Portion of Variance	Cumulative Portion
1.13	.044	.458

Table 16

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 9:

Uninvolved-Low

Variable Name	Loading
Monitors environment	-.66
Passive-attentive activity	-.56
Open-ended, expressive activity	-.16
Closed, structured activity	.01
Asks for assistance	.05
Gives up	.08
Reacts angrily to difficulty	-.14
Considers, tinkers	-.08
Adds new prop or idea	.01
Sees pattern, solves problem	.08
Shares, helps	.19
Participates in group, passive activity	-.22
Participates in group, open activity	.28
Participates in group, closed activity	.16
Does nothing, wanders	-.08
Moves with purpose	.12
Selects activity alone	.09
Selects activity with others	.07
Asks for information	-.01
Asks for permission	-.29
Gives opinion	.33
Receives request	-.11
Receives information, help	-.03
Receives praise	.03
Receives rules	.07
Receives threats	.08

Eigenvalue	Portion of Variance	Cumulative Portion
1.10	.042	.500

Table 17

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 10:

Working Alone-Low

Variable Name	Loading
Monitors environment	-.05
Passive-attentive activity	.16
Open-ended, expressive activity	-.01
Closed, structured activity	-.47
Asks for assistance	-.35
Gives up	-.69
Reacts angrily to difficulty	.14
Considers, tinkers	-.06
Adds new prop or idea	-.01
Sees pattern, solves problem	.05
Shares, helps	-.05
Participates in group, passive activity	-.29
Participates in group, open activity	.26
Participates in group, closed activity	.04
Does nothing, wanders	.11
Moves with purpose	-.13
Selects activity alone	-.15
Selects activity with others	-.07
Asks for information	.03
Asks for permission	-.08
Gives opinion	.08
Receives request	-.26
Receives information, help	.02
Receives praise	-.06
Receives rules	-.03
Receives threats	.22

Eigenvalue	Portion of Variance	Cumulative Portion
1.03	.040	.540

Table 18

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Fall, 1976 Factor 11:

Receives Requests

Variable Name	Loading
Monitors environment	.01
Passive-attentive activity	-.03
Open-ended, expressive activity	.04
Closed, structured activity	.09
Asks for assistance	-.25
Gives up	.09
Reacts angrily to difficulty	.00
Considers, tinkers	-.12
Adds new prop or idea	.08
Sees pattern, solves problem	.12
Shares, helps	-.04
Participates in group, passive activity	-.39
Participates in group, open activity	.11
Participates in group, closed activity	-.13
Does nothing, wanders	-.05
Moves with purpose	.45
Selects activity alone	-.07
Selects activity with others	-.10
Asks for information	.19
Asks for permission	.00
Gives opinion	-.18
Receives request	.60
Receives information, help	-.03
Receives praise	.08
Receives rules	-.02
Receives threats	.39

Eigenvalue	Portion of Variance	Cumulative Portion
1.01	.039	.579

Table 19

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 1:

Problem Solving-Low

Variable Name	Loading
Monitors environment	-.11
Passive-attentive activity	-.01
Open-ended, expressive activity	-.09
Closed, structured activity	-.08
Asks for assistance	-.03
Gives up	-.08
Reacts angrily to difficulty	.03
Considers, tinkers	-.80
Adds new prop or idea	-.54
Sees pattern, solves problem	-.77
Shares, helps	.03
Participates in group, passive activity	.03
Participates in group, open activity	.13
Participates in group, closed activity	.13
Does nothing, wanders	.21
Moves with purpose	.12
Selects activity alone	.01
Selects activity with others	-.13
Asks for information	-.02
Asks for permission	-.02
Gives opinion	.15
Receives request	-.07
Receives information, help	-.09
Receives praise	-.09
Receives rules	-.05
Receives threats	.04

Eigenvalue	Portion of Variance	Cumulative Portion
2.11	.081	.081

Table 20

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 2:

Closed Group Participation

Variable Name	Loading
Monitors environment	-.03
Passive-attentive activity	0.06
Open-ended, expressive activity	-.05
Closed, structured activity	.14
Asks for assistance	-.02
Gives up	.07
Reacts angrily to difficulty	-.07
Considers, tinkers	.09
Adds new prop or idea	-.13
Sees pattern, solves problem	.00
Shares, helps	.05
Participates in group, passive activity	.00
Participates in group, open activity	-.83
Participates in group, closed activity	.76
Does nothing, wanders	.17
Moves with purpose	-.03
Selects activity alone	.03
Selects activity with others	-.13
Asks for information	.00
Asks for permission	-.04
Gives opinion	.06
Receives request	-.05
Receives information, help	.44
Receives praise	.01
Receives rules	.17
Receives threats	-.08

Eigenvalue	Portion of Variance	Cumulative Portion
1.83	.070	.151

Table 21

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 3:

Individualism

Variable Name	Loading
Monitors environment	.01
Passive-attentive activity	-.09
Open-ended, expressive activity	.83
Closed, structured activity	.23
Asks for assistance	-.09
Gives up	.05
Reacts angrily to difficulty	-.05
Considers, tinkers	.17
Adds new prop or idea	.17
Sees pattern, solves problem	-.16
Shares, helps	-.02
Participates in group, passive activity	-.06
Participates in group, open activity	-.15
Participates in group, closed activity	-.24
Does nothing, wanders	-.08
Moves with purpose	.02
Selects activity alone	.56
Selects activity with others	-.07
Asks for information	-.14
Asks for permission	.07
Gives opinion	-.12
Receives request	-.05
Receives information, help	.02
Receives praise	.21
Receives rules	-.10
Receives threats	.03

Eigenvalue	Portion of Variance	Cumulative Portion

Table 22

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 4:

Solicits Others

Variable Name	Loading
Monitors environment	.01
Passive-attentive activity	.00
Open-ended, expressive activity	-.01
Closed, structured activity	-.02
Asks for assistance	-.03
Gives up	.03
Reacts angrily to difficulty	-.02
Considers, tinkers	.02
Adds new prop or idea	-.07
Sees pattern, solves problem	.07
Shares, helps	.07
Participates in group, passive activity	-.05
Participates in group, open activity	-.13
Participates in group, closed activity	-.29
Does nothing, wanders	.02
Moves with purpose	.22
Selects activity alone	-.04
Selects activity with others	-.08
Asks for information	.68
Asks for permission	.61
Gives opinion	.24
Receives request	.17
Receives information, help	.39
Receives praise	.26
Receives rules	.08
Receives threats	-.03

Eigenvalue	Portion of Variance	Cumulative Portion
1.41	.054	.271

Table 23

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 5:

Uninvolved

Variable Name	Loading
Monitors environment	.69
Passive-attentive activity	.02
Open-ended, expressive activity	-.04
Closed, structured activity	-.04
Asks for assistance	-.10
Gives up	.07
Reacts angrily to difficulty	-.08
Considers, tinkers	.03
Adds new prop or idea	-.27
Sees pattern, solves problem	.05
Shares, helps	-.09
Participates in group, passive activity	.03
Participates in group, open activity	-.21
Participates in group, closed activity	-.08
Does nothing, wanders	.63
Moves with purpose	.01
Selects activity alone	.06
Selects activity with others	.05
Asks for information	-.17
Asks for permission	.09
Gives opinion	-.54
Receives request	.21
Receives information, help	-.07
Receives praise	.05
Receives rules	-.11
Receives threats	.06

Eigenvalue	Portion of Variance	Cumulative Portion
1.30	.050	.321

Table 24

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 6:

Frustration

Variable Name	Loading
Monitors environment	-.03
Passive-attentive activity	.02
Open-ended, expressive activity	-.01
Closed, structured activity	-.03
Asks for assistance	.07
Gives up	.74
Reacts angrily to difficulty	.77
Considers, tinkers	.03
Adds new prop or idea	.03
Sees pattern, solves problem	.01
Shares, helps	-.03
Participates in group, passive activity	.00
Participates in group, open activity	-.05
Participates in group, closed activity	-.03
Does nothing, wanders	.03
Moves with purpose	.18
Selects activity alone	.03
Selects activity with others	-.09
Asks for information	-.13
Asks for permission	.11
Gives opinion	.07
Receives request	.08
Receives information, help	-.09
Receives praise	-.05
Receives rules	-.03
Receives threats	.02

Eigenvalue	Portion of Variance	Cumulative Portion
1.23	.047	.369

Table 25

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 7:

Needs Rules-Low

Variable Name	Loading
Monitors environment	.12
Passive-attentive activity	-.01
Open-ended, expressive activity	.02
Closed, structured activity	.07
Asks for assistance	.05
Gives up	.10
Reacts angrily to difficulty	-.08
Considers, tinkers	.03
Adds new prop or idea	-.03
Sees pattern, solves problem	-.04
Shares, helps	-.10
Participates in group, passive activity	.01
Participates in group, open activity	.09
Participates in group, closed activity	-.01
Does nothing, wanders	-.06
Moves with purpose	.08
Selects activity alone	.06
Selects activity with others	-.09
Asks for information	.05
Asks for permission	-.09
Gives opinion	.02
Receives request	.08
Receives information, help	.00
Receives praise	-.30
Receives rules	-.63
Receives threats	-.79

Eigenvalue	Portion of Variance	Cumulative Portion
1.21	.046	.415

Table 26

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 8:

Prosocial

Variable Name	Loading
Monitors environment	.23
Passive-attentive activity	-.04
Open-ended, expressive activity	-.06
Closed, structured activity	.05
Asks for assistance	.07
Gives up	.03
Reacts angrily to difficulty	-.02
Considers, tinkers	.05
Adds new prop or idea	.30
Sees pattern, solves problem	-.16
Shares, helps	.76
Participates in group, passive activity	.00
Participates in group, open activity	-.12
Participates in group, closed activity	-.06
Does nothing, wanders	-.25
Moves with purpose	.04
Selects activity alone	.06
Selects activity with others	.02
Asks for information	.14
Asks for permission	.01
Gives opinion	.00
Receives request	.51
Receives information, help	-.35
Receives praise	.03
Receives rules	.12
Receives threats	-.04

Eigenvalue	Portion of Variance	Cumulative Portion
1.11	.043	.458

Table 27

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 9:

Solitary Work-Study-Low

Variable Name	Loading
Monitors environment	.12
Passive-attentive activity	-.79
Open-ended, expressive activity	-.02
Closed, structured activity	-.66
Asks for assistance	-.02
Gives up	.00
Reacts angrily to difficulty	.00
Considers, tinkers	.00
Adds new prop or idea	.16
Sees pattern, solves problem	-.19
Shares, helps	-.02
Participates in group, passive activity	-.01
Participates in group, open activity	.12
Participates in group, closed activity	-.01
Does nothing, wanders	-.07
Moves with purpose	.16
Selects activity alone	-.18
Selects activity with others	-.07
Asks for information	-.04
Asks for permission	.04
Gives opinion	.03
Receives request	.04
Receives information, help	.14
Receives praise	-.03
Receives rules	.13
Receives threats	-.05

Eigenvalue	Portion of Variance	Cumulative Portion
1.09	.042	.500

Table 28

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 10:

Initiative

Variable Name	Loading
Monitors environment	-.16
Passive-attentive activity	-.06
Open-ended, expressive activity	-.09
Closed, structured activity	.07
Asks for assistance	.04
Gives up	.09
Reacts angrily to difficulty	-.04
Considers, tinkers	-.06
Adds new prop or idea	.16
Sees pattern, solves problem	.02
Shares, helps	.12
Participates in group, passive activity	-.10
Participates in group, open activity	.03
Participates in group, closed activity	-.17
Does nothing, wanders	.18
Moves with purpose	.59
Selects activity alone	.51
Selects activity with others	.70
Asks for information	.08
Asks for permission	.00
Gives opinion	-.18
Receives request	-.15
Receives information, help	-.01
Receives praise	-.25
Receives rules	.06
Receives threats	-.04

Eigenvalue	Portion of Variance	Cumulative Portion
1.07	.041	.541

Table 29

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 11:

Seldom Participates in Group with Passive Activity

Variable Name	Loading
Monitors environment	.03
Passive-attentive activity	-.06
Open-ended, expressive activity	.06
Closed, structured activity	.05
Asks for assistance	.02
Gives up	-.01
Reacts angrily to difficulty	.01
Considers, tinkers	-.05
Adds new prop or idea	.04
Sees pattern, solves problem	.07
Shares, helps	-.08
Participates in group, passive activity	-.92
Participates in group, open activity	.07
Participates in group, closed activity	.09
Does nothing, wanders	.04
Moves with purpose	-.06
Selects activity alone	-.03
Selects activity with others	.16
Asks for information	-.02
Asks for permission	.08
Gives opinion	.30
Receives request	.24
Receives information, help	-.04
Receives praise	.05
Receives rules	-.07
Receives threats	.06

Eigenvalue	Portion of Variance	Cumulative Portion
1.03	.040	.581

Table 30

Rotated Factor Loadings, Eigenvalue, Portion of Variance, and Cumulative Portion of Variance for Spring, 1977 Factor 12:

Reliance on Others

Variable Name	Loading
Monitors environment	-.31
Passive-attentive activity	.06
Open-ended, expressive activity	-.05
Closed, structured activity	-.04
Asks for assistance	.69
Gives up	.15
Reacts angrily to difficulty	-.07
Considers, tinkers	.05
Adds new prop or idea	.13
Sees pattern, solves problem	-.01
Shares, helps	.01
Participates in group, passive activity	-.04
Participates in group, open activity	.18
Participates in group, closed activity	.09
Does nothing, wanders	.00
Moves with purpose	-.13
Selects activity alone	.05
Selects activity with others	.07
Asks for information	-.08
Asks for permission	.07
Gives opinion	.35
Receives request	.31
Receives information, help	.26
Receives praise	.47
Receives rules	.07
Receives threats	-.06

Eigenvalue	Portion of Variance	Cumulative Portion
1.01	.039	.620

APPENDIX F

Tables 31-52

Analysis of Variance and Regression Model Tables for Factor Score Dependent Variables

Table 31

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 1:

Individualism

Source of variance	df	SS	MS	F	p<	R^2
Model	3	2.97	.89	.99	.40	.003
1. No. of children	1	2.86	2.86	2.85	.09	
2. No. of teachers	1	.10	.10	.10	.76	
3. Children x teachers	1	.02	.02	.02	.89	
Error	869	869.23	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.10	.62	.54
No. of children	- .01	- .86	.39
No. of teachers	.02	.26	.79
Children x teachers	.00	- .14	.89

Table 32

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 2:

Productive-Stationary

Source of variance	df	SS	MS	F	p<	R^2
Model	3	26.08	8.69	9.07	.0001	.030
1. No. of children	1	23.81		24.86	.0001	
2. No. of teachers	1	1.12		1.17	.28	
3. Children x teachers	1	1.14		1.19	.28	
Error	869	832.41	.96			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.23	1.50	.13
No. of children	.04	.48	.63
No. of teachers	- .01	-1.31	.19
Children x teachers	.00	-1.09	.28

Table 33

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 3:

Teacher as Resource

Source of variance	df	SS	MS	F	p<	R^2
Model	3	9.52	3.17	3.23	.02	.011
1. No. of children	1	2.14		2.17	.14	
2. No. of teachers	1	7.38		7.50	.006	
3. Children x teachers	1	.01		.01	.94	
Error	869	855.20	.98			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.03	.18	.86
No. of children	.10	1.32	.19
No. of teachers	- .02	-1.63	.10
Children x teachers	- .00	- .08	.94

Table 34

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 4:

Questioning and Expressing-Low

Source of variance	df	SS	MS	F	p<	R^2
Model	3	18.11	6.04	6.14	.0005	.021
1. No. of children	1	15.83		16.11	.0001	
2. No. of teachers	1	.33		0.34	.56	
3. Children x teachers	1	1.95		1.98	.16	
Error	869	853.83	.98			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .49	-3.09	.002
No. of children	.11	1.52	.13
No. of teachers	.03	2.96	.003
Children x teachers	- .00	-1.41	.16

Table 35

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 5:

Problem Solving-Low

Source of variance	df	SS	MS	F	p<	R^2
Model	3	7.70	2.57	2.55	.053	.009
1. No. of children	1	.28		.28	.60	
2. No. of teachers	1	5.35		5.32	.02	
3. Children x teachers	1	2.07		2.06	.15	
Error	869	873.39	1.01			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .18	-1.12	.26
No. of children	.02	.22	.83
No. of teachers	.02	2.19	.03
Children x teachers	- .00	-1.44	.15

Table 36

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 6:

Needs Rules-Low

Source of variance	df	SS	MS	F	p<	R^2
Model	3	7.55	2.52	2.52	.06	.009
1. No. of children	1	4.75		4.76	.03	
2. No. of teachers	1	.21		.21	.65	
3. Children x teachers	1	2.59		2.59	.11	
Error	869	867.69	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.06	.39	.70
No. of children	- .12	-1.64	.10
No. of teachers	.00	.00	1.00
Children x teachers	.01	1.61	.11

Table 37

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 7:

Extravert

Source of variance	df	SS	MS	F	p<	R^2
Model	3	1.24	.41	.41	.75	.001
1. No. of children	1	.16		.16	.69	
2. No. of teachers	1	.87		.86	.35	
3. Children x teachers	1	.21		.21	.65	
Error	869	876.02	1.01			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .06	- .39	.69
No. of children	- .00	- .02	.99
No. of teachers	.01	.88	.38
Children x teachers	- .00	- .46	.65

Table 38

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 8:

Closed Group Participation

Source of variance	df	SS	MS	F	p<	R^2
Model	3	12.44	4.15	4.17	.006	.014
1. No. of children	1	2.31		2.32	.13	
2. No. of teachers	1	9.51		9.55	.002	
3. Children x teachers	1	.62		.62	.43	
Error	869					

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.09	.54	.59
No. of children	- .05	- .71	.48
No. of teachers	.01	.91	.36
Children x teachers	- .00	- .79	.43

Table 39

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 9:

Uninvolved-Low

Source of variance	df	SS	MS	F	p<	R^2
Model	3	2.58	.86	.88	.45	.003
1. No. of children	1	1.49		1.53	.22	
2. No. of teachers	1	1.05		1.08	.30	
3. Children x teachers	1	.04		.04	.84	
Error	869	846.62	0.97			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .03	- .22	.83
No. of children	- .05	- .65	.51
No. of teachers	.01	.83	.41
Children x teachers	.00	.20	.84

Table 40

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 10:

Working Alone-Low

Source of variance	df	SS	MS	F	p<	R^2
Model	3	9.25	3.08	3.09	.03	.011
1. No. of children	1	1.56		1.56	.21	
2. No. of teachers	1	.14		.14	.71	
3. Children x teachers	1	7.56		7.57	.006	
Error	869	867.81	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.27	1.66	.10
No. of children	- .17	-2.28	.02
No. of teachers	- .02	-1.66	.10
Children x teachers	.01	2.75	.006

Table 41

Analysis of Variance and Regression Model Table for Fall, 1976 Factor Score Dependent Variable 11:

Receives Requests

Source of variance	df	SS	MS	F	p<	R^2
Model	3	4.45	1.48	1.48	.22	.005
1. No. of children	1	2.98		2.97	.09	
2. No. of teachers	1	.41		.41	.52	
3. Children x teachers	1	1.06		1.06	.31	
Error	869	871.07	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .00	- .01	.99
No. of children	- .05	- .62	.53
No. of teachers	- .00	- .15	.88
Children x teachers	.00	1.03	.31

Table 42

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 1:

Problem Solving-Low

Source of variance	df	SS	MS	F	p <	R^2
Model	3	13.03	4.34	4.40	.005	.018
1. No. of children	1	10.88		11.02	.0009	
2. No. of teachers	1	1.97		1.99	.16	
3. Children x teachers	1	.18		.18	.67	
Error	869	719.64	.99			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .28	-1.71	.09
No. of children	- .03	- .39	.70
No. of teachers	.02	2.54	.01
Children x teachers	.00	- .43	.67

Table 43

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 2:

Closed Group Participation

Source of variance	df	SS	MS	F	p <	R^2
Model	3	6.41	2.14	2.15	.09	.009
1. No. of children	1	3.14		3.15	.08	
2. No. of teachers	1	.07		.07	.80	
3. Children x teachers	1	3.21		3.23	.07	
Error	869	725.50	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p <
Intercept	.40	2.39	.02
No. of children	- .13	-1.65	.10
No. of teachers	- .02	-2.16	.103
Children x teachers	.01	1.80	.07

Table 44

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 3:

Individualism

Source of variance	df	SS	MS	F	p<	R^2
Model	3	7.90	2.63	2.65	.05	.011
1. No. of children	1	6.82		6.86	.009	
2. No. of teachers	1	.97		.97	.32	
3. Children x teachers	1	.12		.12	.73	
Error	869	724.45	.99			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.28	1.68	.09
No. of children	- .06	- .82	.41
No. of teachers	- .01	-1.17	.24
Children x teachers	.00	.35	.73

Table 45

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 4:

Solicits Others

Source of variance	df	SS	MS	F	p<	R^2
Model	3	2.04	.68	.68	.57	.003
1. No. of children	1	1.50		1.50	.22	
2. No. of teachers	1	.21		.21	.65	
3. Children x teachers	1	.33		.33	.57	
Error	869	730.71	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.17	.99	.32
No. of children	- .02	- .24	.81
No. of teachers	- .01	-1.23	.22
Children x teachers	.00	.57	.57

Table 46

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 5:

Uninvolved

Source of variance	df	SS	MS	F	p<	R^2
Model	3	37.18	12.39	12.98	.0001	.051
1. No. of children	1	22.71		23.80	.0001	
2. No. of teachers	1	14.36		15.04	.0001	
3. Children x teachers	1	.11		.11	.74	
Error	869	695.78	.95			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .33	-1.99	.05
No. of children	- .14	-1.79	.07
No. of teachers	.04	4.22	.0001
Children x teachers	.00	- .34	.74

Table 47

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 6:

Frustration

Source of variance	df	SS	MS	F	p<	R^2
Model	3	.55	.18	.18	.91	.001
1. No. of children	1	.21		.21	.65	
2. No. of teachers	1	.29		.29	.59	
3. Children x teachers	1	.05		.05	.82	
Error	869	732.44	1.01			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	.05	.32	.75
No. of children	.01	.10	.92
No. of teachers	- .01	- .61	.54
Children x teachers	.00	.23	.82

Table 48

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 7:

Needs Rules-Low

Source of variance	df	SS	MS	F	p <	R^2
Model	3	3.63	1.21	1.21	.31	.005
1. No. of children	1	2.31		2.31	.13	
2. No. of teachers	1	1.18		1.18	.28	
3. Children x teachers	1	.14		.14	.71	
Error	869	729.24	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p <
Intercept	.14	.87	.39
No. of children	.02	.27	.79
No. of teachers	- .01	-1.47	.14
Children x teachers	.00	.37	.71

Table 49

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 8:

Prosocial

Source of variance	df	SS	MS	F	p <	R^2
Model	3	3.40	1.14	1.13	.33	.005
1. No. of children	1	.17		.17	.68	
2. No. of teachers	1	3.00		3.00	.08	
3. Children x teachers	1	.23		.23	.63	
Error	869	728.82	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p <
Intercept	- .01	- .04	.97
No. of children	.04	.52	.61
No. of teachers	- .01	- .86	.39
Children x teachers	.00	.48	.63

Table 50

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 9:

Solitary Work-Study-Low

Source of variance	df	SS	MS	F	p<	R^2
Model	3	1.15	.38	.38	.77	.002
1. No. of children	1	.00		.00	.95	
2. No. of teachers	1	.93		.92	.34	
3. Children x teachers	1	.22		.22	.64	
Error	869	731.86	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	- .08	- .51	.61
No. of children	.07	.91	.37
No. of teachers	.00	- .06	.95
Children x teachers	.00	- .46	.64

Table 51

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 10:

Initiative

Source of variance	df	SS	MS	F	p<	R^2
Model	3	9.96	3.32	3.35	.02	.014
1. No. of children	1	6.51		6.56	.01	
2. No. of teachers	1	3.13		3.15	.08	
3. Children x teachers	1	.32		.32	.57	
Error	869	723.04	.99			

Parameter	Beta weight estimate	Student's t for parameter	p<
Intercept	-0.16	- .99	.32
No. of children	.04	.47	.64
No. of teachers	.00	.12	.91
Children x teachers	.00	.57	.57

Table 52

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 11:

Seldom Participates in Group with Passive Activity

Source of variance	df	SS	MS	F	p <	R^2
Model	3	1.21	.40	.42	.74	.002
1. No. of children	1	.41		.42	.52	
2. No. of teachers	1	.74		.77	.38	
3. Children x teachers	1	.06		.06	.80	
Error	869	699.82	.96			

Parameter	Beta weight estimate	Student's t for parameter	p <
Intercept	- .10	- .60	.55
No. of children	.05	.68	.50
No. of teachers	.00	.17	.87
Children x teachers	.00	- .25	.80

Table 53

Analysis of Variance and Regression Model Table for Spring, 1977 Factor Score Dependent Variable 12:

Reliance on Others

Source of variance	df	SS	MS	F	p <	R^2
Model	3	3.72	1.24	1.24	.29	.005
1. No. of children	1	2.22		2.22	.14	
2. No. of teachers	1	1.27		1.27	.26	
3. Children x teachers	1	.23		.23	.63	
Error	869	729.10	1.00			

Parameter	Beta weight estimate	Student's t for parameter	p <
Intercept	- .08	- .47	.64
No. of children	.02	.20	.84
No. of teachers	.00	- .08	.94
Children x teachers	.00	.48	.63