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The effect of a thematic play intervention on play skills and peer interaction of children with special needs or non-special needs at an integrated preschool.

Mary B. Regan
University of Massachusetts Amherst

THE EFFECT OF A THEMATIC PLAY INTERVENTION ON PLAY SKILLS AND PEER INTERACTION OF CHILDREN WITH SPECIAL NEEDS OR NON-SPECIAL NEEDS AT AN INTEGRATED PRESCHOOL

A Dissertation Presented

By

MARY BETH REGAN

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Approved as to style and content by:

Thomas Hutchinson, Chairperson

Jane Baran, Member

Patricia Gillespie-Silver, Member

Hariharan Swaminathan, Member

Mario Fantini, Dean
School of Education

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ABSTRACT

The Effect of a Thematic Play Intervention on Play Skills
and Peer Interaction of Children with Special Needs
or Non-Special Needs at an Integrated Preschool

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Mary Beth Regan, B.A., Monmouth College

Ed.D., University of Massachusetts

Directed by: Professor Thomas Hutchinson

This study assessed the impact of two structured thematic play activities at an integrated preschool within the framework of a quasi-experimental time series design. The two play themes selected for the study were hospital and grocery store. Data were collected on ten children over a period of sixty-eight days. Frequencies of pre-defined behaviors were summed to produce index scores for play and social activities. Four analytic methods were used to analyze the group index scores: the least squares regression method, the absolute deviation regression method, a modification of Tukey's method of slope determination, and the Autoregressive Integrated Moving Average time-series analysis of an intervention effect. The index scores for single subjects were analyzed using the absolute deviation regression method and the modification of Tukey's method of slope determination.

Based on the research results, both substantive and methodological can be made. First, thematic play interventions with minimal adult participation have the potential for increasing play behaviors during free play at preschool. The type of theme selected should reflect consideration of the group of children for whom the intervention is intended. An effective theme incorporates play activities children freely choose and already perform.

Second, this dissertation describes several methodological difficulties that are encountered in the analysis of intervention effects in time-series designs. Each statistical procedure is limited in some respects, and therefore, may result in misleading conclusions. The research hypotheses should be accepted or rejected on the basis of several alternative statistical procedures.

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CHAPTER I

INTRODUCTION

Introduction

Federal legislation has been enacted (Public Law 94-142), effective 1978, mandating the establishment of educational services for all children ages 3 to 18, especially those with special needs. Since 1973, the State of Massachusetts has had Chapter 766 to guide administrators, educators, and parents in expanding their public school programs to provide special needs children with the most appropriate educational programs in the least restrictive environments. Many other states have similar legislation.

The development of programs which meet the guidelines outlined by both Federal and State laws for the preschool age special needs child has been gaining momentum since the early 1970's. In the past many educators believed that special needs children required special separate services. It is the separate nature of the services that is being questioned as the most appropriate way to educate children with special needs (Dunn, 1968; Lilly, 1970). It has been noted that the placement of children in programs for specific disabilities has

ignored other important aspects of individual development. Jordan and Dailey (1973) have reported that segregation and isolation from normal environments, such as school and home, have had a negative effect on the special needs child's self-concept and adaptive behavior. Thus, placement in separate programs may have the unfortunate result of teachers, parents and administrators focusing on the atypical aspects of a child's behavior without any recognition of his/her strengths.

Developmental progress for the special needs child may be enhanced in integrated environments. Allen, Benning, and Drummond (1972) have reported that a program developed at the Experimental Education Unit, University of Washington, which included eight special needs children and eight non-special needs children was successful in modifying some non-adaptive behaviors such as physical attacks and toy throwing of the special needs children. The importance of the project was that it provided some data which indicated that certain undesirable behaviors exhibited by children with special needs can be modified within an integrated setting by combining peer interaction with a behavior modification schedule.

Assessment of Early Intervention Programs

Guralnick (1981) reviewed several studies which addressed various aspects of the effectiveness of integrating handicapped children in early education intervention programs. In his summary of relevant research regarding developmental progress and social interaction of

groups of children enrolled in mainstreamed programs, he notes that studies which only approximate ideal experimental designs and quasi-experimental designs have been conducted. Obtaining control over variables such as curriculum, teacher training, and other factors is not possible in settings which occur naturally. Despite this drawback, evidence points to the effectiveness of integration. In one study he cites, researchers Cooke, Ruskus, Peck and Apolloni (1979) investigated the notion of "equivalent" settings by comparing the progress (as defined by a variety of cognitive and developmental measures) of non-handicapped children enrolled in three integrated preschool centers with the progress of non-handicapped children enrolled in three non-integrated preschool centers. Comparisons of cognitive and developmental measures between the children at different sites revealed few differences. All groups of non-handicapped children exhibited substantial progress over a one year period. The progress of the handicapped children enrolled at the integrated centers indicated substantial cognitive and developmental gains.

Another approach used to look at the effectiveness of integrated programs as a medium for enhancing the cognitive and social development of handicapped children is to compare their developmental growth against normative expectations and internally constructed predictions based on prior knowledge of handicapped populations. Ipsa and Matz (1978) evaluated the effects of the participation of two groups of handicapped children (with mild handicapping conditions) in

a cognitively-oriented integrated program. Results of pre- and post-assessments, as measured by the McCarthy Scales of Children's Abilities, indicated significant gains well beyond those expected for children with mild handicapping conditions.

Measures of Social Integration in Integrated Settings

The extent to which handicapped children are socially integrated in integrated settings has been investigated in various ways. Several behavioral measures which attempt to describe the nature and level of social integration have been studied. These include vocalizations, proximal and distal gazing, imitation, gestures, conversation and game partner choices. The setting that many researchers use to observe the characteristics of social integration is free play at school. Guralnick (1981) combined some findings from several research studies which looked at social integration as measured by various behaviors to see if any patterns emerged consistently in peer interactions in integrated settings. Social integration data were aggregated from the other studies by calculating the percentage of interactions for each of the behaviors that measure social behavior of the variables whenever possible. The percentages were adjusted to proportions based the number of handicapped and non-handicapped peers for each setting. As a result, each percentage reflected how non-handicapped children distributed their interactions among peers. The percentage of non-handicapped childrens' interactions were distributed across the

childrens' levels of handicap. Although the procedure for generating data and selecting categories for analysis were approximations of social interactions, some patterns emerged that were consistent across studies. First, the number of interactions decreases as the severity of the peers' handicaps increases. In addition, the variety of social interactions decrease as the severity of handicap increases.

Statement of the Problem

The results of the studies Guralnick analyzed yield tentative information about the types of interactions which occur at integrated centers. The basic problem is that the overall variability of the types of interactions which take place cannot easily be explained in a systematic way. Differences in programmatic factors (e.g., teacher-child ratio, curriculum model, and preparation for mainstreaming) may account for considerable variation in the types of social interactions that occur at preschool centers. Parental attitudes and service delivery systems are other sources of variation. Guralnick adds that much more research needs to be done to answer questions concerning the efficacy of early intervention programs. In conclusion, researchers need to conduct studies that go beyond identifying global classification variables of handicap and start to describe the specific characteristics of children in varying contexts that contribute to the success or failure of integration.

The fact that special needs children are placed in integrated educational settings is not a guarantee of peer interaction and

increased involvement with the surrounding environment. It may be true that the children are in close proximity, but it is unlikely that spontaneous and voluntary peer interaction will occur just because the children are close to one another. In order to exploit the benefits of an integrated setting, careful consideration of what is known about social development and its requisite environmental attributes is required.

Purpose of the Dissertation

The purpose of this dissertation is to plan, implement,and investigate the impact of a thematic play intervention at an integrated preschool. The design of the study is a quasi-experimental time series design. The time series design consists of three time phases: pre-intervention, intervention, and post-intervention. The study attempts to evaluate the benefit of adding a structured thematic play intervention to a preschool classroom setting. In addition to an overall group analysis, the frequency of selected behaviors for each child were compared between pre-intervention and intervention, and intervention and post-intervention to assess individual change as a result of the play intervention.

Many researchers have written extensively on the positive aspects of play (Bruner, 1972; Rubin, 1980). It has been described as a natural learning medium through which children learn about their social and physical environment. Further, some studies report that thematic play (dramatic play) increases the frequency of attentive

behavior to social interactions between peers in an integrated setting when the non-special needs child is instructed to actively reinforce the special needs child for exhibiting a positive social behavior.

In this study, the play intervention consisted of two structured themes that were consistent over time. Unlike studies that use thematic activities preceding free play time, this intervention took place during free play. Since it occurred during free play time, it made use of the structure of peer interaction in directing play activities rather than rely on the teacher to direct the action.

The "structure" of the intervention was the theme, not the specific behaviors or verbal directives of others. The theme was expected to provide structure by the types of social constructs that tend to initiate thematic play, and by the types of materials provided for the theme to be enacted.

Organization of the Dissertation

The dissertation consists of five subsequent chapters. Chapter II contains the review of the literature on play and its role in social development. Chapter III presents a discussion of the time series model as a research design, and four types of commonly used statistical methods for estimating an intervention effect. The methodology of the dissertation is described in Chapter IV. Chapter V contains the results of the three analyses employed in the study, and Chapter VI provides a summary of the study, its limitations, and conclusions.

C H A P T E R I I

REVIEW OF THE LITERATURE

Introduction

Several topics are reviewed in this Chapter because they are relevant to developing a thematic play intervention. First, human development as a process is discussed, followed by an attempt to define play, and its role in social and cognitive development. The second section reviews play as a context for facilitating early social interaction. The third section describes the "need" special needs children have for access to play activities that promote social and cognitive interaction. The fourth section summarizes some results of applying thematic play activities in educational settings. The last section proposes some considerations for designing a thematic play activity.

Development and Environment

Development has been referred to as a process characterized by the increasing complexity of individual organizing and functioning. According to Piaget (1952), developmental progress of complex linguistic and cognitive skills are based on the acquisition of

simpler sensorimotor responses. Most infants come equipped with reflexes that respond to environmental events. As the child interacts with the environment, control of the motor responses shift from involuntary to voluntary actions. Through subsequent environmental interactions, simple action schemes are modified and develop into more complex response patterns. As environmental demands increase, the existing schemes or action patterns become progressively more mature. Two concepts of Piaget's theory provide some direction for this research study. First, the change in the behavioral repertoire of the young child is predicated on action, and second, the environment must provide challenges to the child in order to promote growth. A child's responses to the environment are unquestionably affected by his/her functioning cognitive and sensorimotor processes. The types of interpersonal exchange and the child's access to environmental information are altered as a result of some cognitive or sensorimotor impairment.

Similarities exist between the development of sensorimotor competence and social competence. As an infant exercises the grasping motion, the hand and arm movements become more coordinated and better directed at making contact with the object. Through further interaction between the infant and the environment, the grasping response develops into an increasingly effective mechanism for retrieving and examining objects which provide the child with information about the environment. As a child exercises his/her

knowledge of the social environment, feedback from the environment provides him/her with information about various aspects of the environment. Like the acquisition of sensorimotor competence, social competence is acquired through active participation in increasingly complex situations. The environment must gradually place more demands on the child's behavioral repertoire to promote learning.

The integration of special needs and non-special needs children within a school setting creates a more demanding environment for children, parents, and teachers. For handicapped children it is an opportunity to be in an environment where observation of socially appropriate behavior can be learned through imitation. For non-handicapped children, school can be a place where they can learn about the nature of handicaps and see differences among children with various physical and developmental abilities who are labelled as special needs. For parents and teachers it requires an understanding of the developmental processes of individual children who come into contact with others that have varying levels of ability.

Studies of children in some integrated preschools have noted behavioral changes, i.e., increasing appropriate behavior (Guess et al., 1968), learning to apply rules, and understanding rule structures (Zimmerman & Rosenthal, 1974). Bricker and Bricker (1974, 1972) report that non-special needs children at the Peabody Integrated Preschool show no lags in developmental progress as a result of participating in an integrated setting, and in fact, were progressing

as expected or better. The integrated preschool may be an effective environment that encourages social and cognitive growth for any child.

Knowledge and competence is acquired through direct and indirect interaction with both people and inanimate objects. Direct interactions involve the child as an active participant, while indirect interactions influence the child's knowledge of the world exclusive of the child's own action. Adaptive behavior is a product of establishing culturally appropriate relationships between actions and situational contexts.

Play

One context through which information about the social and physical environment can be communicated is play. Generally, preschool age children's initial responses to a play situation when surrounded by unfamiliar peers is not to play at all or to play with objects. As the child becomes more familiar with peers and the environment his/her play skills become more coordinated and directed toward making closer contact with peers, as well as with inanimate objects. Through further peer contact, a social scheme develops into an effective procedure for playing cooperatively with peers. Each child has his/her own pace, but in order for play skills to develop and mature, it is essential that the child be actively exploring the environment and seeking peer interaction.

According to Michelman (1974), play can be used as an intervention strategy to facilitate the development of a special needs child's sense of control over his/her environment. In her view, play is a natural integrator of sensation, perception, intellect and behavior. Many children with special needs do not play with objects or other children spontaneously, therefore, a play episode needs to be structured to introduce experiences the child can benefit from.

In many cases, children with special needs require considerable assistance to develop a meaningful symbolic language. The most essential function of symbolic language is to define experience and articulate ideas. The process of this function can be called learning.

> The conceptual process is a symbolic process which pervades all mental activity -- perception, apperception, selfhood, and emotion as well as thought and dream. Children learn to use different types of symbols as they build concepts of their world.... Concepts are tools to think with which are then projected through verbal or non-verbal symbol formations. For example, before a deficit child can function in his environment he has the tasks of building concepts of space and time. These concepts must grow out of his concrete experience to make them trustworthy, just as symbols must evolve from sensory experiences to make them meaningful. (Michelman, 1974, pp. 166-167).

Bruner (1972) proposes that learning is facilitated in an atmosphere of playfulness because a child is more likely to engage in trial and error, risk taking and decision making.

For many years child development theorists have believed that play activity serves some developmental purpose for the growing child

(Spencer, 1855; Groos, 1989). Some of the developmental aspects of individual growth and competence believed to be facilitated by play are: problem solving, tool using skills, creativity, communication, language development, Piagetian operativity, cooperation, perspective taking, sex role development, and cultural transmission (Tizard & Harvey, 1977).

Although much importance is given to the role of play in the development of these skills, there doesn't appear to be a consensus of opinion as to what the operational definition of play is. Attempting to define play is made more manageable when researchers contrast their definitions of play against what they do not define as play. One type of activity often contrasted with play is exploration. Berlyne (1969) characterizes two types of exploration: specific exploration is characterized by cautious investigation of the specific properties of an object, and diverse exploration is distinguished by a more relaxed investigation of what the object can be used for. Hutt (1979) and Sutton-Smith (1968) both propose that the second type of exploratory behavior is more characteristic of play. In addition, specific exploration is a sophisticated manifestation of the orienting reflex where the individual in a cautious way attempts to discover the properties and functions of an object. Play by contrast, occurs when the individual experiments with the functions of an object and tries to vary the functions of the object (Bruner, 1972).

Hutt (1979) has demonstrated differences in play activity and exploratory activity by identifying different growth and decay curves,

motivational states and physiological correlates. She also demonstrated that during exploratory activities, children were more resistant to interruption than during play activity. This is consistent with Bruner's description that play serves more as an activity centered around preoccupation with the means of action, not the function or goal of an action. Bruner (1972) offers a characterization of play:

> Looked at logically, play has two crucial formal patterns: one consists of a function and its arguments; the other, an argument and the functions into which it can fit. A ball or a stick are fitted into as many acts as possible; or an act, climbing, is performed on as many objects to which it can be applied appropriately. This pattern I would speculate, is close to one of the universal structures of language, predication, which is organized in terms of topic and comment. (pp. 695-696)

Additional characteristics which attempt to define play have been summarized by Garvey (1977).

1. Play is pleasurable, enjoyable. Even when not actually accompanied by signs of mirth, it is still positively valued by the player.

2. Play has no extrinsic goals. Its motivations are intrinsic and serve no other objectives. In fact, it is more an enjoyment of means than an effort devoted to some particular end. In utilitarian terms, it is inherently unproductive.

3. Play is spontaneous and voluntary. It is not obligatory but is fully chosen by the player.

4. Play involves some active engagement on the part of the player.

5. Play has a certain systematic relation to what is not play (pp. 4-5).

Reynolds (1976) suggests that play may be considered "behavior in the simulative mode." Behavior is organized into complex patterns he terms "affective behavioral systems." Each system can be characterized by objectives, emotional orientations, and typical outcomes. When an affective-behavioral system is uncoupled from its usual relations to other systems, but still operates normally with respect to its own internal dynamics, it is functioning in a simulation mode. "Play is an effective-behavioral system. Its behavior patterns are "borrowed" from other affective behavioral systems" (Garvey, 1977, p. 6).

Play assumes many forms. One way to delineate types of play is to identify points where major changes in development occur. Piaget (1964) has divided play into three general types. The first type is sensorimotor play which occurs from infancy through the second year of life. Play at this stage often consists of repeating and varying motions. The infant derives pleasure from mastering motor skills and experimenting with touch and sound. Symbolic or representational play is the second stage which predominates at age two to about six. During this period the child encodes his experiences as symbols, and images can be recalled. A child begins to play with symbolic representations and their combinations. The third type of play is games which involve rules. An understanding of certain social concepts of cooperation and competition is developed along with objective thinking. Play is believed to reflect the various stages of cognitive development which in turn reflect varying levels of awareness of the external world.

Play and Social Interaction

Infants acquire new information through observation of activity or through active exploration of the environment. It has been suggested in some mother-infant research that infants are more likely to explore and play with objects when the mother is present (Rubinstein, 1976; Gray, 1977; Pawlby, 1976). It is assumed that the mother reduces some of the uncertainty about the environment, thereby enabling the child to engage in exploration and play activity. She also may influence directly active exploration or play by encouraging the child to focus on certain objects and events in the environment. Implicit in the mother-infant relationship is the notion of structure. Researchers have become increasingly interested in the role the mother plays in structuring the infant's environment. One context that has been looked at for the incidence of structuring behavior is mother-infant play.

It appears that initially mothers play games with their infants before the infant takes an active role in the game. These games start before the infant is six months old, and are characterized by the mother repeating certain acts and pausing for the infant to respond. Mothers accept minimal responses such as visual attention, arousal, and some vocalizations (Bruner, 1977; Ratner & Bruner, 1978). As the infant matures, a shift from a passive to an active role is demonstrated (Crawley et al., 1978). By eight months, infants assume active game roles. The mother's domination of the game diminishes.

Mothers tend to encourage the infant's new abilities of game playing (Gustafson, Green & West, 1979). At twelve months of age infants begin to initiate the play episodes. At this time the infants begin to understand the notion of turn-alternation. This can be exhibited by the verbal and non-verbal markers which signal an understanding of the mutual involvement in the interaction.

Much importance is given to the role the mother and other adults play in structuring the environment for the child in the earliest stages of development. Yet another important type of relationship emerges as the child gets older, the peer relationship. Since this study focusses on preschool age children, peer interaction and its impact on individual development will be discussed.

Games that have been observed in the second year of life include games that occur between groups of acquainted children and groups of unacquainted children. Some researchers report a developmental trend from imitative play to more complementary and reciprocated play between the children which is based on increased age and experience with peers (Mueller & Lucas, 1975). However, the research of infant peer play has not yielded consistent results regarding the developmental trend of social play. Stages are not as easily differentiated as they are with mother-infant play. Mother-infant play is most likely more consistent and structured and initially not reliant on the competence of the child. Peer play is more dependent upon the cognitive and social competence of the child and seems to

occur more frequently as understanding of the structure of play becomes known to the child.

The development of game playing with age-mates appears to have different characteristics of mutual involvement. Peer games are rarely studied before twelve months of age. In addition, the definitions of games, or activities classified as games in the literature, are more varied than the research studies of mother-infant games. Therefore, statements describing the developmental trends of infant peer games are tentative (Ross & Kay, 1980).

Maudry and Neskula (1939) observed infants between six and twenty-five months in a play situation structured by an experimenter. Games were defined as being one of two types: socially blind games, which meant there was no direct contact between the two infants as they played with the same objects, and personal games, which were defined as those games where the infants directed friendly actions to one another. They reported that games before the infant was eight months old were socially blind games; between nine and thirteen months 33 percent of the games were personal games; by nineteen to twenty-five months, 77 percent of the games were personal games. Mueller and Lucas (1975) also described a shift from socially blind to social games in infants between fifteen and eighteen months. The type of social turn-alteration sequences that evolved by eighteen months was defined as imitative, which differs from the play pattern that occurs between mother-infant which describes the infant as actively initiating play episodes.

Play Skills and Special Needs Children

The developmental sequences of play behaviors have evolved from observation of normal children. Whether it accurately reflects the cognitive and social stages of children with various handicaps can only be determined after investigation of the play behavior of special needs children. The normal child acquires much information through the observation of activity that is structured and guided by social interaction with others. Much of this informal interaction relies on the presence of functioning sensorimotor skills. Children with handicaps have been described as frequently withdrawn and inattentive to the world around them (Wehman & Abramson, 1976). A difference in selective attention and length of attention span would most likely alter the amount of information processed, and may also tend to inhibit the learning of discrimination necessary for play skills.

In Hartup's (1970) review of peer research, he indicates that without an opportunity to interact with other children, children have difficulty learning effective communication skills, and controlling aggressive feelings. In the absence of sustained and successful encounters with age-mates, children are developmentally "at risk" in several respects. Longitudinal studies show that non-sociable children manifest greater discomfort, anxiety and less willingness to engage in the environment than more sociable individuals. Bronson (1966) notes that submissiveness and high variability in self esteem are characteristic of non-sociable children. Peer relations can

contribute to the acquisition of basic communicative skills in a manner that interactions with adults either cannot or will not produce.

Social learning in peer interaction involves the same psychological processes as social learning in other contexts. Modeling occurs in peer interaction as it occurs in adult-child interaction. However, peer modeling occurs rather unintentionally and can be characterized by a high degree of reciprocity and informality.

Experimental studies that employ the use of peer models for modifying behavior indicate that peer models possess strong and diverse potential for affecting the course of a child's development (Bandura, Grusec, & Menlove, 1967; Bandura & Menlove, 1968). Alterations in social, emotional, problem-solving behaviors, as well as cognitive style, can occur as a result of peer influence.

Although peer modeling has been identified as an important factor in producing behavioral change, this finding has been established as a result of experimental laboratory studies which isolate one situation. There is little empirical evidence to support this notion of peer interaction modifying behavior to a great degree in naturalistic settings (Hartup, 1970).

The impact of the physical, spatial and organizational features in a naturalistic setting cannot be controlled; hence, behavioral effects cannot be explained by the strict application of operant conditioning principles used in experimental studies. Consequently,

the value of peer modeling as a strategy for altering behavior in naturalistic settings has been investigated to a limited extent in integrated settings for handicapped and non-handicapped children. The tentative findings, however, suggest that imitation of peer models may be increased through systematic programming (Guralnick, 1976).

Guralnick reported that the play behaviors and positive verbalizations of two retarded children did not increase during periods when they observed peer models engaged in these behaviors. However, when non-handicapped peers were trained to attend selectively to the handicapped peers appropriate behaviors, play and positive verbalizations of the two retarded children increased considerably. In another similar study, Guralnick (1976) reported a handicapped preschool child increased appropriate language usage after watching a peer model receiving positive reinforcement from a teacher for using appropriate language.

Structured Play

Although this study does not focus on imitation or peer modeling, the preceding section was included to illustrate the informal learning that can occur through a structured interaction. Special needs children may improve their existing social and linguistic skills with the assistance of an intervention strategy that focuses on the reinforcing properties of peer interaction.

Some research indicates that a structured intervention preceding free play can increase social interaction among peers. An example of a

structured activity designed to promote increased social and language behavior during play was reported by Strain and Wiegerink (1975). The "high risk" children of the study were behaviorally disordered preschool children who exhibited extremely limited social and language behaviors. The children were exposed to a socio-dramatic story session in which each child was prompted to engage in a dramatic role. Social play was measured during free play sessions immediately following the dramatic episode. The results report that social play significantly increased over baseline performance.

Strain (1975) replicated the design with eight severely retarded preschool children. At story time, which preceded free play, the teacher read a children's book and prompted the children to make eye contact with her or the book, and to point to familiar objects upon request. During this time a teacher's aide intermittently reinforced in-seat and attending behavior. During free play the children were allowed to engage in self selected activities. Increases in social behavior were reported during the two intervention stages of the study.

Considerations for Selecting Thematic Play Themes

There are primarily two kinds of social constructs which serve to initiate thematic play. One is an action plan which arranges actions and events into a coherent episode. The other is the role assumed by the child. Roles and action plans are interrelated but serve

different functions in play. The social constructs that comprise the resources for pretend play (as defined in Chapter IV) are the child's increasing knowledge of other individuals and their relationships, categories, types of goals, and of the possible actions and sequences that can accomplish these goals. In addition, the "correct" relationships of objects and actions, the expected emotions or attitudes of individuals concerning events and the characteristic combinations of persons and their actions within a context become assimilated (Garvey, 1977).

Several "theme characteristics" must be considered in choosing an appropriate theme. First, the play materials provided for the theme should elicit functional action plans from the children. An action plan is made up of a sequence of events or actions performed or experienced by a cast of functional roles (Garvey, 1978). Some action plans initiated spontaneously by preschool children are: treating-healing, averting threat, adventure, repairing, packing, taking a trip, shopping, cooking, and dining. Vygotsky (1967) suggests that there are rules of internal consistency for thematic play, and that spontaneous "make believe" play represents those features of the environment that are most salient to a child at a given time. These action themes tend to last longer than themes that focus on the roles of specific characters. Some of the play materials provided for the intervention will have specific functional characteristics that encourage specific rules for their use. This

type of play material tends to influence the types of roles assumed by the players. For example, seeing a suitcase would increase the likelihood that the children would plan a trip. Although objects tend to influence the roles adopted by the players, the relationships do not have to be as direct as in the example given above.

The two themes selected for the intervention phase of this study were hospital and grocery store. The themes were selected for their age appropriateness and for the functional type of action plans they tend to elicit spontaneously from preschool age children. They were also selected for their meaningfulness as activities most children have some experience with.

C H A P T E R I I I

DESCRIPTION OF THE TIME SERIES DESIGN AND FOUR METHODS OF ESTIMATING AN INTERVENTION EFFECT

Introduction

Chapter III is included in the dissertation to describe the time series design used in this study and the four analytic techniques commonly used to assess an intervention effect (Campbell & Stanley, 1966; Hersen & Barlow, 1976; White, 1971). The first section briefly summarizes the single/group time series design. The next section presents four analytic techniques: the least squares regression model, the Box and Jenkins' time series (ARIMA) model, the absolute deviation regression model, and a modification of Tukey's method for calculating a median regression line. The advantages and disadvantages of applying these analytic techniques to data collected over time are presented for each model.

Time Series Design

Assessing an intervention effect in a naturally occurring setting across time can be examined through the use of a time-series design. According to Campbell and Stanley (1966), the most basic time-series experiment can be defined as a "periodic measurement process on some group or individual and the introduction of an experimental change

into this time series of measurements" (p. 37). The time series design is appropriate for small groups and single case research studies as the group or individual serves as its own control group. This type of design allows for the inspection of direction of change of the dependent variables as well as the amount of change. The time series design that is used in this study is diagrammed in Figure 1.

$$O_1 \ldots O_n \; XO_1 .. XO_n \; O_1 \ldots O_n$$

Figure 1. Time series design with an intervention component

The time sequence is partitioned into three distinct phases. These phases are: pre-intervention, intervention, and post-intervention. The number of days data was collected for the phases are twenty-five,twenty-five, and eighteen, respectively. Although single case/group time series designs can control for more threats to validity than the one group pre-test/post-test experimental design, there are possible threats to both the internal and external validity of the study. They are summarized in the next two sub-headed sections.

Threats to Internal Validity

The possible threats to internal validity to this time series design are history and instrumentation. The history of the subjects cannot be controlled for. The failure to control for a subject's history can present a threat to the validity of a study because other factors may be considered as rival hypotheses which explain any changes in behavior which take place during the study. Any competing stimuli that is related to the themes chosen for the intervention that currently exist in the environment in the form of media, direct experience, toys and curriculum are possible explanations of changes in behavior. For example, parents of the children will be aware that a study is taking place and what the themes are. It is possible they will encourage their children to engage in these activities at home. No effort will be made by the researcher to control for these factors. Once the themes are prepared for the study, the researcher will ask the teachers at the school not to use the themes in other activities at school. No other precautions will be taken for history.

The second threat to internal validity is instrumentation. The conditions that will be met for meaningful data collection for the repeated measurements are: (1) a set of operationalized definitions, (2) consistent data collection, (3) consistent personnel, and (4) consistent time and location.

According to Campbell and Stanley (1966), the more novel and motivating the measurement device, the more reactive one can expect it

to be in producing changes in behavior. The researcher will be present in the room to record behaviors with pencil and paper. The researcher expects the behavior of the children to be altered by the presence of the researcher for a period of time. In order to minimize this confounding factor the researcher will be present in the playroom for a few weeks prior to data collection. Children typically ignore adults after a short period of time if the adult does not elicit any attention from a child or does not respond to inquiries made by a child.

Threats to External Validity

The threats to external validity for the time-series design are: (1) selection of subjects, (2) the interaction of the treatment and selection of subject, and (3) reactive arrangements. Subjects have not been randomly selected. Any changes in observed behavior for the group is not generalized to other preschool age children. Replications of the study in other settings will determine if the play intervention is a method for increasing the frequency of social behaviors of preschool children. The interaction of the treatment and selection of subjects presents another problem. Each child can respond differently to the theme as indicated by various levels of voluntary participation in the play episodes. The themes will be familiar to all the children at the preschool. Whether it is equally relevant to other similar populations cannot be estimated from one study.

Data Analysis

The statistical procedures for assessing a treatment effect are dependent upon the number of observations (time points) and the number of subjects. Several procedures used to determine a treatment effect for a quasi-experimental time-series design are used in this study for two purposes. The first purpose is to evaluate the advantages and disadvantages of each method of analysis for this particular set of time-series data. The other purpose is to compare the results of each analysis with the others to see if there are convergent or divergent interpretations of the results. The techniques used in this study are: the least squares regression model, the absolute deviation regression model, a modification of a median regression model proposed by Tukey, and the Box and Jenkins' time-series analysis. The advantages and disadvantages of utilizing each model are briefly presented in this section to provide background information concerning the relationship between the time-series design and the type of analysis employed for the estimation of a treatment effect.

The Analysis of Variance Model

The type of model quite commonly used to assess an intervention effect is the analysis of variance model where the treatment mean is compared to a pre-treatment mean. Using the analysis of variance model for comparing means to estimate a difference due to a treatment effect raises problems when the data are repeated measurements over

time. While an overall difference may be associated with a treatment effect, trends in the data are ignored. Ignoring the trends in the data may lead to spurious conclusions about the treatment impact. A linear slope beginning in baseline and continuing into the treatment phase could be evaluated as a significant difference between the two time periods. It reveals an overall difference between phases, but it does not necessarily mean a continued change in the hypothesized direction of progress.

According to Jones, Vaught, and Weinrott (1976), patterns of change in the time series designs are described by the following characteristics across phases: (1) change in level, (2) change in slope, and (3) the presence or absence of drift or slope. A change in level usually refers to a change at the point at which the intervention is made. A change in slope refers to a change in trend between or among phases. Drift or slope refers to whether or not there is a linear trend in the data.

An assumption that is made for the analysis of variance model is the independence of the errors of the observations. If this assumption is not met the test of significance (F) is positively biased because a significant autocorrelation reduces the number of independent sources of information in the data. The degrees of freedom based on the number of observations would overestimate the F value because the autocorrelations spuriously reduce the variability of the time series data that would result from independent observations.

Autoregressive Integrated Moving Average Model

There are different models of time series analyses, each model makes different assumptions about the nature of the data and provides different equations. The most well known time-series model used in the social sciences for assessing an intervention effect is the Autoregressive Integrated Moving Average (ARIMA) model, which was proposed by Box and Jenkins (1970). The ARIMA model refers to a procedure for modelling the autocorrelation structure of the time series data. The dependence among data points is modelled in terms of previous observations. The parameters estimated in this procedure are autoregressive parameters(AR parameters), previous random shocks (moving average or MA parameters), or a combination of the two types of parameters. In addition, the data are usually transformed to satisfy the conditions of stationarity using a procedure known as differencing.

The extent of the dependency can be assessed by examing the autocorrelations of the data. Autocorrelation refers to a correlation of the data separated by different time intervals or lags in the sequence. For the general case, an autocorrelation of the lag t can be computed by pairing observations t data points apart. The serial dependency throughout the series is identified by computing and plotting correlations of different lags. The plot of the autocorrelations is called a correlogram. Usually as the lag increases the correlation between points become somewhat less stable,

in part because the number of observations from which the coefficient can be computed gets smaller.

The conditions of stationarity are based on the assumption that the specific characteristics of the time series process remain stable across time. One condition of stationarity requires that the mean of the series remain constant and the variance uniform throughout the series. Another condition of stationarity that must be met is that the autocovariance of the time series process is independent of historical time, which means the covariance of two time points is determined solely by the relative lag of the time points, regardless of which section of the series is being inspected.

As a preliminary step in identifying time series models, it is essential to examine the data for violations of the stationarity conditions. Several characteristics of the observed data set can be considered when examining the series for stationarity: (a) a plot of the time series data, (b) a correlogram of the data, (c) tables of means, variances, and autocorrelations for different segments, and (d) the spectral density function of the time series data.

Time series data rarely conform to the conditions of stationarity. It is likely that the data exhibit at least one of the following characteristics: (a) a change in level of the series over time, (b) periodicity, (c) nonconstant variance, or (d) a shift in the autocovariance structure. A method commonly used for analyzing data sets that are not stationary with respect to level involves a

transformation of the data known as differencing. Differencing the observed time series is done by calculating the differences between pairs of observed values separated by a fixed number of time points.

This type of model is traditionally specified as ARIMA(p,d,q), where p denotes the number of autoregressive parameters, d indicates the number of times the series is differenced, and q represents the number of moving averages parameters. This procedure for modelling the interdependence of the time series observations allows the researcher to utilize test statistics that are analogous to those based on the assumption of independent observations.

One limitation of this analysis is that a large number of data points must be obtained to reliably estimate the autocorrelation function of the series. Another reason to obtain a large number of data points is to adjust for the degrees of freedom for dependent data that are lower than the degrees of freedom for independent observations. It is difficult to specify in advance how much data is needed to model a time series due to the nature of the dependency and variability of an observed data set. Glass, Willson, and Gottman (1974) recommend at least 50 to 100 points are necessary to estimate autocorrelations of a series. Fewer observations can be used, and as a rule of thumb, authors Jones, Vaught, and Reed (1974) recommend the use of at least 10 points per phase.

Median Regression Techniques

The data will be analyzed using two median regression techniques. These techniques are nonparametric methods for predicting a line progress for the single case or group. The calculated regression line describes the performance of a single case or group over time. It allows for the prediction of future levels of performance based on the line obtained from a previous time sequence. While most other techniques are used for post hoc examination, the median regression analysis is most often used for ongoing examination of the data to provide information that may be relevant before the time sequence is completed.

The types of data that can be used to estimate the regression line can be represented in the form of: (1) frequency counts which are the number of times a behavior occurs wherein the time in which the counts are taken remains constant, (2) rate (usually per minute) in which the behavior count is divided by the terms interval, or (3) the time it takes to complete a standard number of behaviors.

According to White (1972), it is assumed future performance is related to existing performance. The more information that describes present behavior the more accurate the prediction of future behavior will be. "Successful prediction is determined by the ability of the prediction to come as close to future data as the data which were used to predict the median slope" (p. 9). This means the data in the future will be no further away from the median slope predicted line of

progress than the data used to estimate the prediction line. This is called the same deviation criteria. Results from some validity studies of the median regression technique indicate that between nine and thirteen data points are necessary to approximate successful prediction when the "same deviation" criteria is applied (White, 1972).

Calculating the median slope is similar to the least squares method of slope determination. The least squares regression will minimize the sum of the signed or squared deviations whereas the median slope will minimize the sum of the unsigned deviations. The median line of progress will always be found in the set of all possible slopes between all possible pairs of data. Two important properties of the median slope is that the line must pass through two points and it must also be situated such that 50% of the data points fall on or above the line and 50% of the data points fall on or below the line. The line that meets the requirements stated above is the line used for prediction.

The tests of significance available for testing hypotheses of changes in step and slope are ones that require the least number of assumptions made regarding the distribution of the data. One test used is an exact test of significance for a 2 x 2 table developed by R. A. Fisher (Ferguson, 1976). For any 2 x 2 table the restrictions imposed by the marginal totals result in a finite number of arrangements of the cell frequencies. The exact probability associated with each arrangement may be calculated.

Fisher's test of significance can be used to test the following hypotheses: (1) that a slope other than a flat line exists, (2) that the line constructed through the median rate represents the true line of progress, (3) that the observed change between phases could have occurred by chance, (4) that the steps alone between phases are significant, and (5) that the change in slope is alone significant. The advantages of using the median regression techniques are: (1) relatively few data points are needed to estimate a line, (2) it provides information on a single case, (3) it is simple enough for practitioners in the field to use, and (4) it can be used to make decisions during the administration of treatment.

Two median regression techniques are used in the study, the absolute deviation regression method and a modification of a median regression technique proposed by Tukey. Unlike the least squares regression model, the absolute deviation model does not have a simple expression to calculate the minimized absolute deviations. The regression line is found by comparing all possible pairs of points in order to minimize the deviations. A computer is often necessary to obtain a solution if there are large data sets. The regression technique suggested by Tukey is less cumbersome to calculate and can be described as follows:

1. divide the points into three nonoverlapping regions that are of the same approximate number. Compute the median of the x values and the median of the y values in each of the outer regions. Call these values (xB,yB) and (xT,yT), respectively.

2. Compute the slope of the line joining points (xB,yB) and (xT,yT). By definition this is (yT-yB)/(xT-xB) .

3. Compute the median of the differences, y- slope*x, and take this as the y-intercept of the fitted line. (McNeil, D.,1977,p.50)

C H A P T E R I V

DESIGN OF THE STUDY

Introduction

This chapter describes the subjects of the sample, the intervention materials, data collection equipment, and preparatory steps for implementing an intervention strategy in a preschool classroom. The procedures for data collection, the definitions of the dependent variables and the organization of the data for analysis are also presented in this chapter. The hypotheses stated at the end of the chapter are tested using the techniques described in Chapter III.

Subjects

The subjects were ten preschool children enrolled at the Side by Side West program at the Buckland-Shelburne Regional School for the Fall of 1983 and the Spring of 1984. Subject characteristics are presented in Table 1.

Setting

The setting was the preschool classroom at the Buckland-Shelburne Regional School. All data were collected during a regularly scheduled free play time period which occurred in the morning starting at 8:30 and ending about 9:15.

Table 1

Subject Characteristics

ID	Sex	DOB	Began School	Began Side by Side	Disability
01	F	9/12/78	9/82	11/82	none
02	M	9/11/78	-	9/81	Language Delay
03	M	12/14/78	9/81	9/82	none
04	M	11/03/78	-	9/83	none
05	F	08/21/79	-	9/83	none
06	F	02/20/80	-	9/83	none
07	M	11/26/77	9/82	9/83	MD
08	M	03/11/80	-	9/83	none
09	F	03/25/79		3/82	CP
10	M	12/04/80	-	12/82	Down Syndrome
11*	M	09/17/77		9/80	CP
12*	F	11/21/80		12/83	Down Syndrome
13*	M	11/06/80		11/83	CP

* Data not collected on these children
CP = Cerebral Palsy
MD = Muscular Dystrophy
DOB = Date of Birth

Intervention Materials

The materials the children used for the two themes included clothes to put on, and objects relevant to the theme, such as bandages, thermometers, medicine, money. Table 2 lists the thematic play equipment present in the classroom during the first thematic play sequence, hospital. Table 3 lists the equipment present in the classroom for the second theme, grocery store.

Equipment for Data Collection

The equipment used for data collection was:

1. a Sony Walkman tape recorder
2. a pair of headphones
3. a tape cassette that had a beep signal which indicated the beginning of a ten second interval
4. pencils
5. observation forms

Activities in Preparation of the Intervention

The first thematic play activity was hospital. The children were prepared for the intervention by the following activities:

1. The week before the play intervention, the children were assigned to small groups and were read the story, Curious George Goes to the Hospital*.
2. After reading the story to the children the teachers encouraged the children to talk about any experiences they had or they knew about that were related to going to the doctor or hospital.

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*Rey, M., & Rey, H. Curious George Goes to the Hospital. Boston: Houghton Mifflin, 1966.

Table 2

Intervention Play Materials for the Hospital Intervention

10 lab coats child's (size 5)
3 containers of bandaids
2 play hospital kits
5 play stethescopes
tongue depressors
gauze pads
eye patch
sheets to cover tables
ambulance made out of a wagon
medicine bag
face masks (disposable)
3 pairs of gloves
syringes
cotton balls
alcohol wipes
ace bandage
4 mini flashlights
adhesive tape
2 plastic bowls

Table 3

Intervention Play Materials for Grocery Store Intervention

Converted book shelves into store shelves
one play cash register
play money
2 plastic play shopping carts
15 large brown paper bags
food ads on the bulletin board
empty food and drink cartons
some plastic play food

3. The teachers took out two play doctor kits and asked the children to identify the equipment and the purpose of the equipment.

4. The first day of the hospital intervention, the hospital equipment was added to the room.

The second intervention was grocery store. The children were prepared for the second intervention by the following activities:

1. A few days before the intervention, the teachers took the children to visit a "store" the sixth grade class ran which was located in the school building.

2. The children made money out of construction paper to use in the grocery store.

3. The first day of the grocery store, ads for food were stapled to the bulletin boards, the book shelves were converted into food shelves, and two "aisles" were set up by placing two tables by the shelves.

Data Collection

All of the data was collected during the free play sessions and was recorded with pencil and standard observation form. Each child participating in the study was observed for two continuous minutes for every day he/she was present during the study. The author collected all the data for the study. A random subject by time sample schedule was prepared previous to data collection. Each child was assigned a number and each number was randomly selected for the order of observation for each day. Each child was observed once during free play for two continuous minutes. The two minute segment is subdivided into 12 ten second intervals. A child's behavior was scored for its presence in any of the twelve intervals for any of the behaviors defined in Table 4.

Observation Schedule

The dates and corresponding number of days for each phase of the study are:

	Dates	Days	Time
Training	09/19/83 - 10/03/83	10	8:30-9:15
Baseline	10/04/83 - 11/10/83	25	8:30-9:15
Intervention[1]	11/14/83 - 12/07/83	13	8:30-9:15
Intervention[2]	12/08/83 - 01/12/84	12	8:30-9:15
Post-Intervention	01/17/84 - 02/17/84	18	8:30-9:15

Observation Form

The observation form selected for the study incorporates behaviors identified and defined for the most part by other researchers who have investigated various behavioral aspects of preschool children. The behaviors selected for this schedule are actions typically exhibited by normally developing preschool age children during free play at school. Although the study closely adhered to many of the definitions provided by others (some of the definitions have been slightly modified), the method of data collection was not exactly the same as any study from which these behavioral categories were selected from, therefore the results are not directly comparable.

The reliability of the observation schedule can be assessed by its use in previous research studies by the author and others for

Behavior 1 through Behavior 16. The author and three other researchers were trained to an agreement ratio of .90 for each behavior (see Kearney, 1979). The agreement ratio was defined as the percentage of agreements between two observers recording the behaviors of the same subject. The agreement ratio was assessed for each behavior by subtracting the number of disagreements from the sum of agreements, and dividing this quantity by the total number of possible agreements. The researchers were trained for three weeks in the first of a series of studies beginning in 1979, at three integrated preschools in the local area. Since then, the author has used most of these behaviors in other integrated preschool settings.

Behaviors 17 through 23, some aspects of play, were added to this study to further describe the type of pretend play. The author was not able to reliably distinguish between the categories they were using in the research hypotheses.

There are several broad categories which serve to describe the behaviors listed in the schedule: play activities, non-play behavior, verbal behavior, vocal behavior and aspects of thematic play. Table 4 lists the behaviors and the corresponding definitions used in the study.

Table 4

Operational Definitions of Behaviors

Behaviors	Definitions
PLAY BEHAVIORS	
1 Social Play[1]	Cooperative play, sharing an object or setting, clearly interacting with another with or without touching. The outcome of the activity is not known.
2 Associate Play[1]	No interaction with a playmate but playing with the same objects within 1.5 and 3 feet of another child. The outcome of the activity is not known.
3 Parallel Play[1]	Playing with objects that are different from other children within 1.5 feet of each other. The outcome of the task is not known.
4 Object Play[2]	Playful manipulation of objects, not interacting with another. The outcome of the task is not known.
5 Social Constructive Activity[2]	Purposeful activity that serves the function of learning a specific task and accomplishes a specific end. Done with a teacher or a peer.
6 Non-social Constructive Activity[4]	Purposeful activity that serves the function of learning a specific task and accomplishing a specific end. Done alone.
7 Pretend Alone	The child is engaged in pretend play alone.
NON-TASK BEHAVIORS	
8 Tactile Explore[4]	Orienting to the feel of an object or surface with hands, body or mouth.
9 Visual Explore[4]	Orienting to someone or something clearly. Attentive to someone or something.
10 Idle Passive Watching[4]	Observer cannot identify a visual orientation. The child is in a stationary posture.

11 Locomotion[2]	Not part of a task, but steps in any direction, crawling, walking or running.
12 Social Contact[4]	Touching another's body with one's own (e.g., hugging).

VERBAL BEHAVIORS

13 Social Talk[3,4]	Speech between children or with teacher which is not related to a task activity as determined by the observer using operational definitions for task behaviors.
14 Symbolic Gesture[4]	Touching, nodding, pointing to express meaning to another.
15 Vocalization to Others[4]	Utterance or sounds directed to another which are unintelligible to the observer.
16 Vocalization	Utterance or sounds not directed to any other person as determined by the observer. The sounds are unintelligible to the observer.

SOME ASPECTS OF PLAY

17 Repetition[5]	Replaying fragments of everyday life experience. Repeated over an over with little effort to integrate them into a longer sequence.
18 Action Based Repetition[5]	The essence of this type of pretending is the sequence of action the child performs. Although the child may use language or sound effects to go along with the action the words are not necessary to guide the activity.
19 Preplanning[5]	Preparing props for a play sequence. Assignment of roles is clearly evident.
20 Sustained by Language[5]	Play is created and sustained by language.The language discourages ritualistic repetition by encouraging a plot to develop.
21 Projecting the Feelings of Others[5]	Props are assigned human characteristics. Child will talk to object and may also speak characters for the prop.

22 Danger Packed Themes[5]	Choices of themes include elements of danger. Children display active interest in matters of life and death situations.
23 Inventiveness[5]	Pretend play is elaborated in detail and new ideas enter into a familiar theme. Props are gathered more selectively, costumes are more complete and familiar incidents are given a new twist. Language is used more to set the scene, set the mood, and create the pretense.

References to Definitions

[1]Parten, M. B. Play among preschool children. Journal of Abnormal Psychology, 1933, 28, 132-147.

[2]Kearney, D. S. A study of the social skills of four year old hearing impaired children and hearing children in an integrated preschool, Clarke School for the Deaf, Northampton, MA Unpublished Master's Thesis, 1979, University of Massachusetts.

[3]Day, D., Perkins, E., & Weinthaler, J. The behavior checklist of child-environment interaction. An observational record of children's behavior in child care and early education settings. 2nd Ed., 1982, Early Education Program, School of Education, University of Massachusetts.

[4]Novak, M., Kearney, D., & Olley, J. Play behaviors of special needs children. Presentation, American Association on Mental Deficiency, New Orleans, 1977.

[5]Segal, M., & Adcock, D. Just Pretending, 1981. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Data Organization for Analysis

Behaviors were analysed for each child for each day. This was accomplished by counting the number of intervals the behavior occurred in. The possible range of values for any behavior for one day were 0 to 12. Several of the behaviors were added up to obtain five index scores for some of the categories of behaviors defined on the observation schedule. The five index scores were computed by summing the following frequencies of groups of behaviors:

Play index = cooperative + associative + parallel + object + pretend play

Constructive activity index = social constructive activity + nonsocial constructive activity

Non-task index = tactile explore + visual explore + idle passive watching + locomotion

Social index = social contact + social talk + symbolic gesture

Teacher directed activity index = the sum of play, + constructive activity + social behaviors directed by the teacher

Hypotheses Pertaining to Group Data

There will be no difference among the three phases of the study with respect to the average group index measures of

- Play Behavior
- Social Behavior
- Non-task Behavior
- Teacher-directed Behavior
- Constructive-activity Behavior

Hypotheses Pertaining to Individual Subject Data

There will be no difference among the three phases of the study with respect to individual subject index measures of

- Play Behavior
- Social Behavior

CHAPTER V

RESULTS AND DISCUSSION

Introduction

In this chapter, four analytic techniques were used to assess an intervention effect. The first analysis employs a least squares regression procedure to examine the equality of the slopes and intercepts for the three phases. The second and third methods are nonparametric regression techniques. For the two analyses, it is assumed that if the lines of best fit across the three phases are the same, there are no differences between the observations in the three phases. Fourth, is the ARIMA time series analysis proposed by Box and Jenkins.

The results of the statistical tests for the group indexes are presented in the following order: the least squares, the Tukey method for fitting a line, the absolute deviation method, and the ARIMA time series analyses. The five index scores described in Chapter IV are analyzed by each of the methods. A summary of the advantages and disadvantages of the four analytic methods are presented in Table 5 for a review before the results of the group analyses are discussed. The outcomes of the statistical tests performed for these scores are summarized together in Table 6. Statistical tests for two indexes: play and social are performed for the individual cases using the two

Table 5

A Summary of Advantages and Disadvantages of the Four Analytic Methods

Method	Advantages	Disadvantages
Least Squares	• simple to interpret level and trend • standard error of estimates known	• data assumed to be independent • variables assumed to be normally distributed • estimates strongly affected by extreme values • assumes same trend across phases • assumes linear trend
Tukey	• simple to interpret • easy to calculate • not subject to extreme values	• data assumed to be independent • standard error of estimates unknown • does not use all data
Absolute Deviation	• easy to interpret • uses all data • is not subject to extreme values	• data assumed independent • difficult to calculate by hand • standard error of estimates unknown
ARIMA Time Series	• model assumes data are • flexibility of models permits modeling of wide variety of dependencies • variety of intervention effects can be modeled	• requires many data points • time series must be stationary across phases • model identification is trial and error

Table 6

Summary of Group Index Scores by Four Methods

Index	Least squares	Tukey	Absolute Deviation	ARIMA
H_o:				
Play	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ * $\mu_3 = \mu_1$	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$	$\mu_2 = \mu_1$ * $\mu_2 = \mu_3$	$\mu_2 = (\mu_1 + \mu_3)/2$
Constructive Activity	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ * $\mu_3 = \mu_1$ *	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$	$\mu_2 = (\mu_1 + \mu_3)/2$
Non-task	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ $\mu_3 = \mu_1$	$\mu_2 = \mu_1$ * $\mu_2 = \mu_3$	$\mu_2 = \mu_1$ * $\mu_2 = \mu_3$ *	$\mu_2 = (\mu_1 + \mu_3)/2$
Social	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ $\mu_3 = \mu_1$	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ *	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ *	$\mu_2 = (\mu_1 + \mu_3)/2$
Teacher-Directed Activity	$\mu_2 = \mu_1$ $\mu_2 = \mu_3$ $\mu_3 = \mu_1$	$\mu_2 = \mu_1$ * $\mu_2 = \mu_3$	$\mu_2 = \mu_1$ * $\mu_2 = \mu_3$	$\mu_2 = (\mu_1 + \mu_3)/2$

*Statistically significant difference.

nonparametric methods. The results of these tests follow the group analyses.

Least Squares Regression

For the regression methods, two parameters are estimated, the slope and the intercept. In a typical regression analysis the variables are interval data and assumed to be normally distributed about the mean. In this case, the predictor variable, day, is monotonically increasing variable which can present problems in utilizing the three regression methods. As pointed out earlier, it can be assumed that there are no treatment effects if the least squares regression line is the same across the three phases. The first hypothesis that should be tested is the equality of slopes. The equality of slopes hypothesis used to test this assumption is represented as:

$$H_o: \quad \beta 1 = \beta 2 = \beta 3$$

This hypothesis, if accepted, implies that the lines are parallel. If the regression lines are parallel, the analysis of covariance can be used as a procedure to assess a change in the dependent behavior between phases by using the model:

$$Y_i(j) = \beta + T_j + \beta_j t_i + e_{ij}$$

where t_i indicates the ith time point, and T_j the effect of phases j.

The assumption of homogeneity of the regression coefficients is evaluated by constructing a phase by day interaction term in the analysis of covariance model. This is test for equality of the slopes across the treatment phases and should be performed before testing the hypothesis of equal intercepts.

Table 7

Least Squares Simultaneous Tests for Slopes and Intercepts: Four Index Scores

Index	sv	df	ss	ms	F	prob.
Play	intercept	2	46.99	23.50	5.41	.01*
	slope	1	4.23	.97	.97	.32
	error	64	277.78	4.34		
Constructive Activity	intercept	2	24.18	12.09	4.75	.01*
	slope	1	1.54	1.54	.60	.44
	error	64	162.96	2.55		
Non-task	intercept	2	19.84	9.92	4.67	.01*
	slope	1	17.36	17.36	8.18	.01*
	error	64	135.83	2.12		
Social	intercept	2	1.81	.90	.99	.37
	slope	1	.02	.02	.02	.88
	error	64	57.63	.90		

*$p < .05$

Table 8

Least Squares Adjusted Means and Confidence Intervals for Significant Overall Tests of Index Scores

Adjusted Means Index	Time1	Time2	Time3
Play	8.51	9.68	7.48
Constructive Activity	.95	.73	2.71
Non-task	3.75	2.76	4.01

	Contrasts					
Index	$UL^{\mu 2-\mu 1}$	LL	$UL^{\mu 2-\mu 3}$	LL	$UL^{\mu 3-\mu 1}$	LL
Play	-.52	2.86	.36	4.04*	-.80	2.88
Constructive Activity	-1.57	1.13	-3.39	-.69*	-3.18	-.48*
Non-task	-2.16	.20	-2.54	.04	-1.56	1.02

*p<.05

Median Regression Analysis

In the previous section, regression coefficients were estimated using the least squares method. In this section, a modification of the Tukey method of fitting a line, and the absolute deviation method are used for estimating the lines of best fit. The purpose of estimating the three methods is to compare the estimates of each method. The least squares method is more sensitive to extreme values, however, the standard error of the estimates are known. The two nonparametric methods are not as susceptible to extreme values but the standard errors of the estimates of the regression coefficients for the two methods are not known. It is also important to compare the two nonparametric methods to each other. The Tukey method can be easily calculated by hand, whereas the absolute deviation method is more difficult and time consuming if many points are involved. There is no simple algorithm to calculate the coefficients for the absolute deviation method like the least squares method.

Descriptive statistics for the five index scores are presented in Table 9 to provide some reference point to the data under consideration. The estimates of the slopes and intercepts for each index for the group is presented in Table 10. In general, the estimates look quite similar. The direction of the slope is the same for all three methods for every condition. The intercepts vary more but are still close to one another. The next five graphs (Figures 2-6) represent the average group frequencies for the five index scores

Table 9

Descriptive Statistics for the Five Group Index Scores

Phase	Index				
	Play	Constructive Activity	Non-task	Social	Teacher-Directed Activity
Baseline					
N=25					
Mean	7.72	1.43	5.36	1.78	1.89
SD	1.52	1.45	1.58	1.24	1.64
Median	7.80	1.14	5.57	1.45	1.63
Mode	7.29	0.00	5.00	1.29	0.00
Intervention					
N=25					
Mean	9.82	.65	2.50	1.24	1.32
SD	1.72	.92	1.50	.64	.98
Median	9.99	.01	2.29	1.25	1.43
Mode	10.00	0.00	2.00	1.63	2.00
Post Intervention					
n=18					
Mean	8.40	2.16	2.14	1.34	2.34
SD	3.03	2.35	1.52	.79	2.33
Median	8.92	1.42	1.74	1.13	1.26
Mode	4.17	0.00	1.14	1.00	1.00

Table 10

Estimate of slopes and intercepts of the five index scores for the group

BEHAVIOR	METHOD	PHASE					
		Baseline		Intervention		Post Intervention	
		B_1	B_0	B_1	B_0	B_1	B_0
Play	LS	.02	7.5	.05	9.2	.06	7.8
	Tukey	.05	7.5	.02	9.5	.05	8.6
	AD	.00	7.8	.01	9.8	.18	7.5
Construc-	LS	-.05	2.0	.01	.6	-.04	2.5
tive	Tukey	-.04	1.9	.04	-.1	-.06	1.9
Activity	AD	-.03	1.9	.02	-.0	-.05	1.8
Non-task	LS	-.09	6.5	-.10	3.8	.03	1.9
	Tukey	-.07	6.1	-.05	3.1	.04	1.6
	AD	-.08	6.3	-.11	3.4	.05	1.5
Social	LS	-.02	2.1	.02	.9	.01	1.2
	Tukey	-.01	1.6	.05	.7	.01	1.0
	AD	-.02	1.8	.05	.6	.04	.8
Teacher	LS	-.12	3.4	-.03	1.6	.22	.2
Directed	Tukey	-.07	2.5	-.01	1.6	.21	-.1
Activity	AD	-.07	2.5	-.02	1.7	.18	.3

LS = Least Squares
AD = Absolute Deviation
B_1 = Slope
B_0 = Intercept

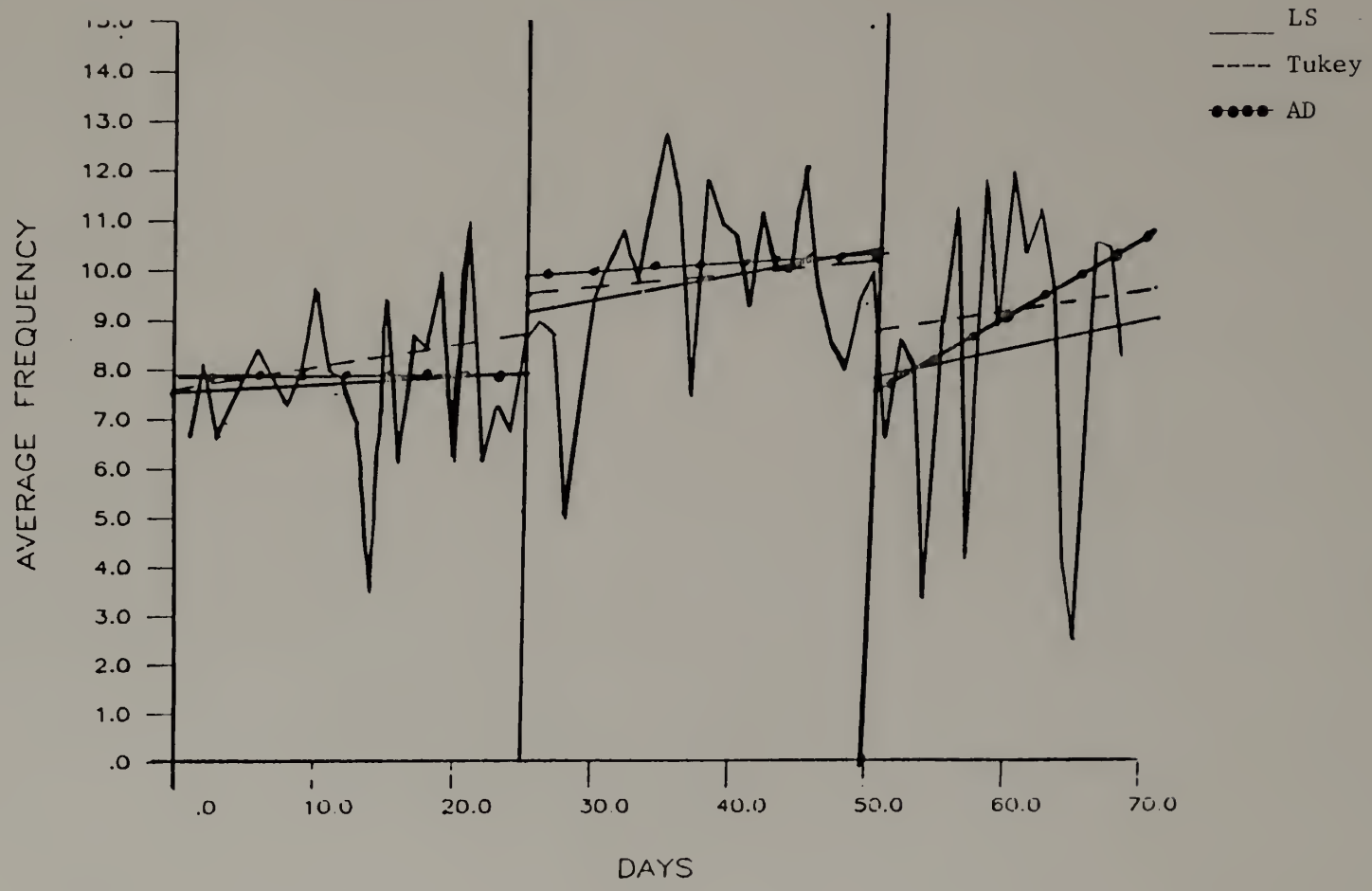

Figure 2. Average play frequency for group.

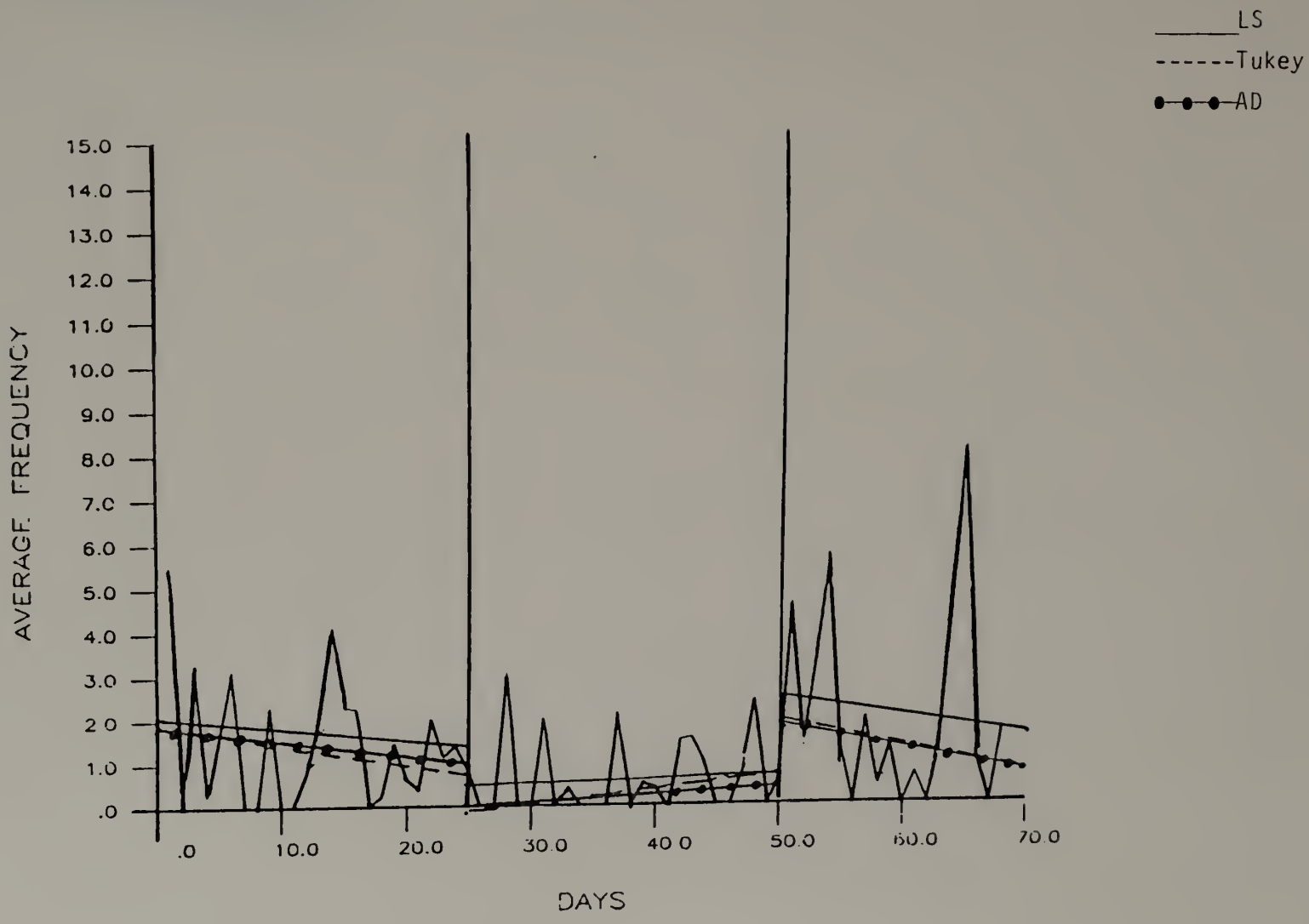

Figure 3. Average constructive activity frequency for group.

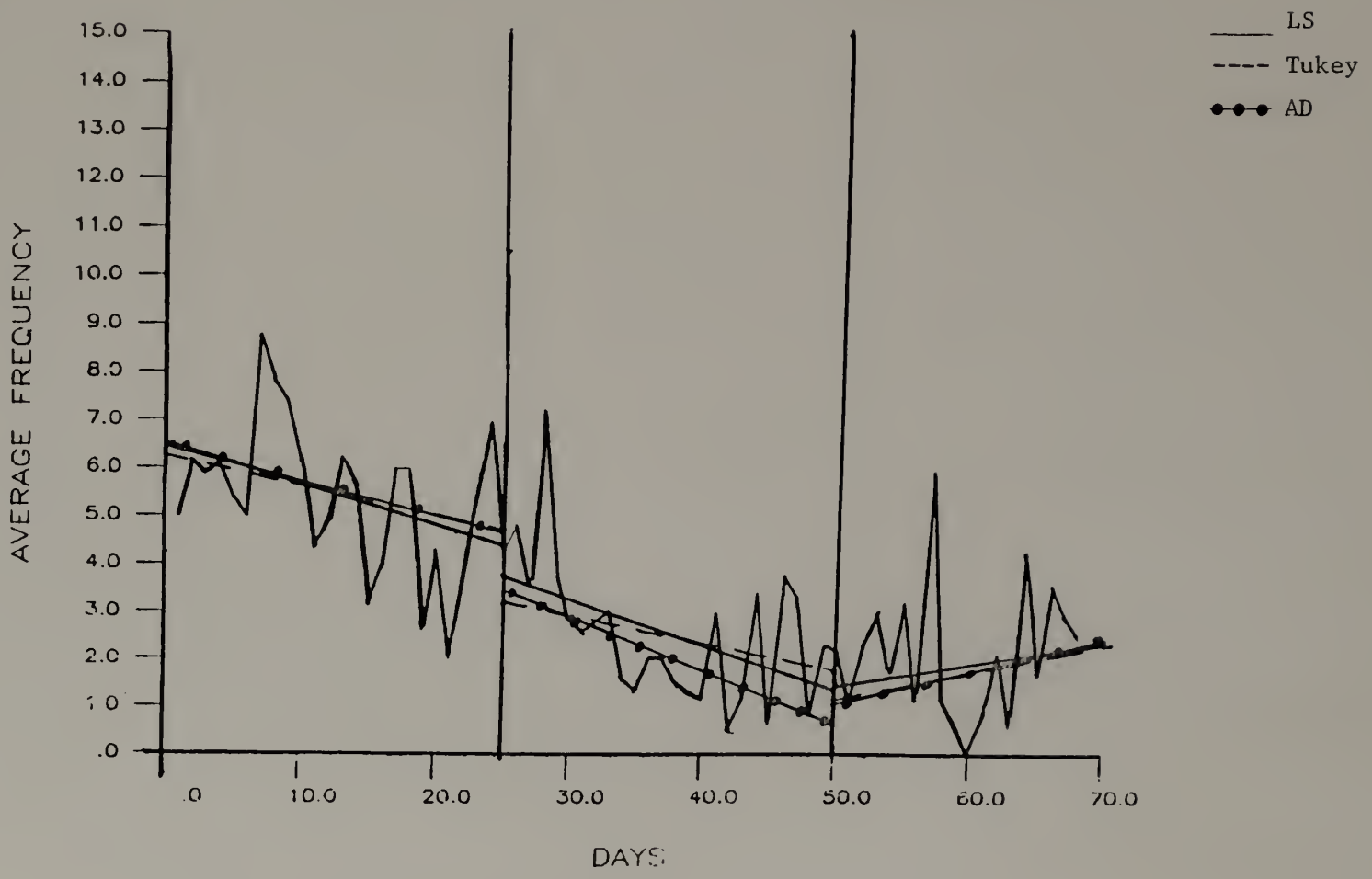

Figure 4. Average non-task activity frequency for group.

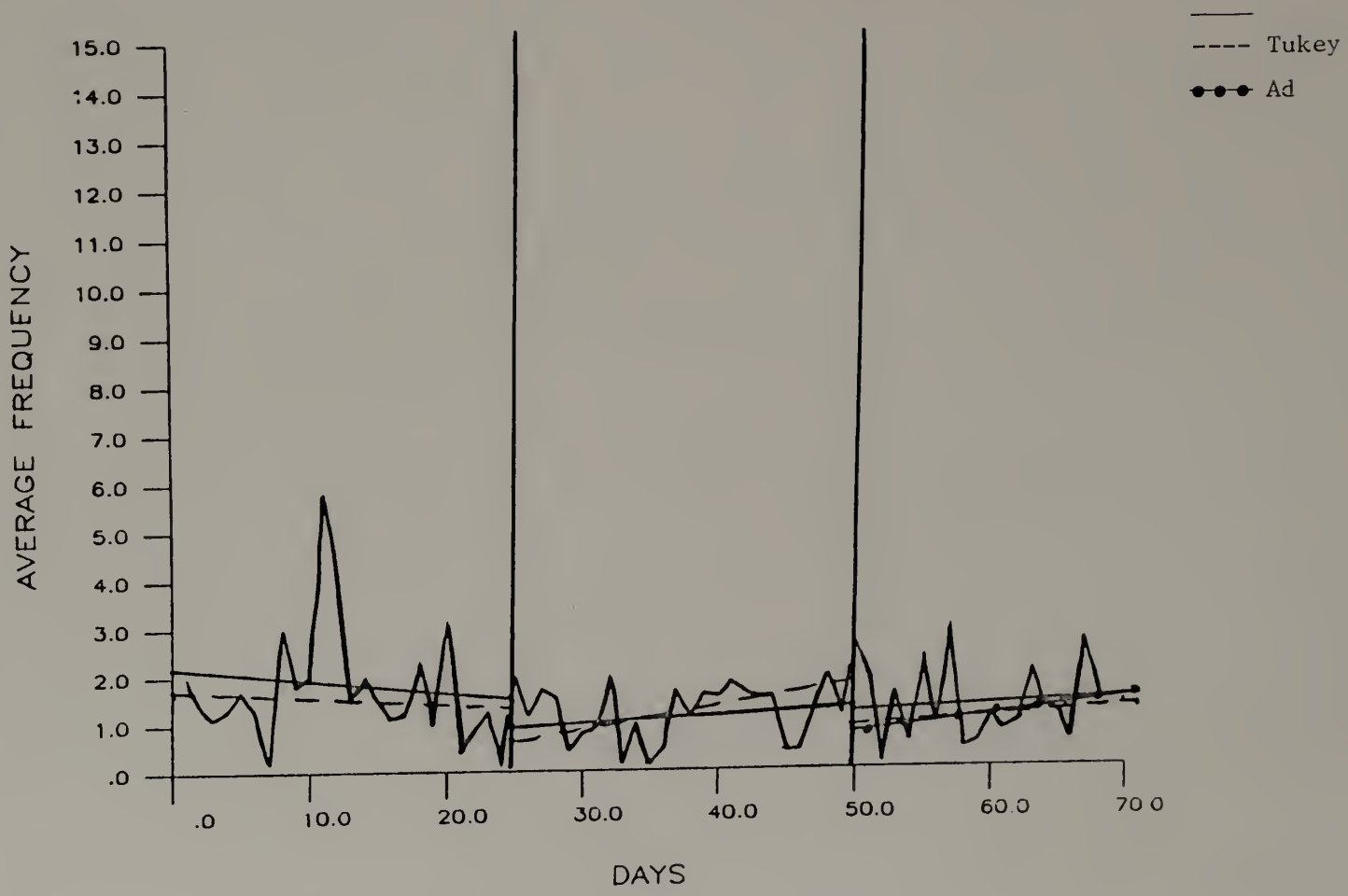

Figure 5. Average social activity frequency for group.

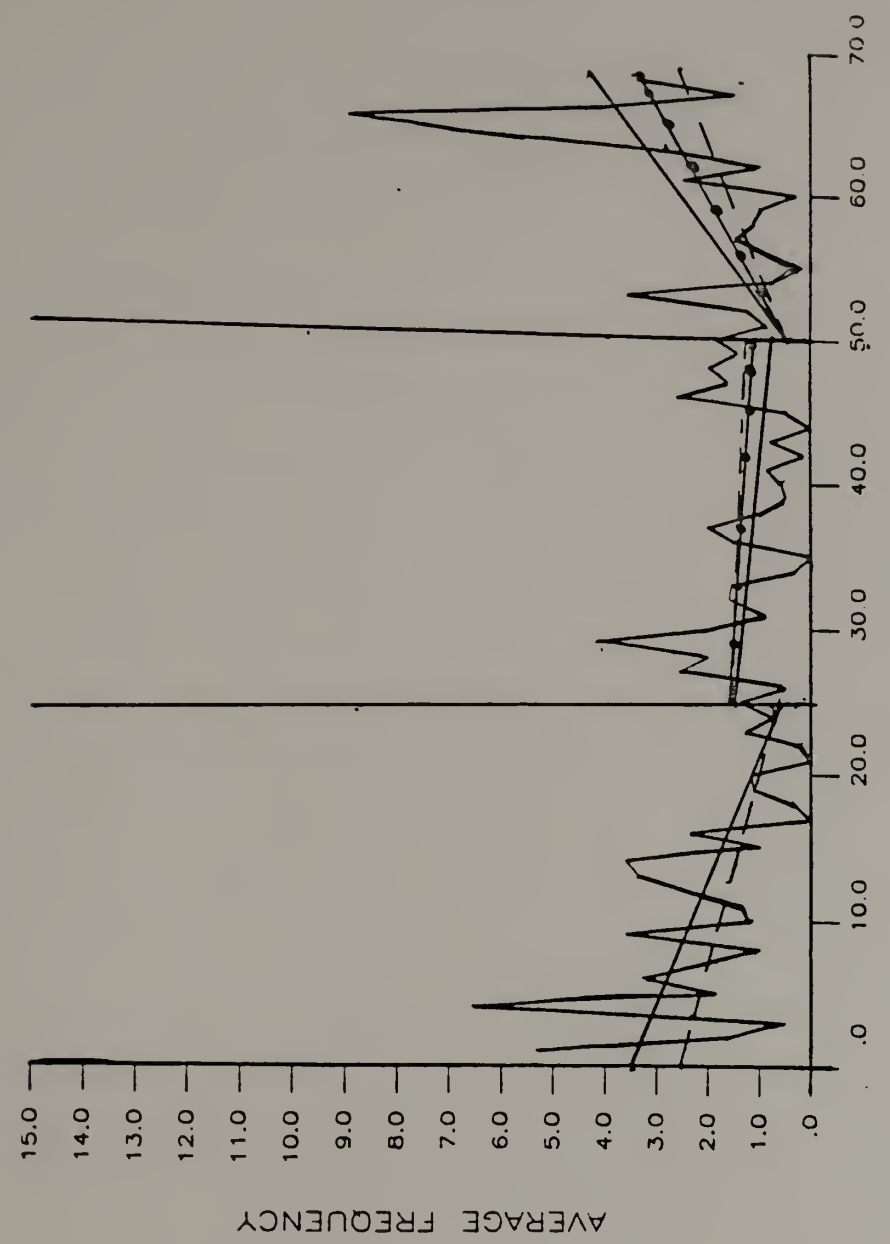

Figure 6. Average teacher directed activity of group.

in each phase of the study. Three regression lines are drawn for the methods within each phase.

One method used to determine whether the intervention had an effect for the two nonparametric methods is to extend the baseline median regression line into the next phase and count the number of points above the extended line. If no change had occurred in the next phase, fifty percent of the points should be above or on the line and fifty percent of the points should be on or below the line.

The null hypothesis of no change (H_o: P = .5) is tested as a Bernouli process, with a test statistic that is based on the Binomial distribution. The null hypothesis is rejected if the cumulative probability of observing the number of points above the line is < .05. The rejection of the null hypothesis indicates that the true probability is greater than P = .5.

Table 11 presents the probabilities for the hypothesis: Baseline = Intervention. Two probabilities are given for each index score. The first probability is obtained from the line drawn using the modification of Tukey's method of fitting a line. The second probability is determined by the line drawn from the slope and intercept of the absolute deviation method. For the play index score, there is no intervention effect using the Tukey method if a probability of .05 is the criterion for rejecting the hypothesis. There is a significant intervention effect if the absolute deviation line is considered the line of progress. The results of using the

Table 11

Probabilities of Hypothesis P = .5 for Baseline = Intervention for the Group: Five Index Scores

Behavior		Group Tukey	p	AD	p
Play	Above	16	.114	21	.001
	Below	9		3	
Constructive Activity	Above	13	.5	8	.99
	Below	12		17	
Non-Task	Above	5		5	
	Below	20	.002	20	.002
Social Activity	Above	14	.35	15	.21
	Below	11		10	
Teacher-Directed Activity	Above	23	.000	23	.000
	Below	2		2	

$p<.05$

absolute deviation estimates are not in agreement with the other two methods. There was no significant difference between baseline and intervention lines for both methods for the constructive activity index. This is also consistent with the analysis of covariance results. The lines show a slightly decreasing trend in the first phase. The average frequencies in baseline are fluctuating at fairly low values.

For the Non-task variable the two lines were extended into the intervention phase. The desired direction of progress was a decrease in frequency, therefore the points were counted below the line to test the effect of the intervention. There was a significant decrease in Non-task activity for the intervention phase. This is in conflict with the least squares method.

There was no significant difference between the frequencies of social behavior, this is also in agreement with the analysis of covariance. The frequency of this index was low in general for all three phases. By definition these variables are an indication of social interaction in the absence of an activity like play or constructive activity. It appears that if children are not attending to any particular task, they are also not interacting in a social manner.

An interesting result is the significant difference between the two phases for the teacher-directed index. It was expected that the frequency of teacher-directed behavior would remain the same across

phases. The slope of the first phase was negative indicating a decrease in the frequency of teacher-directed behavior. The value of the predicted behavior at the last day of baseline is calculated as: $y = a + (b)x$ which is substituted with the values $.78 = 2.53 + (-.07)25$. The predicted value of teacher directed behavior is below one at day twenty-five. If the average estimated frequency of teacher directed activity is calculated for day 50, the result is -.97. Since it is not possible to have negative behavior, this is a good example of the limitations of regression analysis using a monotonically increasing variable like "day". Visual inspection of the teacher directed activity index on Figure 6 shows the opposite of what is concluded from the binomial test. There are slightly lower frequencies of teacher-directed activity in the intervention phase.

When the intervention regression lines are extended into the post-intervention phase the number of points below the line are counted for the following indexes: play, constructive activity, social and teacher directed activity. For the non-task index points were counted above the line because it was expected that the incidence of non-task occurrences would decrease as a result of the intervention.

The results on Table 12 show a discrepancy between the two non-parametric methods for the non-task index. According to the Tukey method there is not a significant increase in non-task behavior for the third phase while there is a significant increase for the absolute deviation method. The least squares method is in agreement with the

Table 12

Probabilities of Hypothesis P = .5 for Intervention = Post-Intervention for the Group: Five Index Scores

Behavior		Group Tukey	p	AD	p
Play	Above	7		7	
	Below	11	.24	11	.24
Constructive Activity	Above	11		13	
	Below	7	.88	5	.98
Non-Task	Above	10	.40	16	.001
	Below	8		2	
Social Activity	Above	3		4	
	Below	15	.004	14	.015
Teacher-Directed Activity	Above	9		12	
	Below	9	.59	6	.12

$p<.05$

Tukey method of fitting a line. There is a significant decrease in the amount of social behavior in the third phase according to these two methods, but not for the least squares method. In the test of intercept for the least squares method there are significant differences for both play and constructive activity between the two phases, but it is not apparent with these two methods. It becomes evident that different methods can produce different results.

The same procedures used to test the intervention effect for group were repeated for the ten children participating in the study for two index scores: play and social. The purpose of this was to identify changes in the frequency of play and social behavior for individual children. The estimates on Tables 13 to 22 indicate the two methods would produce the same interpretation of the binomial test with the exception of child number 3.

The hypothesis Baseline = Intervention is discussed first for the play index. Table 23 lists the number of points counted above and below the line for the two median regression lines. The corresponding probabilities of obtaining the number of points above or on the line are indicated next to the observed values. In most cases the two lines drawn produce the same number of points above and below the line. According to the results two children had an increase above what was expected in the intervention phase. One child was special needs the other was non-special needs.

Table 13

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 01

Child 01

Behavior	Method	Phase					
		1		2		3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	.03	6.10	.07	9.93	-.23	12.73
	Tukey	.11	7.58	.00	12.00	-.11	12.74
	AD	.11	7.56	.00	12.00	.00	12.00
Social	LS	-.05	3.56	-.04	1.84	-.02	1.78
	Tukey	-.09	2.46	.03	.35	.26	-.69
	AD	-.09	2.54	.00	1.00	.25	-.50

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 14

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 02

Behavior	Method	Child 02 Phase 1 b_1	1 b_0	2 b_1	2 b_0	3 b_1	3 b_0
Play	LS	-.07	8.70	.16	7.18	.58	5.83
	Tukey	.07	8.64	.17	8.14	.42	7.13
	AD	.07	8.64	.35	6.65	.60	6.40
Social	LS	-.02	2.62	.06	1.09	-.30	3.73
	Tukey	.05	1.80	.08	.37	-.16	2.25
	AD	.00	2.00	.00	1.00	.00	1.00

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 15

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 03

Child 03							
Behavior	Method	Phase					
		1		2		3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	.18	5.19	-.23	12.45	.34	6.95
	Tukey	.18	6.05	.00	12.00	.70	6.67
	AD	.35	4.94	.00	12.00	.00	12.00*
Social	LS	.06	1.23	-.03	.56	-.04	1.06
	Tukey	.11	-.22	.00	.00	.00	.00
	AD	.00	1.00	.00	.00	.00	.00

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 16

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 04

Behavior	Method	Child 04 Phase 1		Phase 2		Phase 3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	.15	7.69	-.09	11.10	.04	8.69
	Tukey	.00	12.00	.00	12.00	-.15	12.15
	AD	.00	12.00	.00	12.00	-.18	12.18
Social	LS	-.21	3.75	-.05	1.27	.02	.27
	Tukey	-.08	1.16	.00	.00	.00	.00
	AD	-.08	1.17	.00	.00	.00	.00

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 17

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 05

Behavior	Method	Child 05 Phase 1		Phase 2		Phase 3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	.54	.62	-.11	9.07	.07	5.33
	Tukey	.57	-.58	.00	9.00	.13	4.69
	AD	.75	-.75	.00	9.00	.00	.00*
Social	LS	.00	.00	.12	-.15	-.21	2.41
	Tukey	.00	.00	.11	-.43	-.25	2.63
	AD	.00	.00	.00	.00	-.20	2.20

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 18

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 06

Behavior	Method	Child 06 Phase 1		Phase 2		Phase 3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	-.04	6.51	.28	6.66	.22	5.47
	Tukey	-.20	8.00	.19	9.28	-.42	9.83
	AD	-.09	6.36	.00	12.00	-.25	9.50
Social	LS	.08	.51	.08	-.12	.08	.36
	Tukey	.08	-.08	.10	-.42	.00	1.00
	AD	.08	-.08	.00	.00	.00	1.00

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 19

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 07

Behavior	Method	Child 07 Phase 1		2		3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	-.46	12.74	.26	7.19	-.33	10.74
	Tukey	-.26	12.34	.00	12.00	-.60	14.40
	AD	-.37	13.50	.00	12.00	-.27	12.27
Social	LS	.00	.17	-.04	1.72	.09	.80
	Tukey	.00	.00	.05	.08	.10	.53
	AD	.00	.00	.00	1.00	.20	-.40

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 20

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 08

Child 08							
Behavior	Method	Phase					
		1		2		3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	-.24	12.12	-.21	12.85	-.75	15.00
	Tukey	.00	12.00	.00	12.00	-.56	14.07
	AD	-.09	12.46	.00	12.00	-.50	13.50
Social	LS	.05	2.60	.09	.55	.10	1.34
	Tukey	.38	-.69	.09	-.29	.37	-.38*
	AD	.20	1.60	.08	-.17	.38	-.38

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 21

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 09

Behavior	Method	Child 09 Phase 1		Phase 2		Phase 3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	.14	6.09	.27	6.86	.61	2.43
	Tukey	.19	6.82	.22	8.82	.75	.75
	AD	.20	6.80	.00	12.00	.80	.60
Social	LS	.08	.16	.12	.73	.06	.10
	Tukey	.05	-.15	.32	-1.24	.00	.00
	AD	.00	.00	.33	-1.33	.00	.00

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 22

Estimates of Slopes and Intercepts Using Median Regression Procedures for Play and Index Scores for Individual 10

Behavior	Method	Child 10 Phase 1		Phase 2		Phase 3	
		b_1	b_0	b_1	b_0	b_1	b_0
Play	LS	.03	9.10	.13	8.30	.38	3.85
	Tukey	.10	9.88	.21	9.01	.89	1.44
	AD	.00	11.00	.23	8.77	1.00	1.00
Social	LS	-.26	4.44	.02	1.09	.25	-.45
	Tukey	-.36	5.59	.09	-.08	.15	-.22
	AD	-.25	4.00	.09	-.09	.17	-.33

LS= Least Squares
AD= Absolute Deviation
b_1= slope
b_0= intercept

Table 23

Probabilities of Hypothesis P = .5
Intervention = Post Intervention Play Index for Individuals

Child	Points	Tukey	p	AD	p
01	Above	11	.73	11	.73
	Below	13		13	
02	Above	11	.58	11	.58
	Below	11		11	
03	Above	11	.06	10	.00
	Below	4		5	
04	Above	11	.06	11	.06
	Below	4		4	
05	Above	5	.96	3	.99
	Below	10		12	
06	Above	14	.01	14	.01
	Below	3		3	
07	Above	18	.00	18	.00
	Below	5		3	
08	Above	11	.11	11	.11
	Below	5		5	
09	Above	2	.99	2	.99
	Below	16		16	
10	Above	1	1.00	1	1.00
	Below	14		14	

$p<.05$

Graphs of the frequency of play for each child indicate most children were observed frequently in play in the baseline phase (see Appendix A, Figures 7 to 16). Subjects 06 and 07 show a decreasing trend in the baseline phase. With the exception of child 08, all other children show an increasing trend, or highly stable level of play activity.

For the hypothesis: Intervention = Post-Intervention, the number of points that fall below or on the line were counted, and the corresponding probability of that cumulative event was determined for each child. Table 24 lists both the number of points above and below the line and the corresponding probability for both regression lines. For the most part, the results of both methods are fairly close with the exception of subject #3 . The interpretation of the results are the same for the two methods. An interesting result is that the frequency of play behavior decreased significantly for subject 07 and was close to being significantly different for subject 06. These two subjects were the only two to show a significant increase in play behavior during the intervention phase. Subjects 09 and 10 (both special needs children) also had a significant difference in expected frequency of play behavior for the post-intervention phase. Inspection of the graphs for these subjects (09 and 10) show a very similar pattern. An immediate drop off in play activity as noted by the intercepts in the third phase. A steeper slope for both children can also be seen. It does not seem as valid to assume these results

Table 24

Probabilities of Hypothesis P = .5
Intervention = Post Intervention Play Index for Individuals

Child ID	Points	Tukey	p	AD	p
01	Above	14		14	
	Below	4	.99	4	.99
02	Above	4		3	
	Below	8	.19	9	.07
03	Above	9		9	
	Below	3	.98	3	.98
04	Above	7		7	
	Below	6	.71	6	.71
05	Above	6		6	
	Below	6	.61	6	.61
06	Above	2		2	
	Below	7	.09	7	.09
07	Above	1		1	
	Below	11	.00	11	.00
08	Above	4		4	
	Below	9	.13	9	.13
09	Above	0		1	
	Below	17	.00	16	.00
10	Above	0		0	
	Below	14	.00	14	.00

$p < .05$

can be used to indicate an intervention effect because the direction of the line is not reversed for either child. More confidence is assigned to the results for subjects 06 and 07 because the direction of the lines change in the expected direction for the three phases.

The same hypotheses were applied to the social index for each child. Table 25 presents the results for the hypothesis Baseline = Intervention for the Social Index. The graphs of the individual's frequencies for the Social Index are presented in Figures 17-26 (Appendix A). The results of using both regression lines lead to comparable interpretations. For subjects 01 and 10 the results indicate a significant difference in the number of points above the line. This result for both cases is misleading because of a downward trend in baseline of the social index. If the line is extended into the intervention phase in both cases the line drops below zero. This is another example of expected values exceeding the "floor" or minimum value possible. This is a problem encountered while using these regression approaches when the values are low to begin with and decrease within a phase. One would not regard these two results as meaningful. Another subject identified as having a significant outcome in the intervention phase is subject 08. The results of getting no points on or above the line is highly improbable. One reason for this may be that while the overall frequency of play was the same for both baseline and intervention, the child could be engaging in more cooperative play in the intervention phase. If this

Table 25

Probabilities of Hypothesis: P = .5 for
Baseline = Intervention for Social Index of Individuals

Child	Points	Tukey	p	AD	p
01	Above	23	.00	23	.00
	Below	1		1	
02	Above	2	1.00	2	1.00
	Below	20		20	
03	Above	1	1.00	4	.98
	Below	14		11	
04	Above	15	.00	15	.00
	Below	0		0	
05	Above	3	.99	3	.99
	Below	12		12	
06	Above	2	.99	2	.99
	Below	15		15	
07	Above	12	.33	12	.33
	Below	9		9	
08	Above	0	.00	0	.00
	Below	16		16	
09	Above	9	.59	9	.59
	Below	9		9	
10	Above	15	.00	15	.00
	Below	0		0	

$p<.05$

is true, he would not be recorded as being involved in just social behavior (which is communication with another while not playing together). In order to address this possibility, individual play behaviors would have to be analyzed separately. In summary, there was not a significant increase in social behavior for any child in the intervention phase. It is possible that cooperative play increased for the intervention which would account for the apparent decrease during that phase.

Table 26 represents the result of the hypotheses Intervention = Post-Intervention. Once again the results of using the two methods produce similar interpretations. Three children, subjects 04, 06, and 09 appeared to show a decrease in the amount of social behavior in the post intervention phase. The difference in the frequency of social interactions is most noticeable with child 09.

ARIMA Time Series Models

For the ARIMA time series analysis, at least one parameter is estimated, depending upon the the kind of dependencies assumed to be present in the data set. In addition, an intervention component can be added to the ARIMA models to test for a treatment effect. Several time series analyses were performed for each of the five index scores for the group. This section of results is divided into two parts; a summary of the model identification procedures used in this study, and the results of the statistical tests of several models selected for analysis.

Table 26

Probabilities of Hypothesis: P = .5 for Intervention = Post Intervention for Social Index of Individuals

Child	Points	Tukey	p	AD	p
01	Above	9		9	
	Below	9	.59	9	.59
02	Above	3		3	
	Below	9	.07	9	.07
03	Above	4		2	
	Below	8	.19	10	.02
04	Above	2		2	
	Below	11	.01	11	.01
05	Above	5		5	
	Below	7	.39	7	.39
06	Above	0		0	
	Below	9	.00	9	.00
07	Above	5		5	
	Below	7	.39	7	.39
08	Above	6		6	
	Below	7	.50	7	.50
09	Above	1		1	
	Below	16	.00	16	.00
10	Above	5		5	
	Below	9	.21	9	.21

$p<.05$

Model Identification Procedures Used in the Study

The identification procedure used to select an appropriate ARIMA (p,d,q) model for a set of time series data is dependent upon a statistic called the autocorrelation function (ACF). For any time series process, Y_t, the ACF is expressed as:

$$ACF(k) = COV(Y_t Y_{t+k}) / VAR (Y_t)$$

The ACF(k) is a measure of the correlation between Y_t and Y_{t+k}. The process of model identification begins by examining the theoretical patterns of the autocorrelation functions of various ARIMA (p,d,q) processes. The researcher then attempts to match an observed autocorrelation function with the theoretical function of an ARIMA (p,d,q) process. Eight common ARIMA models are described in the next paragraph. The expected patterns of these models are compared to the patterns obtained to specify the models tested.

An ARIMA process (0,0,0), or white noise, is expected to have a uniformly zero ACF. An ARIMA (0,1,0) integrated process is characterized by a positive ACF that slowly dies out. A first-order moving average (0,0,1) process is expected to have a non-zero ACF at lag one, and all other lags are presumably zero. A second-order moving average (0,0,2) process is characterized by the first two lags of the ACF as non-zero, with the rest of the lags as zero. The expected pattern for ARIMA (1,0,0), a first autoregressive process (where the first lag is positive), is illustrated by exponentially decreasing lags after the first lag. If the first lag is negative,

successive lags alternate between positive and negative values that exponentially decrease. Finally, an ARIMA (2,0,0) second-order autoregressive process is expected to have non-zero correlations for the first two lags with the remaining lags exponentially decreasing.

The next step is to model the serial dependency in the data by specifying an ARIMA model, and then assess the adequacy of the model fit. An intervention component may also be included in the model to represent the hypothesized change in level of the time series process. The models presented in the previous paragraph are theoretical patterns of several ARIMA (p,d,q) processes described by McCleary and Hay (1980) as commonly used processes for social science research.

Comparing the expected ACFs with the observed ACFs of the finite time series allows the researcher to infer that time series data was generated by one of the eight processes. In practice, however, the identification is not that simple. The ACFs previously described are expected ACFs which assumes either a knowledge of the process or an infinitely long realization of the process. The true time series process is always unknown and only a finite number of time points is available. Moreover, the estimated ACFs of ARIMA (0,0,q) and ARIMA (p,0,0) processes look quite similar and are difficult to distinguish on the basis of the ACF alone.

Another statistic, the partial autocorrelation function (PACF) is used to identify an ARIMA (0,0,q) from an ARIMA (p,0,0) process. The PACF(k) is a measure of correlation between observation (k) units

apart after the correlation at intermediate lags has been partialled out. Autoregressive processes are characterized by decreasing ACFs and spiking PACFs. Moving average processes are illustrated by spiking ACFs and decaying PACFs. Both of these statistics are considered in specifying the models for the analysis of the intervention effect for the five index scores in the next section. Appendix B illustrates the ACF for each index score.

Play Index

The estimated ACF for the Play index is illustrated in Figure 27 in Appendix B. Visual inspection of the plot indicates mostly small positive correlations that slowly die out. This pattern looks most like the expected pattern of ARIMA (0,d,0) Integrated process which specifies high positive correlations that die out slowly. The ARIMA (0,d,0) is a nonstationary model, and differencing is typically done. Inspection of the ACF and PACF of the differenced series produces larger correlations in the series rather than reducing them. The ACFs are small to begin with and taking the difference may result in introducing dependency. Three models were used to estimate the ARIMA and intervention parameters: (0,1,1), (1,1,0), and (1,0,0). The results of each analysis in Table 27 indicate significant ARIMA estimates and a nonsignificant intervention effect. Examination of the mean of the residuals for each analysis identifies ARIMA (1,0,0) as the poorest fitting model. ARIMA (0,0,1) appears to produce the

Table 27

Test of Intervention Effect for Entire Group Using
ARIMA Time Series Analysis for the Play Index

	MODEL								
	1 0 0			1 1 0			0 1 1		
	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio
1st ARIMA	.94	.04	21.84	-.47	.11	-4.29	.85	.07	12.52
2nd ARIMA	-	-	-	-	-	-	-	-	-
Intervention	2.22	2.04	1.09	-.03	.35	.10	-.03	.08	.38
Residual SS	524.19			422.51			330.86		
DF	65			64			65		
Residual MS	8.07			6.60			5.09		
Mean of Residuals	.14			.02			.03		
SE of Mean Resid.	.35			.31			.26		
T Value of Mean vs. Zero	.39			.06			.10		
Minimum Residual Autocorrelation	-.45			-.32			-.14		
Maximum Residual Autocorrelation	.19			.21			.14		

best fit, however, and examination of the residual ACF plot reveals not much is gained by introducing a moving average parameter. The correlations have been shifted around, but are not significantly reduced from the original ACF pattern. It is possible these data are independent. The correlations are not significantly different from zero to begin with.

Teacher-Directed Activity Index

The pattern of the ACF for the Teacher Directed Activity Index doesn't match any of the eight expected simple ARIMA ACF patterns. The correlations flip back and forth from low positive to low negative correlations. The highest correlation (.23) is at lag 11. Although it does appear that the data will not fit any model, two were estimated. Table 28 present the results of ARIMA processes (0,0,1), and (1,0,0) respectively. Differencing was not included in the analysis because the PACF pattern of the differenced series indicated the dependencies among the data increased rather than decreased. The results of the first model (0,0,1) indicated a significant moving average parameter. The data was a poor fit to the model as illustrated by a mean residual of .88 which is significantly different from zero.

Model two was specified as ARIMA (1,0,0). The autoregressive parameter estimated was significant, but the intervention variable was not significant. Analysis of the residuals show that the model does

Table 28

Test of Intervention Effect for Entire Group Using
ARIMA Time Series Analysis for the Teacher Directed Activity

	MODEL					
	0 0 1			1 0 0		
	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio
1st ARIMA	-.57	.10	-5.71	.66	.09	7.42
2nd ARIMA	-	-	-	-	-	-
Intervention	1.44	.59	1.91	.91	.84	1.08
Residual SS		254.92			185.07	
DF		66			65	
Residual MS		3.86			2.85	
Mean of Residuals		.88			.41	
SE of Mean Resid.		.21			.19	
T Value of Mean vs. Zero		4.27			2.08	
Minimum Residual Autocorrelation		-.19			-.26	
Maximum Residual Autocorrelation		.29			.15	

not fit the data since the mean residual of the series is significantly different from zero. It is interesting to note that estimating the parameters for the two models resulted in larger ACF patterns among the data than were initially produced. The correlations do not appear to have a simple pattern, and the correlations between various lags are not significant. It is assumed these data for this index score are independent.

Non-task index.--The pattern in Figure 29 (Appendix B) of the estimated ACF for the Non-Task Index clearly shows significant high positive autocorrelations for the ten lags. This index score is the only variable that shows unquestionable dependency among the observations. The other index scores had low fluctuating positive and negative correlations among the lags which indicate the time series could be considered independent observations. This is not the case with the non-task variable. The first autocorrelation has a value of .60, and successive lags decrease very slowly. The PACF pattern indicates the correlations decrease suddenly after the first and second lags. These two patterns may indicate an ARIMA (1,0,1) process, which means there is a combination of both an autoregressive process and moving average process. Several models that included the intervention term were tried out. The following analyses presented in Table 29 demonstrate the difficulty in correctly identifying one model because the results are fairly close.

Table 29

Test of Intervention Effect for Entire Group Using ARIMA Time Series Analysis for the Non-Task Index

	MODEL								
	1 0 1			0 0 1			0 1 1		
	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio
1st ARIMA	.78	.08	9.53*	-.62	.09	-6.29*	.77	.08	9.85*
2nd ARIMA	.98	.01	84.19*	-	-	-	-	-	-
Intervention	-.34	.69	-.49	2.54	.87	2.91*	-.11	.07	-1.49
Residual SS		148.22			517.29			149.13	
DF		64			66			65	
Residual MS		2.31			7.84			2.29	
Mean of Residuals		.03			1.55			-.05	
SE of Mean Resid.		.19			.28			.18	
T Value of Mean vs. Zero		.16			5.62*			-.26	
Minimum Residual Autocorrelation		-.23			-.30			-.24	
Maximum Residual Autocorrelation		.15			.63			.15	

The ARIMA model (1,0,1) produced significant estimates for the autoregressive and moving average parameters. There was not a significant treatment effect. The model appeared to fit well as indicated by a small mean of the residuals. The estimates, however, came close to the value 1 which is an indication of parameter redundancy. That is an indication that the model may be inappropriate. A moving average process (0,0,1) was estimated for the series. There was a significant intervention effect as well as a significant estimate for the moving average model. The examination of the residual analysis indicates the average residual is significantly different from zero, therefore the data doesn't adequately fit the ARIMA (0,0,1) model.

When differencing was added to the model (0,1,1) the data fit the model but there was no intervention effect. There was no significant difference between the average residual and zero. The minimum and maximum values of the ACF of the residuals for the ARIMA (0,0,1) model were -.24 and .15 compared to much higher correlations of -.30 and .60 resulting from the first ARIMA (0,0,1) model fit.

Two autoregressive processes were tested out. The first ARIMA model in Table 30 (1,0,0) resulted in a significant autoregressive parameter estimate but not a significant intervention effect. Examination of the residuals indicate a reasonably good fit but not as good as the ARIMA (0,1,1) model. When the differencing parameter is added (1,1,0), the results are the same but the residual plot of the

Table 30

Test of Intervention Effect for Entire Group Using
ARIMA Time Series Analysis for the Notask Index

	MODEL					
	1 0 0			1 1 0		
	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio
1st ARIMA	.87	.06	14.84*	-.49	.11	
2nd ARIMA	-	-	-	-	-	-
Intervention	1.18	1.26	.93	-.17	1.05	-.17
Residual SS		217.24			175.38	
DF		65			64	
Residual MS		3.34			2.74	
Mean of Residuals		.29			-.06	
SE of Mean Resid.		.21			.20	
T Value of Mean vs. Zero		1.34			-.33	
Minimum Residual Autocorrelation		-.45			-.27	
Maximum Residual Autocorrelation		.22			.22	

ACF is considerably reduced. In fact, the results of the two models (1,1,0) and (0,1,1) are virtually indistinguishable. The ARIMA model (0,1,1) produces a slightly better fit, but it is not clear which model is better.

Social Index.--The estimated ACF pattern for the social index doesn't resemble any expected ACF. There doesn't appear to be any pattern for the series, however, two models were tested along with the intervention variable. Table 31 shows the results of two models, ARIMA (1,0,0) and (2,0,0). The first analysis (1,0,0) results in a significant autoregressive estimate and a nonsignificant intervention effect. The data do not fit the model as indicated by the residual analysis. The mean of the residuals of the series is significantly different from zero. Nothing is gained by introducing another autoregressive process, in fact, the residuals get a little larger.

Constructive Activity.--The pattern in Table 32 of the ACF for the Constructive Activity index most resembles ARIMA (0,0,0) white noise process. The PACF doesn't look different from the ACF pattern. However, three models were specified with the intervention variable: ARIMA (0,0,1), ARIMA (1,0,0), and ARIMA (0,0,2). The minimum and maximum autocorrelations for the unmodeled series are -.13 and .24, respectively.

The results of the first model (0,0,1) illustrate a poor match between the data and the model even though the moving average parameter is significant. Similar findings for models (1,0,0) and

Table 31

Test of Intervention Effect for Entire Group Using
ARIMA Time Series Analysis for the Social Index

	MODEL					
	1 0 0			2 0 0		
	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio
1st ARIMA	.69	.09	7.72*	.36	.13	2.65*
2nd ARIMA	-	-	-	-	-	-
Intervention	.77	.61	1.25	.54	.54	1.79
Residual SS		87.21			82.32	
DF		65			62	
Residual MS		1.34			1.33	
Mean of Residuals		.34			.37	
SE of Mean Resid.		.13			.13	
T Value of Mean vs. Zero		2.60*			2.92*	
Minimum Residual Autocorrelation		-.44			-.24	
Maximum Residual Autocorrelation		.24			.27	

Table 32

Test of Intervention Effect for Entire Group Using
ARIMA Time Series Analysis for the Constructive Activity Index

	MODEL								
	0 0 1			1 0 0			0 0 2		
	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio	Estimate	SE	T-Ratio
1st ARIMA	-.39	.11	-3.41*	.46	.10	4.43*	-.54	.11	-5.01*
2nd ARIMA	-	-	-	-	-	-	-	-	-
Intervention	.55	.53	1.03	.30	.63	.43	.29	.68	.44
Residual SS		251.81			208.58			239.44	
DF		66			65			65	
Residual MS		3.82			3.21			3.68	
Mean of Residuals		.76			.60			.62	
SE of Mean Resid.		.21			.21			.21	
T Value of Mean vs. Zero		3.68*			2.87*			2.97*	
Minimum Residual Autocorrelation		-.20			-.24			-.25	
Maximum Residual Autocorrelation		.19			.21			.20	

(0,0,2) occur. Both have significant autoregressive parameter estimates and insignificant intervention parameter estimates. Neither model adequately fits the data.

Summary of Methodological Results

The results of the analyses performed for the index scores are not in complete accord. For the regression methods used, the methods were not similar in the interpretation of the hypotheses tested for the play index. A significant difference was found for Baseline = Intervention using the absolute deviation method. It was close to statistical significance for the other two methods. For Constructive activity all regression methods are in agreement with not rejecting the hypothesis Baseline = Intervention. For the hypothesis Intervention = Post-Intervention the least squares method indicates a significant increase in frequency of Constructive activity while the other two methods do not. For the Non-task Index there are consistent results for the nonparametric methods for the hypothesis Baseline = Intervention. There are a significant number of points that are below the line of progress for the intervention period. Although the same result was not statistically significant for the least squares method, it was close. Generally, the Scheffe confidence intervals constructed for the contrasts are more conservative than other methods. Less conservative methods may lead to different conclusions. For the hypothesis: Intervention = Post-Intervention only the absolute

deviation method indicates a significant increase in Non-task activity for the post-intervention. The least squares method shows an increase but it is not statistically significant.

The Social and Teacher-directed indexes were not statistically significant in the overall test for the least squares method, therefore contrasts were not applied. For the other two methods, the binomial test was applied. For the hypothesis: Baseline = Intervention there was a significant increase of teacher-directed activity for the intervention phase. This result cannot be interpreted meaningfully because of the "floor" effect previously mentioned.

For the hypothesis: Intervention = Post-Intervention, there was a statistically significant decrease in social behavior below what was expected for both nonparametric methods during the post-intervention. The estimates produced from these estimates look very similar. Except for the post-intervention phase for the teacher-directed variable, the slopes for the variables for all three methods were close to zero. This indicates that day is not a significant predictor for behavior for the index scores. There is much greater variation between the relationship of day and behavior index scores when individual children were analyzed.

The time series analyses were inconclusive for several reasons. First, model identification was not straightforward. It is a trial and error method even with the use of the ACF and PACF statistics to

guide the process. Inspection of the autocorrelations of the data for the five index scores taken as a total time series of sixty-eight days looks quite different compared to the autocorrelations of the three time phases. An assumption of the time series models is that the autocorrelation function is the same throughout the series. If differencing the data does not work in making the series stationary, the assumption is violated and the properties of the test statistic are not known. The other problem with using this technique is that it requires many data points. Although sixty-eight data points is a substantial amount of data (a period of 5 months during a school year), the autocorrelations within individual time phases are not stable (See Appendix B, Tables 33 to 35). The apparent change in the autocorrelation structure indicates a high likelihood that the time series process is non-stationary. If the intervention changes the autocorrelation structure of the observations, as well as the level of the time series process, then the time series process cannot be properly modeled.

The most appropriate method of analysis given the respective constraints for this type of design cannot be answered in this paper. Further studies need to done for all the methods. For the regression methods, the assumption of independence is violated. How serious the bias is cannot be determined without conducting simulation studies to investigate the dependencies among the data.

Theoretically, the design of the study is best analyzed by the time series analyses. Further investigation of the number of points and data transformations needs to be done. There are several ways to define the intervention variable within the time series analysis. The way it was introduced in this design was as a discrete and immediate effect. Other ways of introducing the variable are by incremental weighting. If it is predicted the change in behavior won't occur immediately or that the impact will increase slowly, different kinds of weighting are required to test the hypotheses.

Another problem with using group data for time series analysis is the combining of individual processes. It's highly likely the processes underlying the individual behavior vary. Combining these individuals into a group can average out those processes. All that is known at this point about combining the data in this way is that no simple model was identified as fitting the data. More analyses need to be performed on individual cases. Several analyses were performed for individuals, however, these results were based on even fewer data points than the group data due to absenteeism.

Summary of the Intervention Effect

The number of days any child was present in the classroom during the intervention varies; therefore, it is necessary to look at the proportion of days the children were observed participating in the intervention. Every child participated in the intervention to some

degree. The proportion of time observed in the intervention had a minimum value of .27 for one child to a maximum value of .64 for another. The average proportion for intervention participation of the group was forty-eight percent. This percentage was obtained by calculating the proportion of children participating in the intervention from the total number of children present for each day, and taking the average proportion across the days. The participation rate also varied for the two thematic play activities; hospital and grocery store. Some children played with both activities with similar degrees of frequency while other children were primarily interested in one theme. All the children participated in each theme at least once. It was not expected one thematic play activity would be equally appealing to all the children and captivate their interest over a period of twenty-five days. Specific characteristics within each theme appeared to be more useful in structuring play activity than others. Larger objects that could be moved around were used successfully to sustain cooperative play spontaneously.

A good example of such an object that requires more than one child to make it work was the ambulance made from a wagon. Up to three children could ride in the wagon while one child pulled it around. Since many of the children wanted to be riders and drivers, turn-taking was required to cooperatively play. The children spent a considerable amount of time at this activity. Children also got into the role of being "sick" by lying down in the ambulance. The theme

expanded to other children playing doctors examining the "sick" person at the hospital. Those expanded themes were not observed until the hospital intervention was nearly over. For the first week of the intervention, the children were primarily engaged in associative play. The types of activity observed were children putting on lab coats and examining dolls with stethoscopes. The children administered care to the "sick" dolls by applying bandaids all over the dolls' bodies. The children did not take on roles to play cooperatively at this point.

When the grocery store was introduced, a similar preference for objects that could be moved around was apparent. There were two toy food carts available at one time. They were desirable toys of the store theme based on the observation that children spent so much time trying to get them away from others. Again, children were required to take turns with carts and therefore had to interact with one another. Bagging groceries was another popular activity. Some children liked to play with the cash register, but the exchange of money was not observed. The grocery theme did not elicit the expanded action plans and role play like hospital. There tended to be more repetitive action plans of bagging groceries and putting groceries into carts.

In summary, the two themes were different in the variety of play plans observed. The hospital theme took approximately ten days to elicit role playing. It was enhanced by adding an ambulance which introduced an element of danger that is typically quite popular with four and five year olds. Children had to negotiate with other children

to use the equipment. At times, teachers had to intervene, but surprisingly, most often the children did work it out for themselves. Sometimes this meant a child just gave up negotiating and moved on to something else. Negotiations were seen to vary in terms of physical attempts to take the toy away and verbal requests. It is also likely that these toys are popular for children at this age. Other props such as the "medical lab coats" and "hospital instruments" may be more appropriate for slightly older children. The action plans observed during the intervention had several consistent characteristics which are very important to consider for future planning of interventions:

- The play observed was more action-based than language-based.
- Both special needs children and non-special needs children were observed repeating actions with minor variations over again.
- There were instances where some special needs children exhibited knowledge of the role playing and could respond as a role player.

These behaviors are quite typical of the play behaviors seen in three and four year olds. The play is not solely reliant upon language to a large extent. The themes may develop into expanded situations over time, but in considering appropriate themes for three and four year old non-special needs children, themes that involve elaborate language should be at least identified as being different than those themes that do not require much language.

The observation schedule included categories of pretend play which would be checked for the occurrence of one of the types of

pretend play. During data collection it became apparent that it was hard to recognize or distinguish these categories. One reason for this may be due to the type of time sampling schedule employed. If a component is added to the design, such as qualifying the type of pretend play, it becomes necessary to treat the play as an episode where there is a beginning, middle, and an end. It was not possible in this study to record the types of pretend play with the accuracy and regularity that would be more apparent if episodic sampling rather than time sampling was used. The problem with episodic sampling is that one has to wait for the desired event to happen in order to record the activities.

Some aspects of pretend play were observed. The most commonly observed type was action based pretending for most children. Repetition was observed at lower frequencies with some of the special needs children. Pretend play sustained by language and projecting the feelings of the characters was also observed at various times. Interestingly enough, the appearance of these aspects of pretend play were observed more frequently during the hospital theme. Danger packed themes occurred when the ambulance was introduced as a prop. Children used the ambulance to get the "sick" person to the hospital quickly because he/she was "hurt". Danger packed themes were also observed during baseline where some children spontaneously chose other themes.

Age appropriate play behavior is exhibited by the observance of all the types defined on the observation schedule. The most commonly

observed play behaviors were associative and parallel play. It is not appropriate in this study to differentiate between special needs children and non-special needs children in the amount of each type of play because it cannot be determined if the type of play is play by choice. If play is a learning medium in and of itself, it is very important to look at the proportion of time spent in play during free play because it indicates the children are involved in an activity.

CHAPTER VI

SUMMARY, LIMITATIONS, AND CONCLUSIONS

Summary

The purposes of this dissertation were to assess the impact of two theme interventions at an integrated preschool over time, and to evaluate commonly used analytic methods for assessing change. In particular, the objectives were to:

- o design a classroom play intervention that elicited action and role plans with minimal assistance from adults;
- o record the frequency of play and socially directed activity across three time periods; and,
- o assess the intervention effect by using several methods; the least squares, absolute deviation, a modification of Tukey's fitting a line, and Box and Jenkins' ARIMA time series analysis.

In order to accomplish these objectives, an integrated preschool was chosen, two themes were selected as appropriate to the group, and analytic methods for assessing change were examined.

The results of all the analyses employed for assessing change were presented for the group data. For the regression techniques, some results were inconsistent. The two nonparametric procedures were very similar to each other in producing estimates for determining the

line of progress. However, there were slight differences in the estimates which resulted in different interpretations for these methods.

The Box and Jenkins time series analysis is an alternative procedure for the analysis of this type of quasi-experimental time series intervention design. However, the assumptions for this model limit its applications. Firstly, a large number of data points is required to perform the analysis, and this is often hard to obtain in research studies of this nature. Secondly, the conditions of stationarity must be met for data analysis and interpretation. In this case the data displayed evidence of non-stationarity when the separate ACFs for the three phases were considered. Thirdly, various types intervention effects could be hypothesized by modeling the intervention component in different ways.

For the individual cases, the nonparametric techniques were used to assess an intervention effect. As with the group data, the binomial test was applied to determine whether differences existed between phases. The estimates of both methods were very similar to one another. It should be noted that small differences can affect the interpretation of the data.

One potential problem with using the least squares and nonparmetric regression methods with a monotonically increasing variable is the result of a "floor" or "ceiling" effect. A "floor" can be reached before the line is drawn into the comparison phase. For the most part, the slopes were close to zero and the lines drawn into

the next phase were fairly flat. A problem did occur with negative slopes when the frequency of a behavior was low. Extending the predicted line into the next phase can produced "negative" frequencies of behavior. These constitute cases when the interpretation of the binomial test is clearly inappropriate. This procedure should not be used if the line reaches the floor before it is extended into the next phase.

Although the results were not statistically significant for the group for the hypothesis: Baseline = Intervention, there are indications that the average play activity did increase. A failure to reject the null hypothesis of no treatment effect does not necessarily indicate that the intervention did not influence the dependent variables under consideration. A lack of power in the statistical tests applied under these conditions may also account for the failure to reject the null hypothesis. The power functions of the test are not known, and thus, the likelihood of failing to detect true differences between the phases cannot be determined. Tests of the null hypothesis often approached the nominal levels of statistical significance, and therefore, the issue of poor statistical power must be considered a viable explanation for the failure to reject the null hypothesis.One indication is the dramatic decrease in nontask behavior during intervention as evidenced by examining the means of the notask index for the two time periods. Other non-statistical means provide criteria for judging the impact of the intervention.

Informal observations support the point of view that integrated environments provide opportunities for integrative experiences. First, toys did set up a situation to encourage peer proximity and increase social interaction. It was evident by the participation of every child in the intervention that each child was aware of the new "toys" in the classroom. There was imitation of play activity by both special and non special needs children. An interesting observation by the author of the study supports other researchers. Vandell, Wilson, and Buchanon (1980), note that toys that encourage use by two or more children increase the possibility of peer interactions.

Limitations

As previously noted in Chapter IV, the time series design does not control for history or instrument by subject interaction. History is a very important factor in play behavior, or any type of classroom behavior since many unknown factors such as family environment and health influence daily behavior. The only control imposed to partially account for history was to ask the teachers not to use the thematic play activities during other times of the day. In one sense, history determined the choice of hospital and grocery store as themes because the teachers knew the children had exposure to those settings. If the purpose of the study is to choose what already exists within the classroom and build upon the experience, history becomes a very important consideration. It is impossible to control for history in a naturally occurring setting. Once it is determined that the

structured play activities (as defined by this study) do contribute to increased play activity, different experimental designs can be employed to verify the findings in this study.

Instrumentation also serves as a threat to internal validity. Obviously, the more unobtrusive the researcher is the more likely the rival hypothesis of instrument-subject interaction can be ruled out. The subjects were aware of the presence of another woman in the room who was not the teacher. After initial questions directed to the teachers about the "observer" with the earphones and pad of paper, the children ignored the researcher to the point of bumping into her. At that age, and in that setting, it appears that children ignore adults after they have made a few attempts at contact and are ignored. The ideal situation for data collection would be where the observer is out of the room but can still hear and see everything. In this study the author moved around the room as the play activity moved around the room. It would require a sophisticated set-up of mirrors and microphones to pick up all the activity from one vantage point outside of the classroom.

Whether these types of themes can be used in other settings can only be answered through replication. These themes have been used in other settings and occur spontaneously in children's play. It is not clear what the earliest age is before children spontaneously act on these themes. The nature of childrens' handicapping conditions also serve to limit the generalizability of action based thematic play activity.

Conclusions

This study attempted to assess an intervention in a naturally occurring setting. Very little structure was imposed from adult sources other than providing the materials of the intervention. As with other exploratory studies, the purpose of the study is not solely to confirm a hypothesis. An important purpose is to test what is believed to be true and further refine it and formulate better research questions that can be tested once some possibilities are ruled out. Several important observations were made during the study which generate a different set of research questions. The first observation is that the children were willing to explore and play with the materials. If the goal is to encourage the children to play with those materials, perhaps removing other distracting play materials would increase the frequency of the desired behaviors. Other researchers have noted that play materials that are not part of the play theme may distract the players and reduce the involvement in the dramatic play (Tizard, Philips, & Plewis; 1976). Authors Rubin and Seibel (1976) note that specific play materials such as puzzles and art activities inhibited dramatic play. If the desired goal is to determine whether dramatic activities increase social interaction, it may be that removing competing objects from the room is necessary. It does reduce the free choice element of play, which seems to be somewhat contrary to what is being defined as an important component of play.

Many psychological constructs have been associated with play (e.g., creativity, language development, social knowledge, and cognitive skills). The importance of play and its relationship to these constructs is indicated by the numerous research studies conducted within the past ten years (Christie & Johnsen, 1983). Many of these studies involve children from middle income or low income families. Most of the research designs are experimental designs that impose a treatment for a short period of time to many subjects. One of the criticisms of these studies is that very few provide information concerning the impact of the treatment once the treatment is taken away. Time series designs attempt to answer questions pertaining to long term effects. Although there are problems associated with the design, one of the benefits of employing the design is that there is extensive and repeated exposure to the children under consideration. Its use in exploratory research may lead to better defined research questions.

Very few studies focus on the benefits of thematic play at an integrated preschool. Of the studies that do investigate play as a learning medium in an integrated setting, the role of the teacher is usually essential in producing the desired results. More work needs to be done with thematic play involving minimal adult intervention because peer play is a valuable learning medium. One possibility is to use more structure in play through peer modeling.

This study concludes that children voluntarily participated in the play theme. They exhibited the expected action plans, and to some

extent, they engaged in role play with minimal adult intervention. Visual inspection of the graphs as well as impressions of the activities in the classroom lead the researcher to conclude there was an intervention effect for the group of children. There were clear individual differences as well. The decrease in nontask behavior indicates the children were more involved in activities during the intervention. The statistical tests performed on the group data do not support the conclusion that play behavior increased from the baseline phase. They do support a difference in frequency of play behavior when comparing intervention to post-intervention.

As a result of this study, several observations lead to new research questions. The specific behaviors recorded were summed to form index scores to provide information in broad categories. Indexes were developed because the researcher did not want to investigate the specific types of play observed, but rather, the level of play in general. It is likely that treating the behaviors individually, would produce other research findings. Examples of some research questions are: (a) do the types of play change in frequency as a result of an intervention? (b) does the proportion of social interaction change as a result of the intervention?

Other research questions worthy of investigation within a time series design are: (a) does removing competing toy objects and art activities increase the frequency of involvement in thematic play, (b) does including more props that require cooperation for their use increase the frequency of thematic play, and (c) does reducing the

amount of available props increase social interaction by requiring children negotiate with each other in order to take turns.

Thematic play interventions have the potential for enhancing learning opportunities for special needs children in an integrated setting. The effective application of theme play relies on proper planning, implementation, and assessment of types of play activities that are developmentally appropriate for preschool children. Time must be taken to choose themes that are relevant and accessible to special needs children. The type of themes selected should be a result of the consideration of the group of children present within the classroom. Things to consider are their interests, the types of activities they already engage in, and the level of language required to play.

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A P P E N D I X A

PLAY INDEX

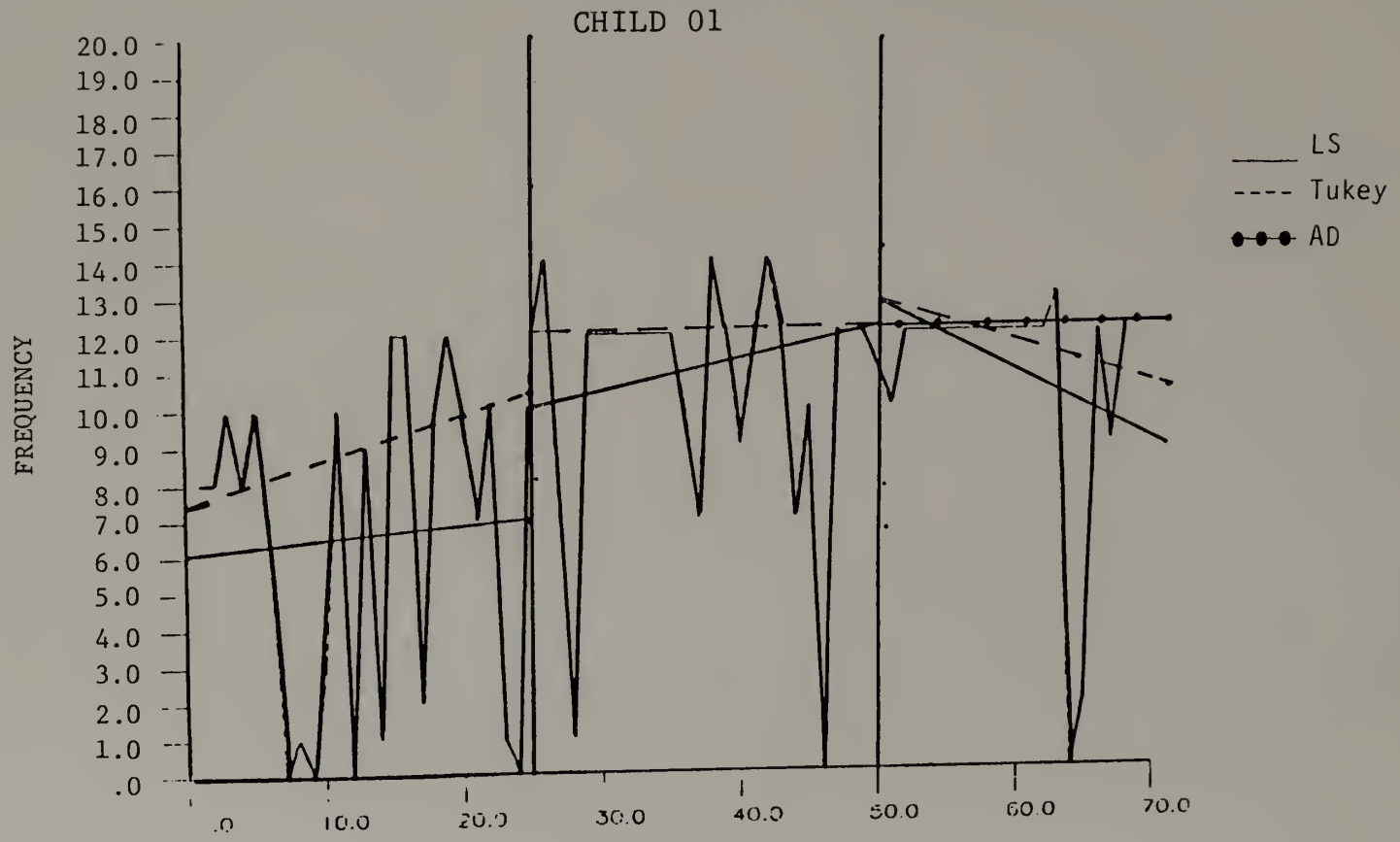

Figure 7. Median regression lines drawn for each phase for the Individual 01.

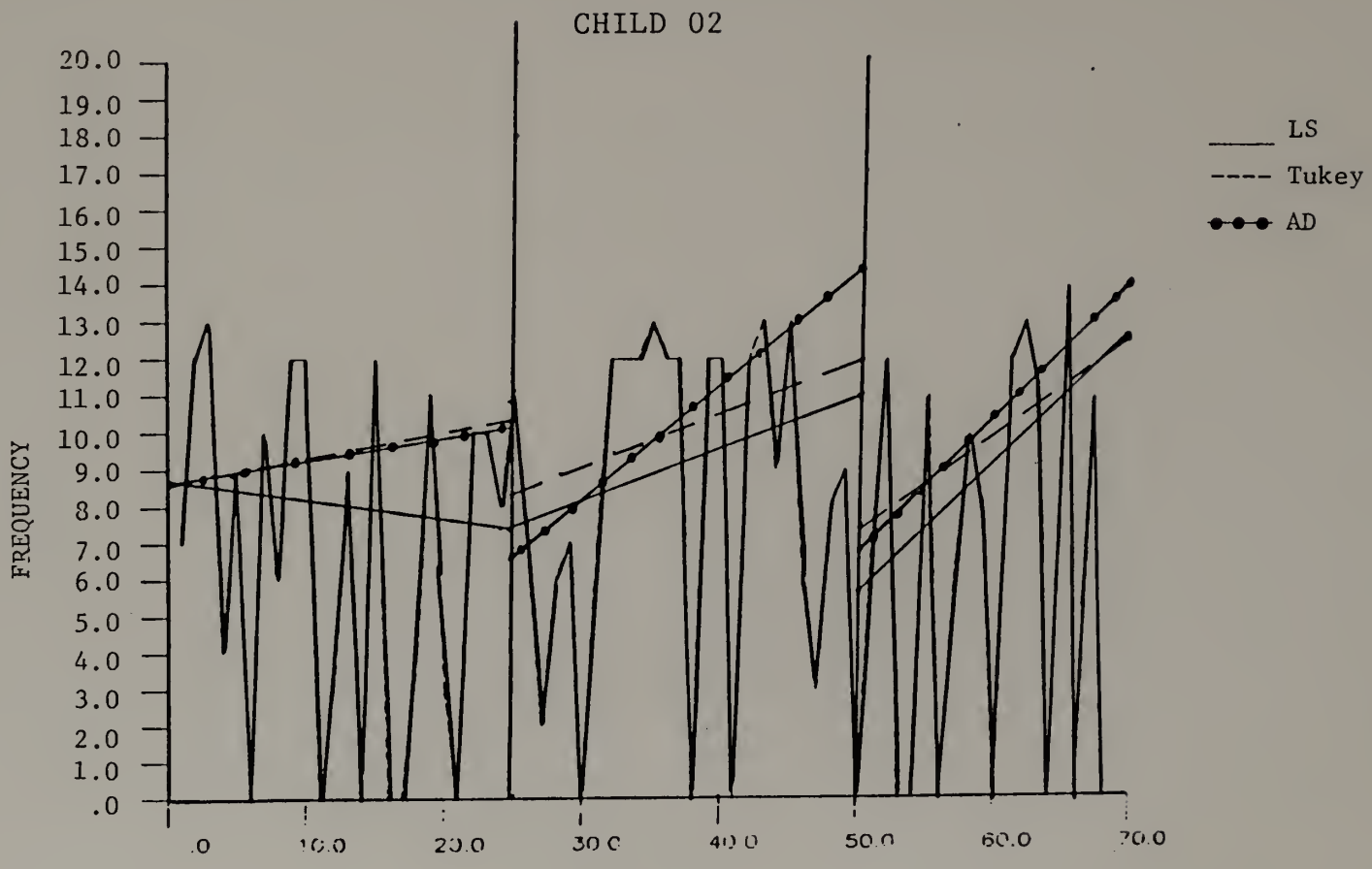

Figure 8. Median regression lines drawn for each phase for the Play Index for Individual 02.

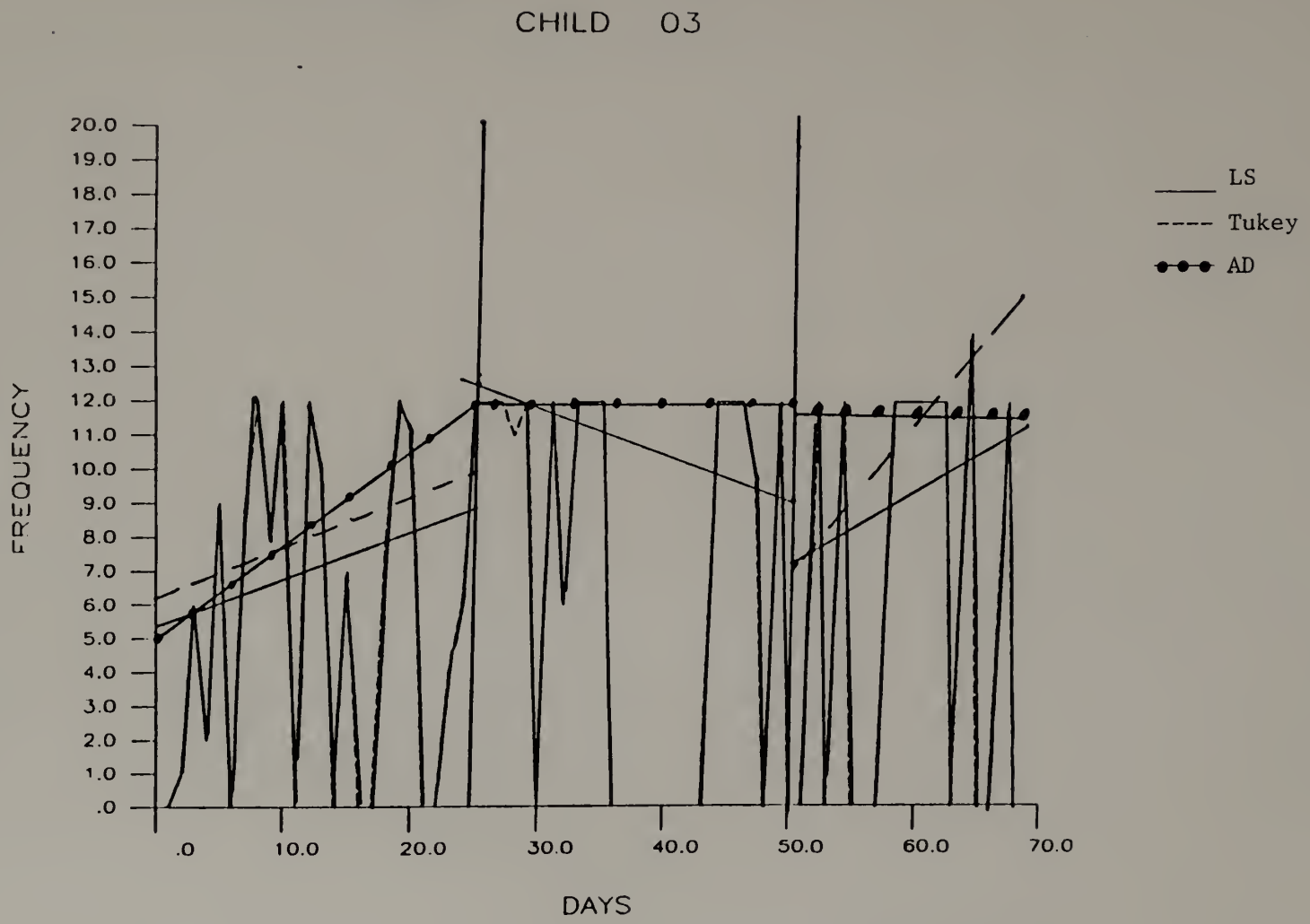

Figure 9. Median regression lines drawn for each phase for the Play Index for Individual 03.

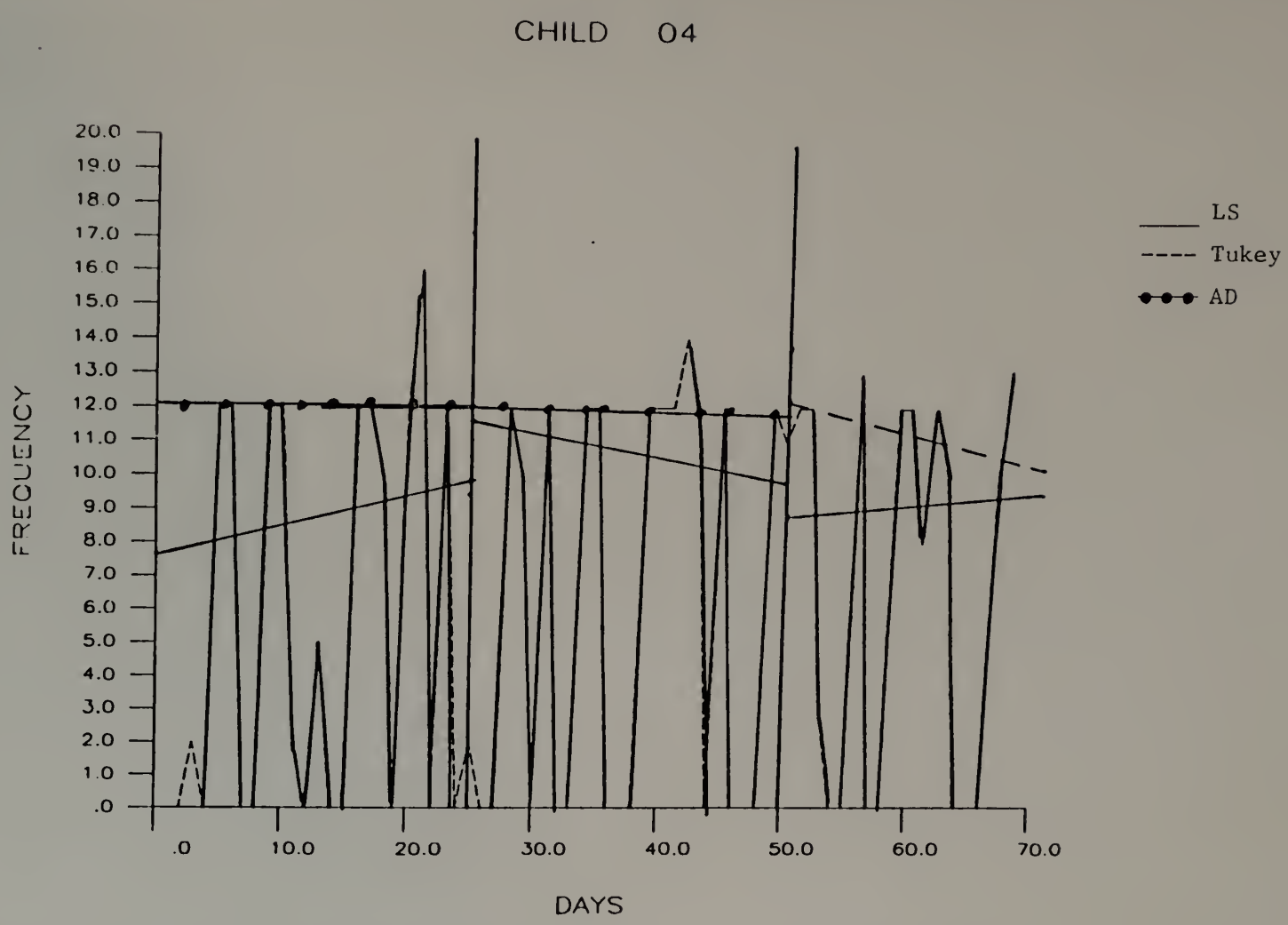

Figure 10. Median regression lines drawn for each phase for the Play Index for Individual 04.

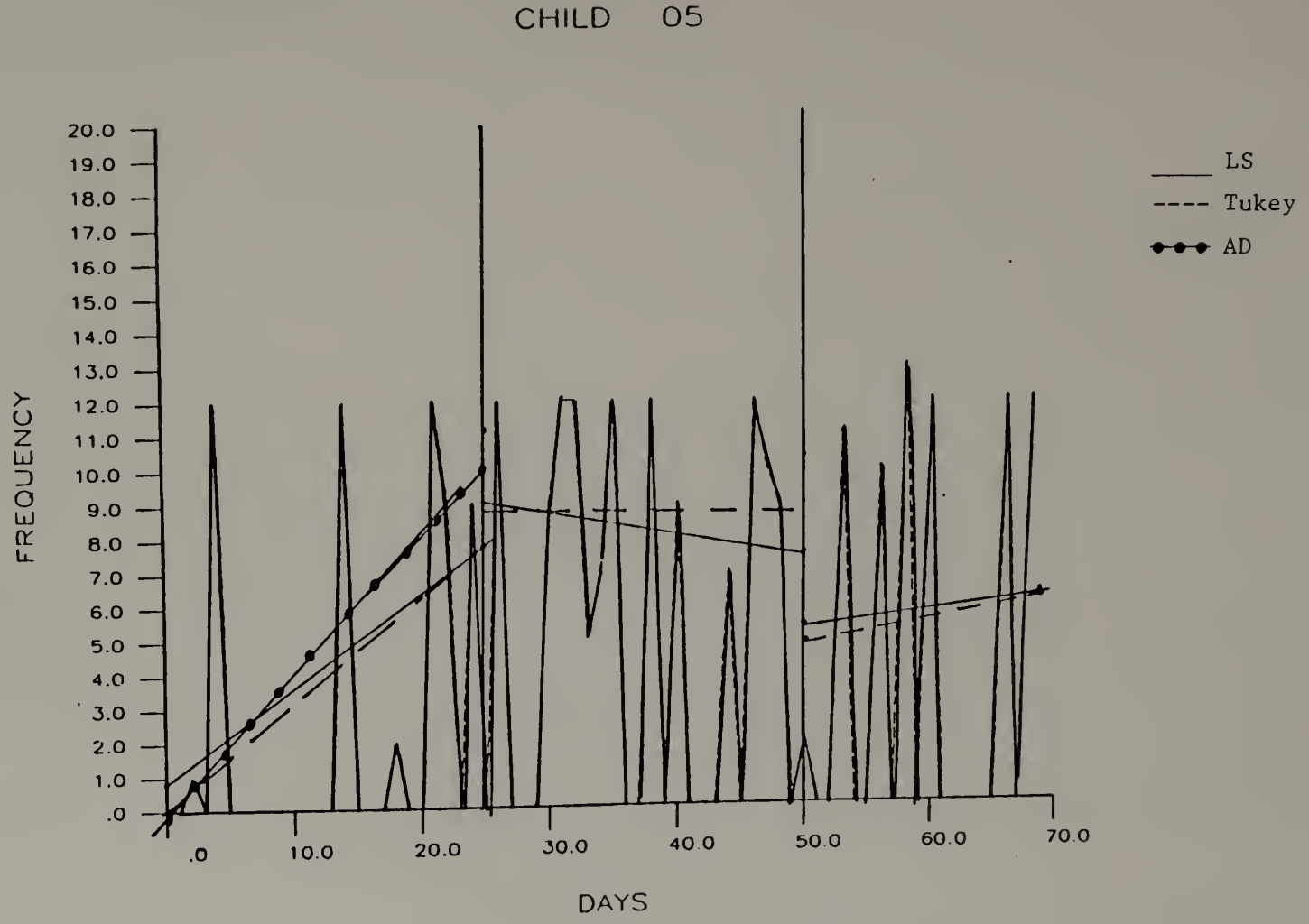

Figure 11. Median regression lines drawn for each phase for the Play Index for Individual 05.

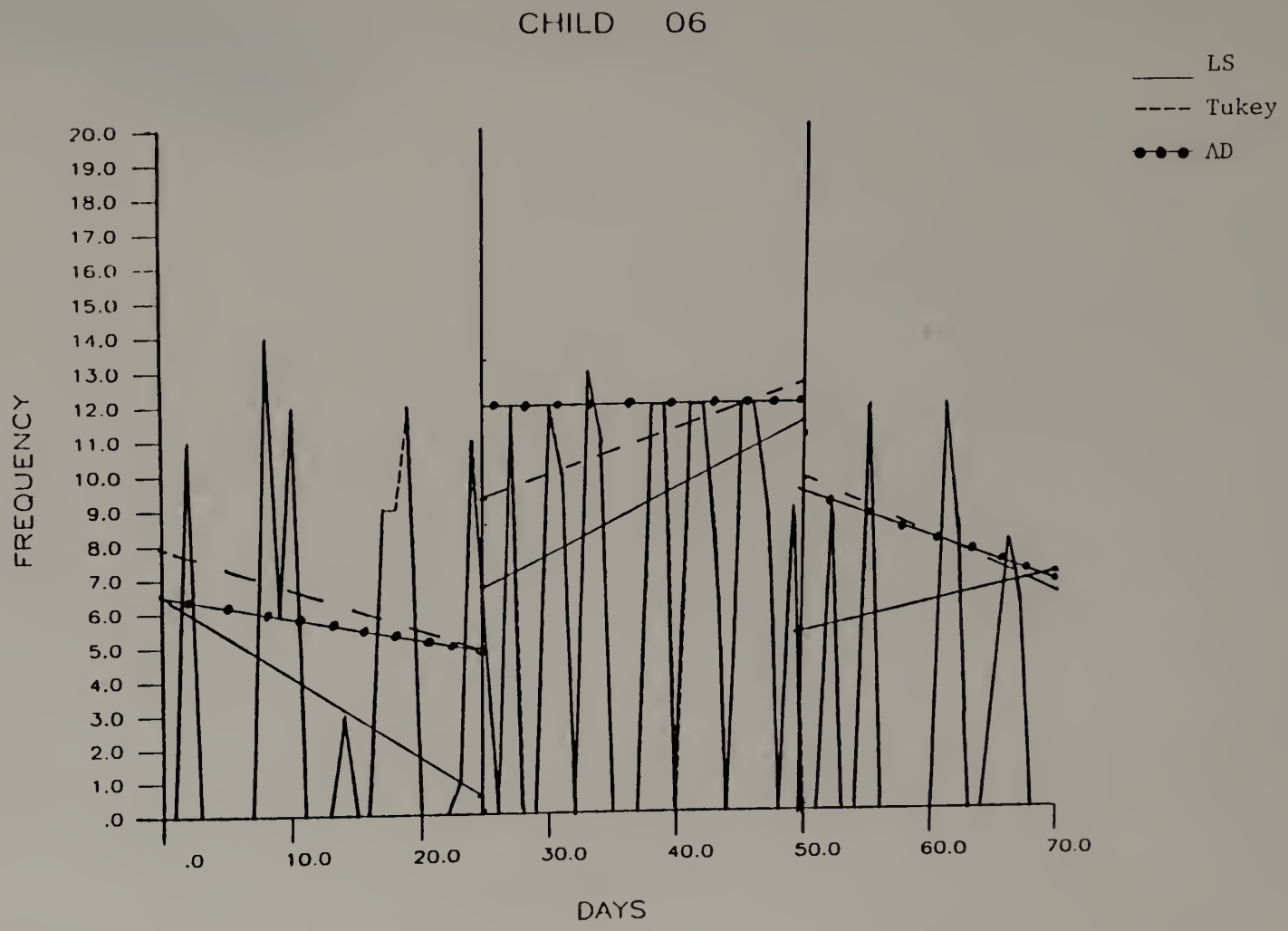

Figure 12. Median regression lines drawn for each phase for the Play Index for Individual 06.

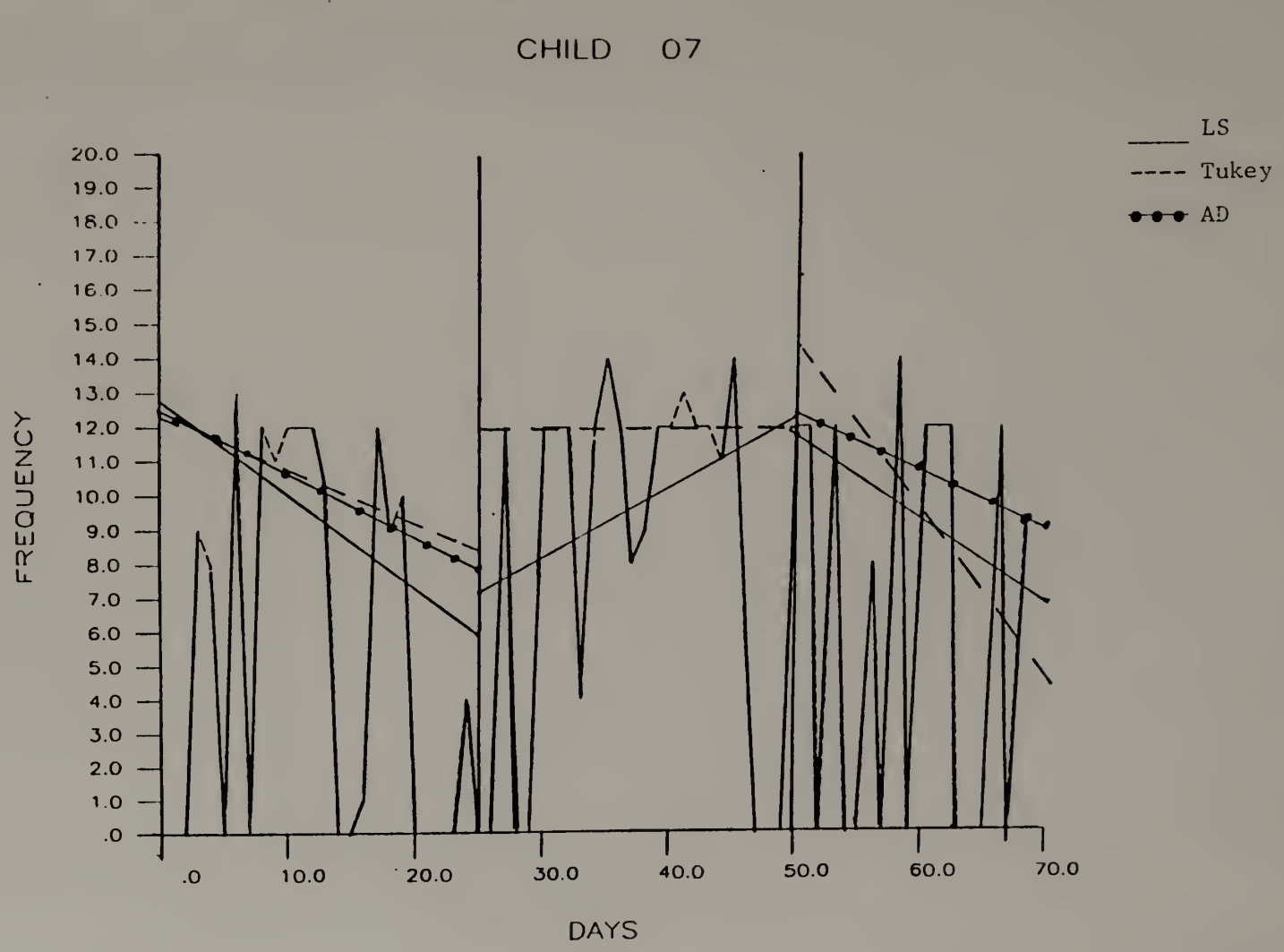

Figure 13. Median regression lines drawn for each phase for the Play Index for Individual 07.

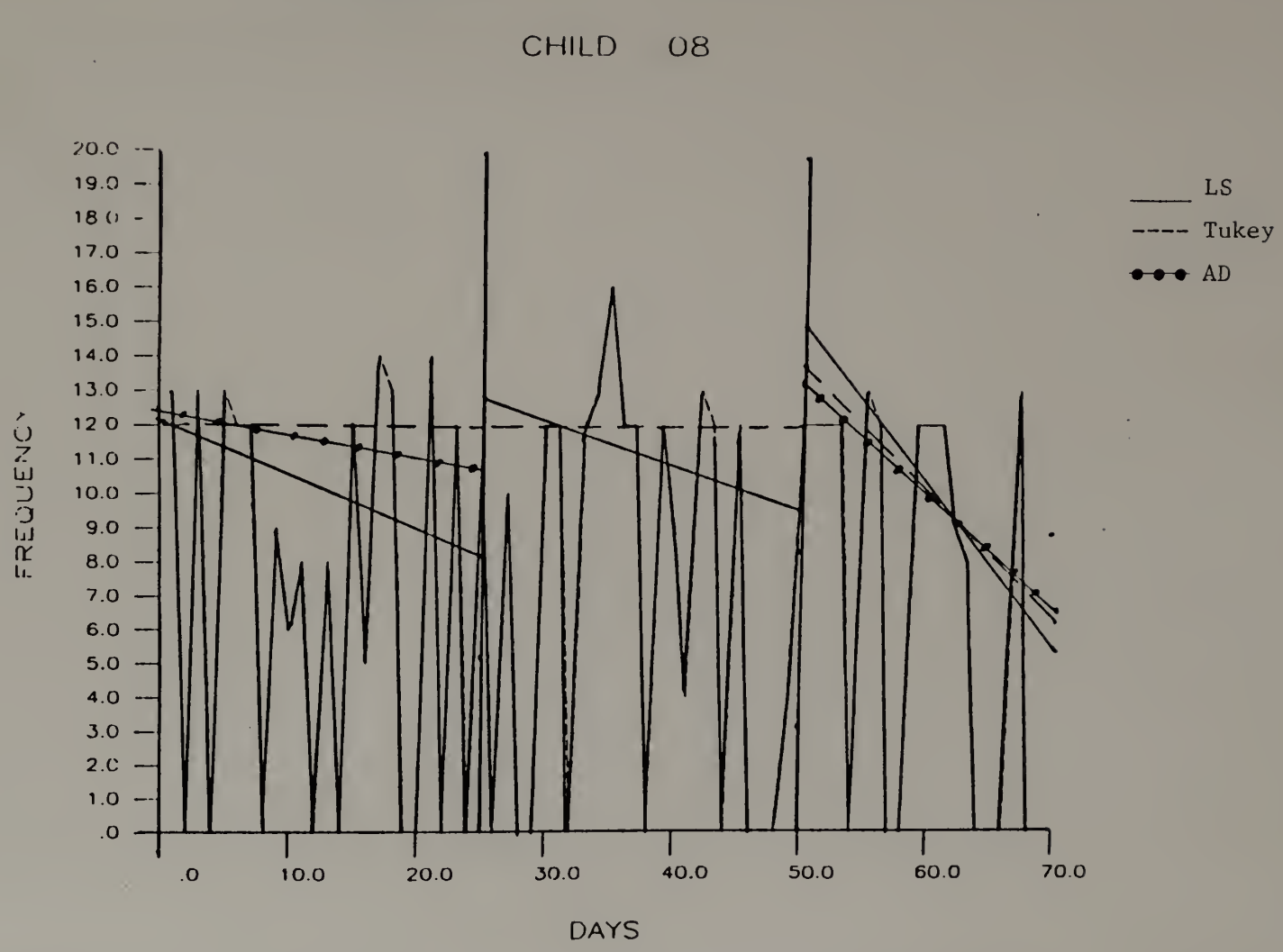

Figure 14. Median regression lines drawn for each phase for the Play Index for Individual 08.

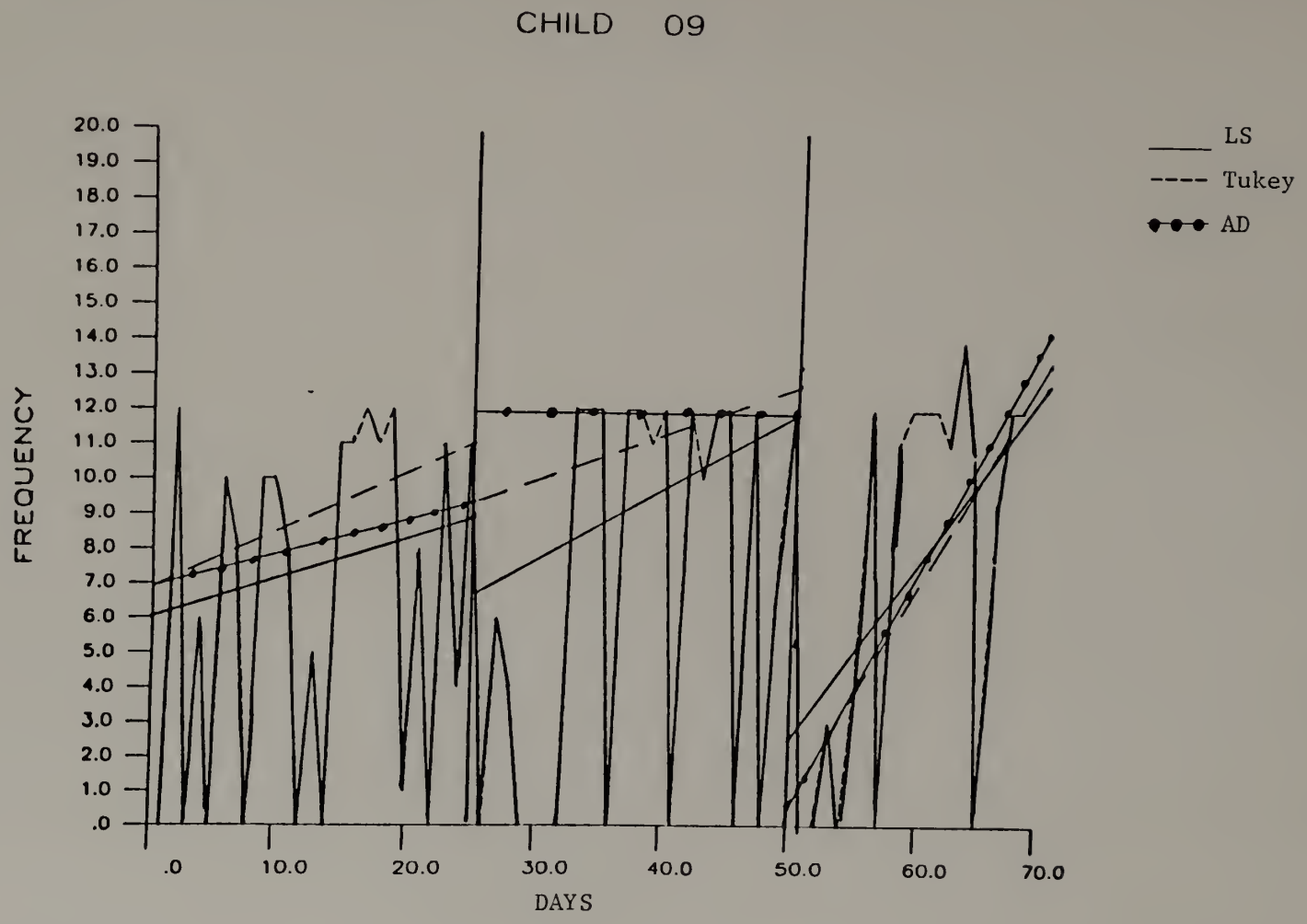

Figure 15. Median regression lines drawn for each phase for the Play Index for Individual 09.

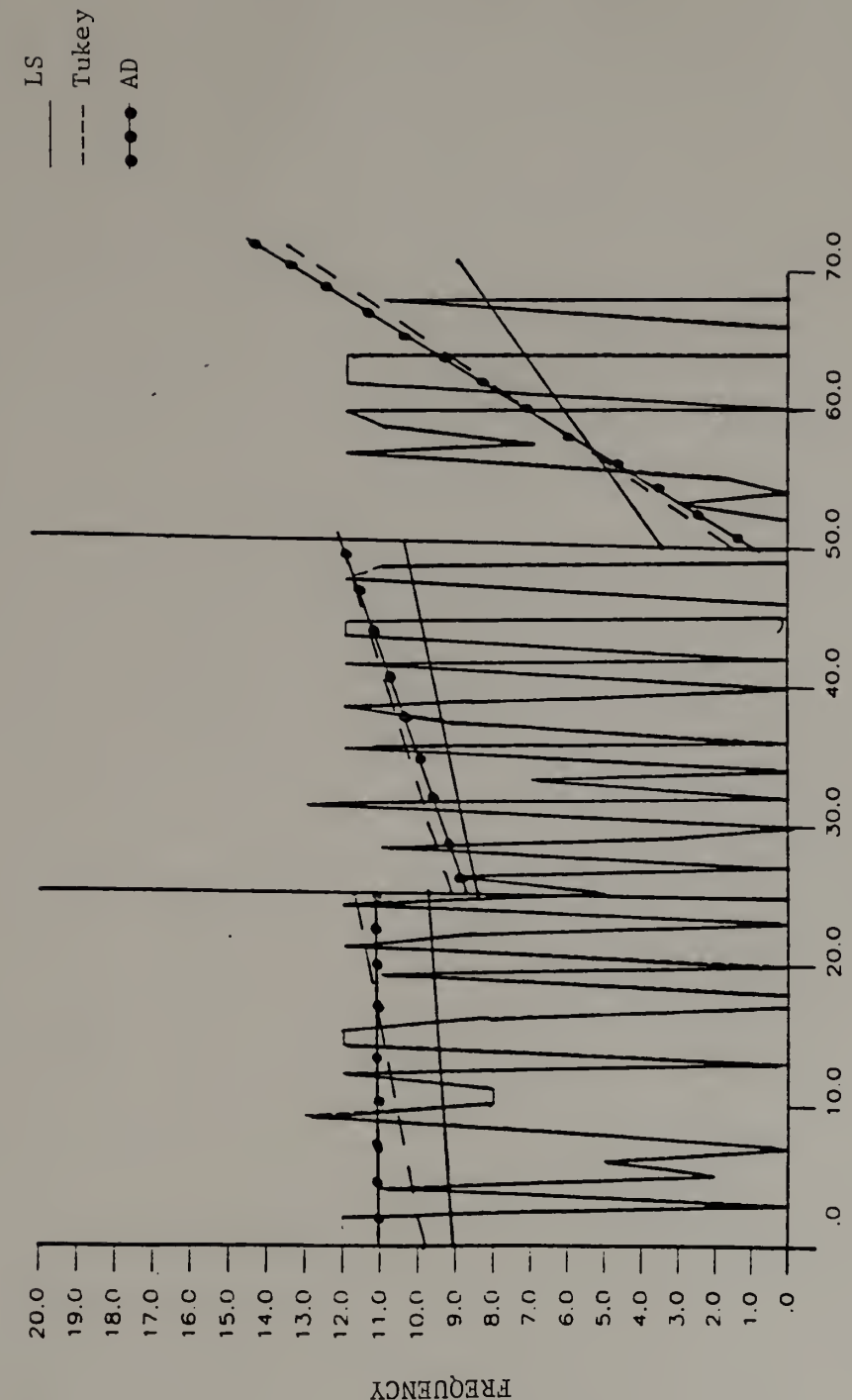

Figure 16. Median regression lines drawn for each phase for the Play Index for Individual 10.

SOCIAL INDEX

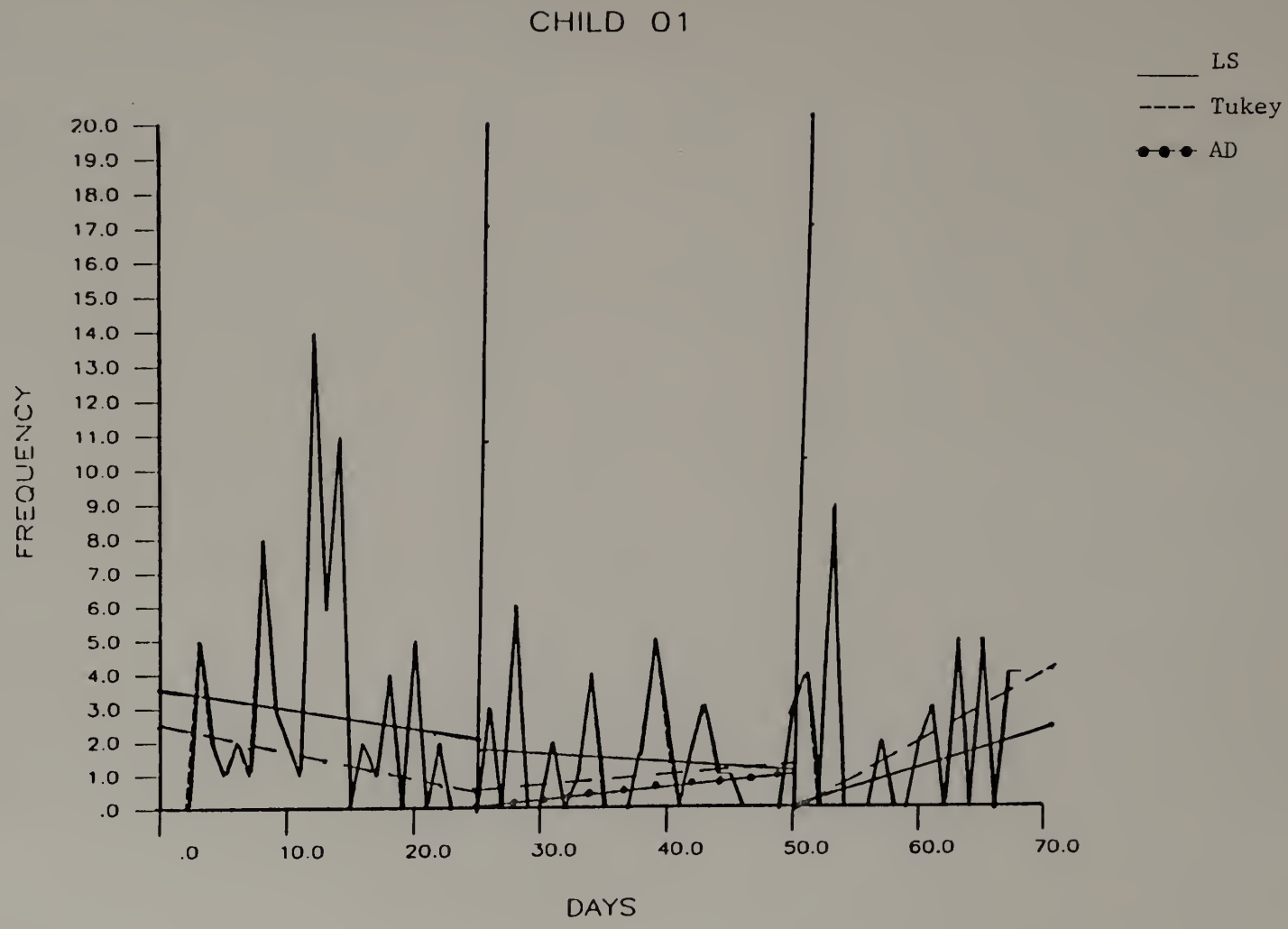

Figure 17. Median regression lines drawn for each phase for the Social Index for Individual 01.

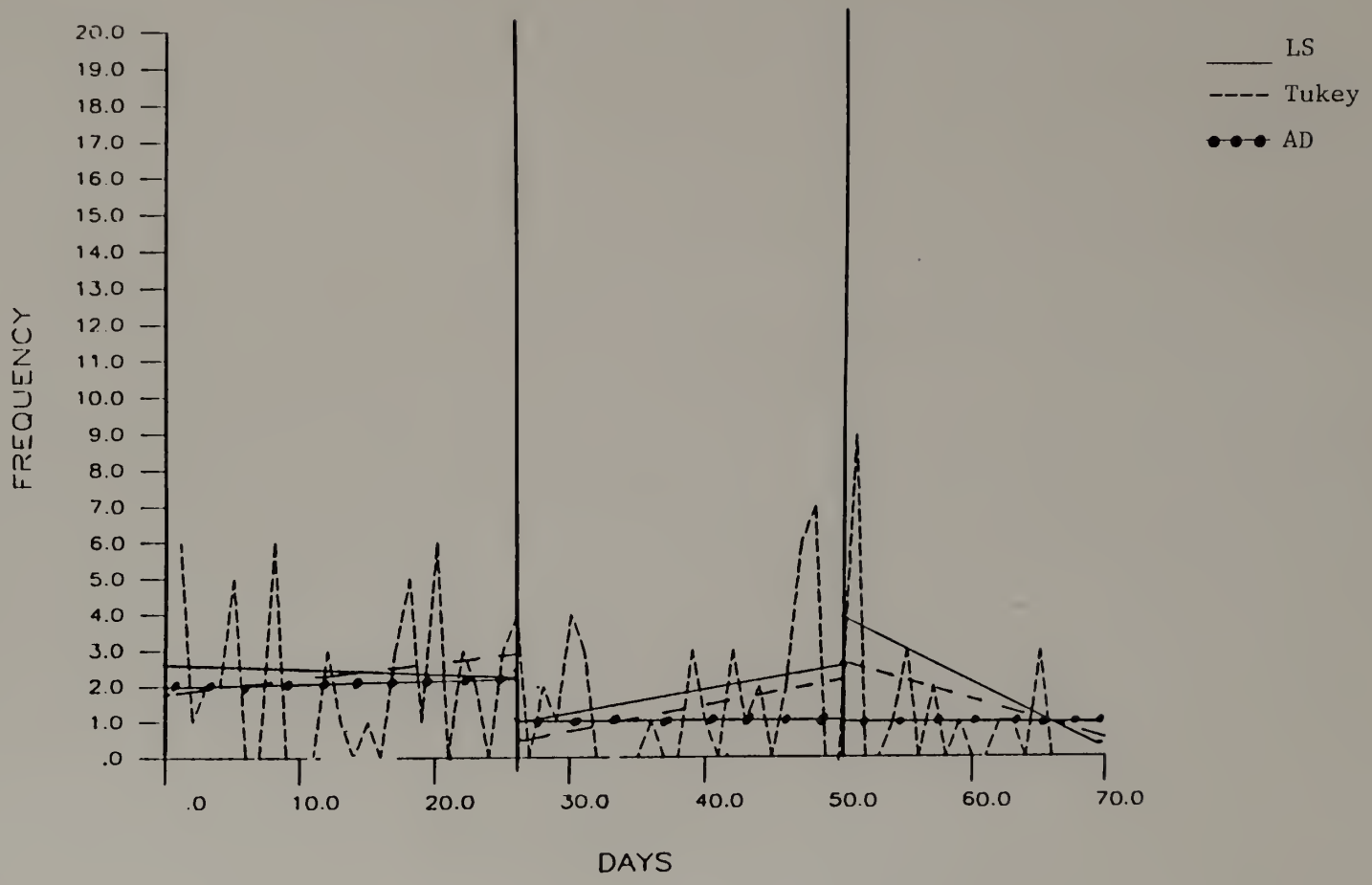

Figure 18. Median regression lines drawn for each phase for the Social Index for Individual 02.

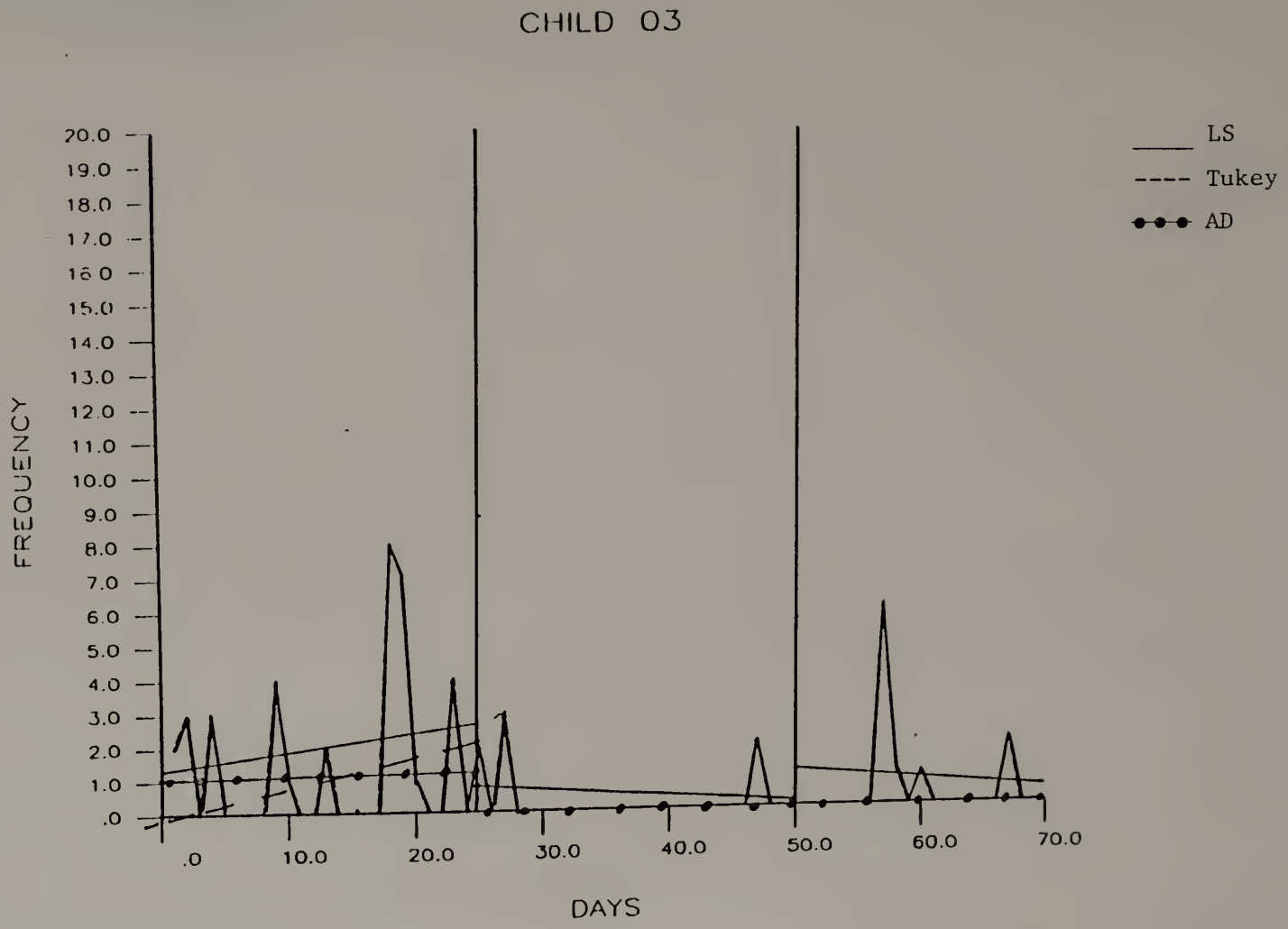

Figure 19. Median regression lines drawn for each phase for the Social Index for Individual 03.

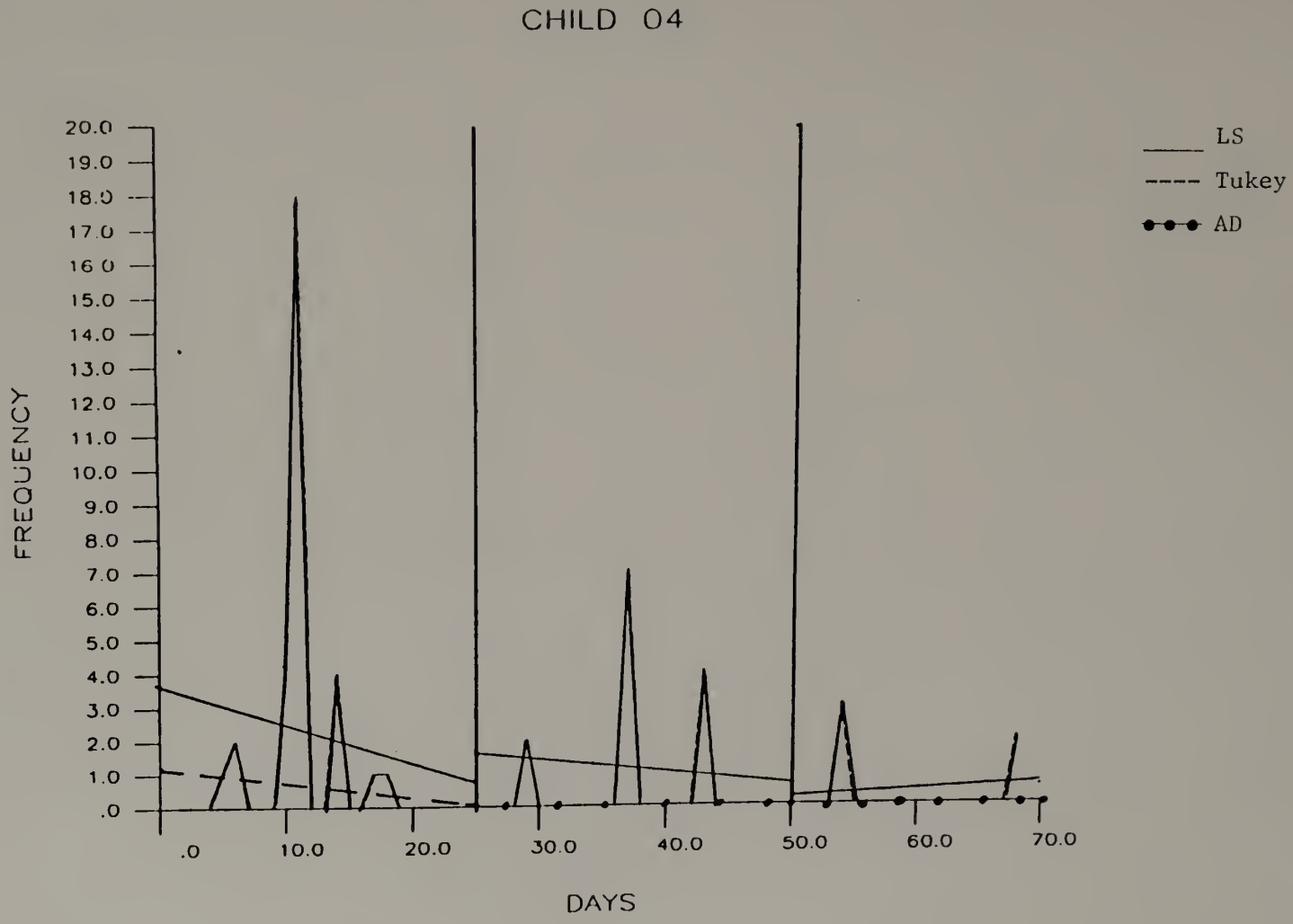

Figure 20. Median regression lines drawn for each phase for the Social Index for Individual 04.

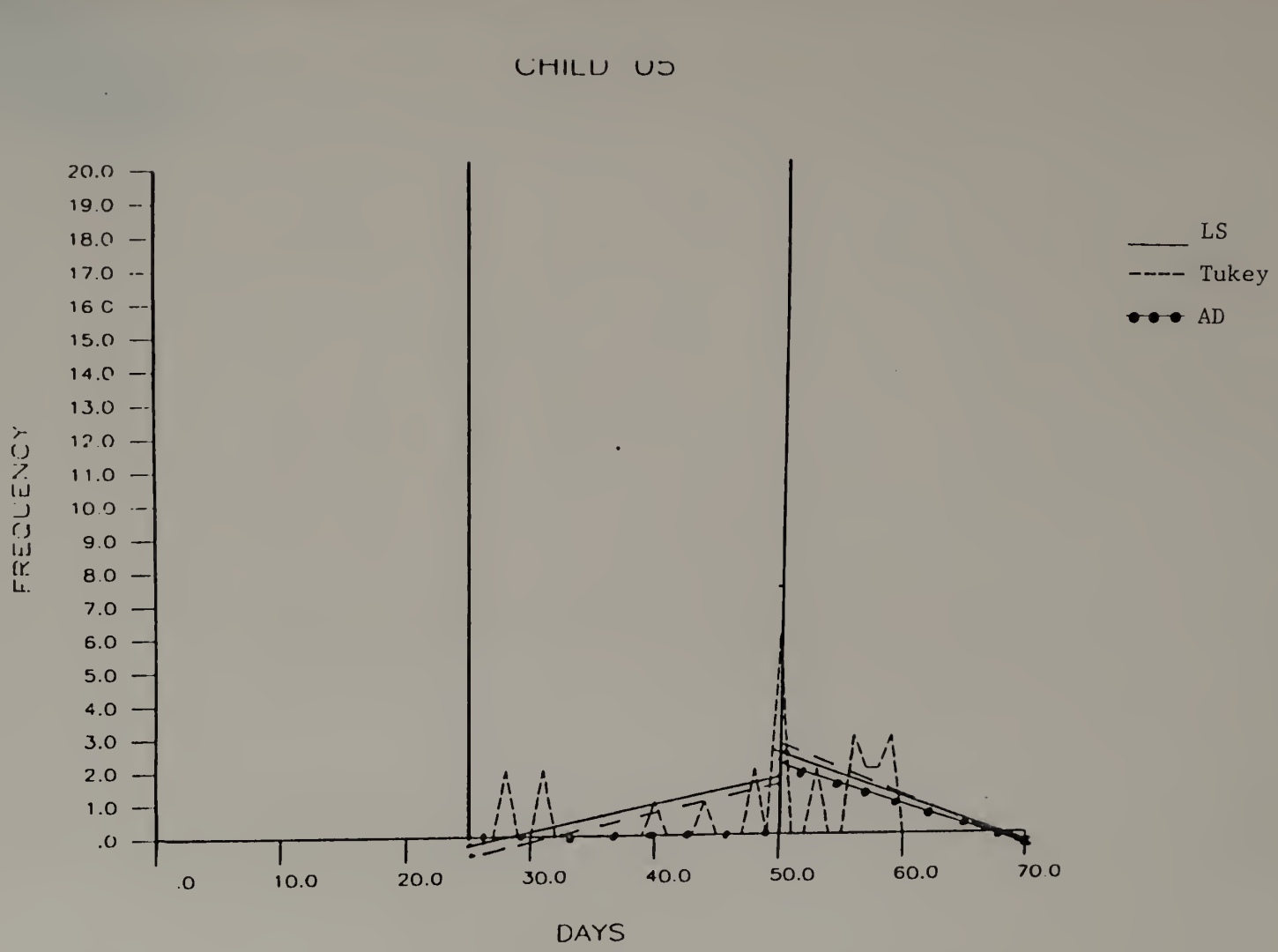

Figure 21. Median regression lines drawn for each phase for the Social Index for Individual 05.

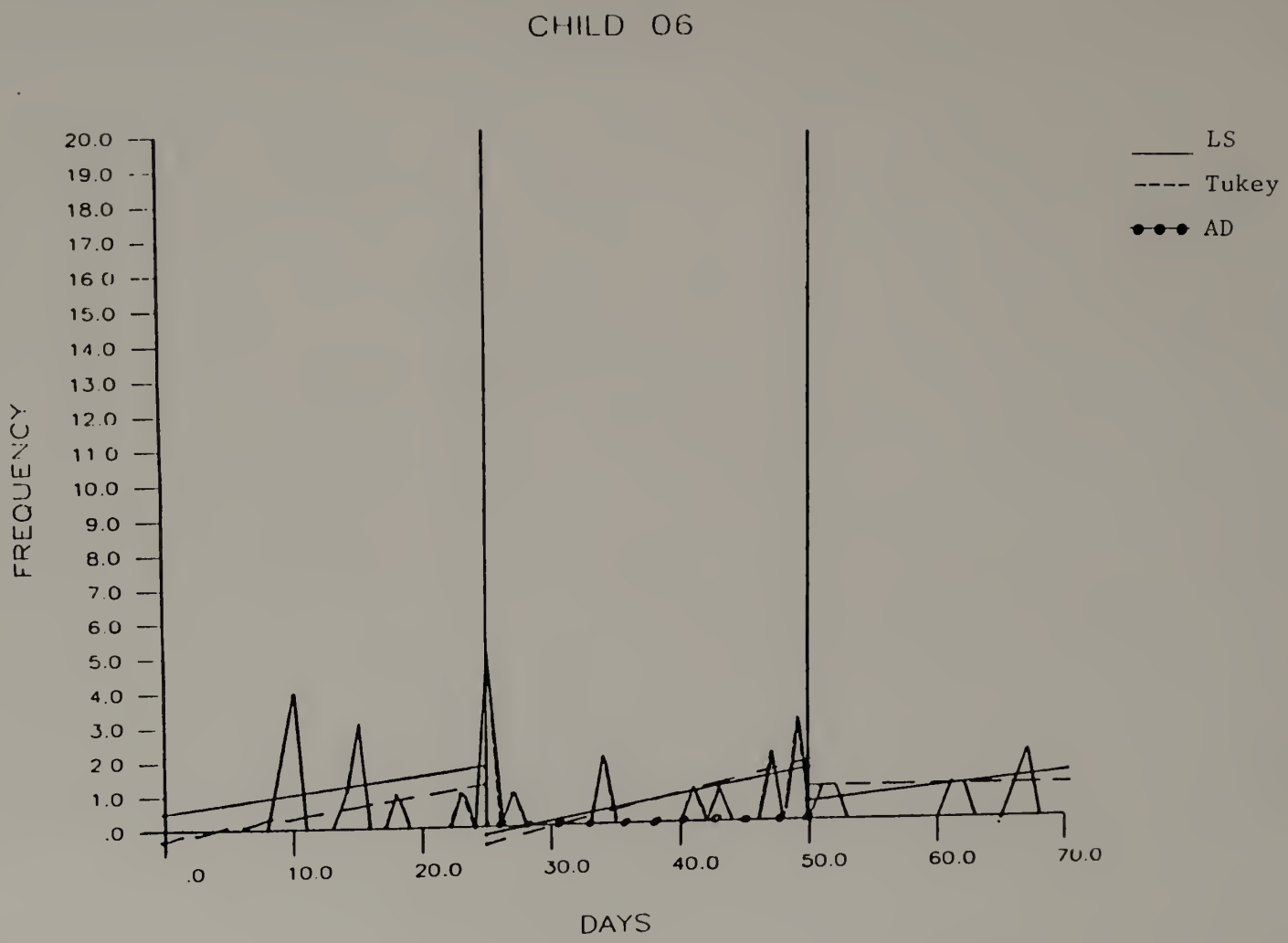

Figure 22. Median regression lines drawn for each phase for the Social Index for Individual 06.

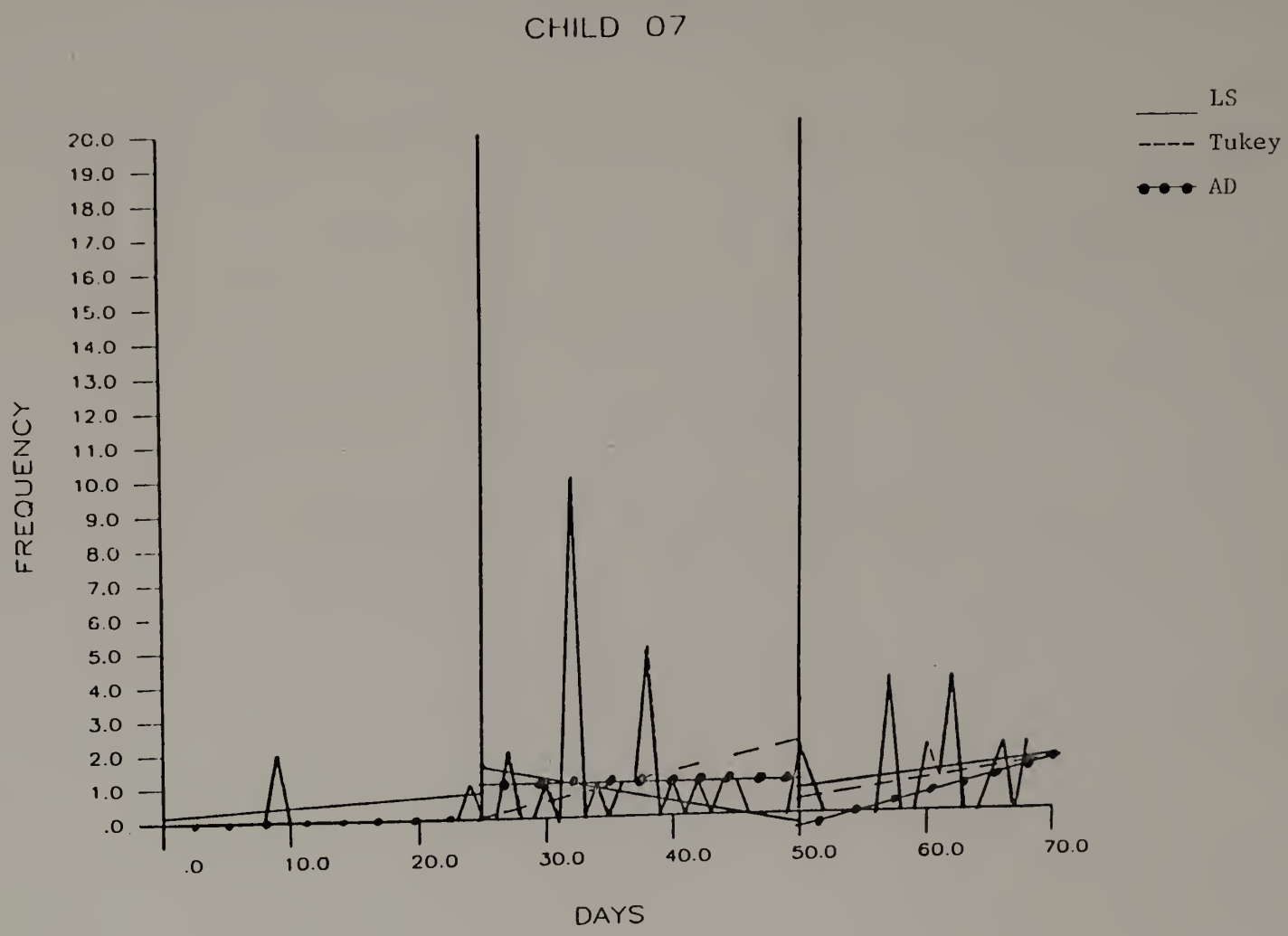

Figure 23. Median regression lines drawn for each phase for the Social Index for Individual 07.

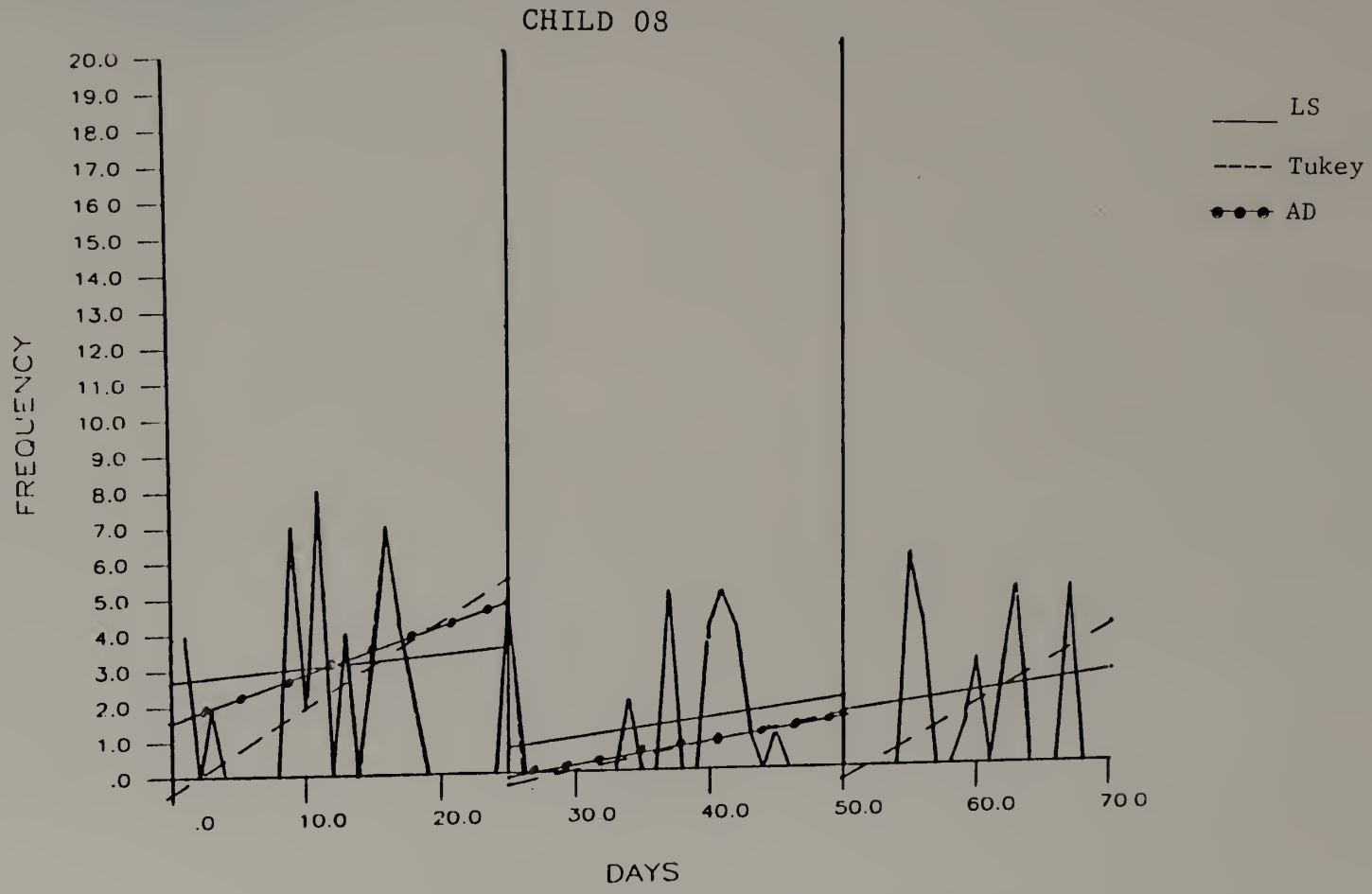

Figure 24. Median regression lines drawn for each phase for the Social Index for Individual 08.

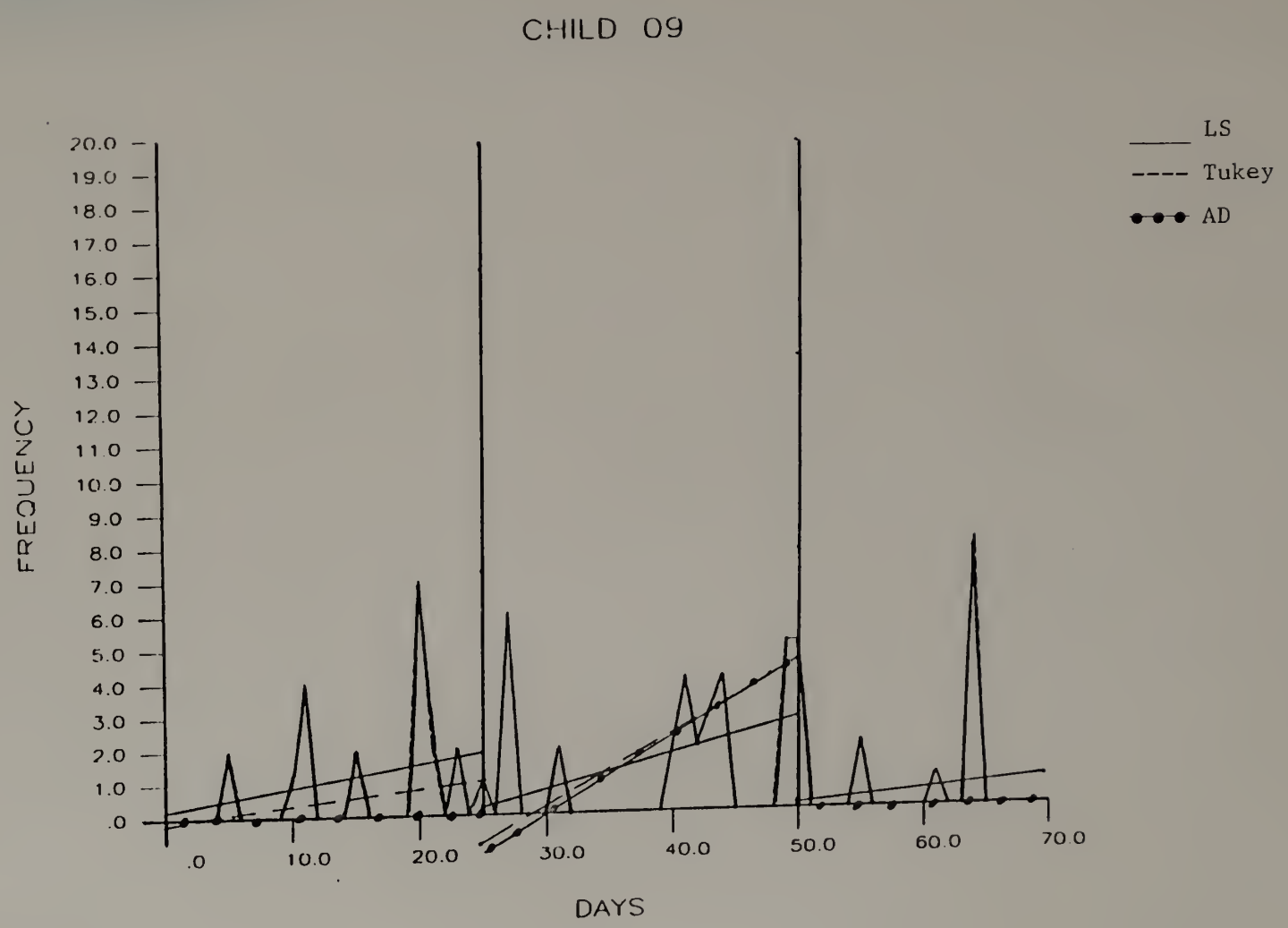

Figure 25. Median regression lines drawn for each phase for the Social Index for Individual 09.

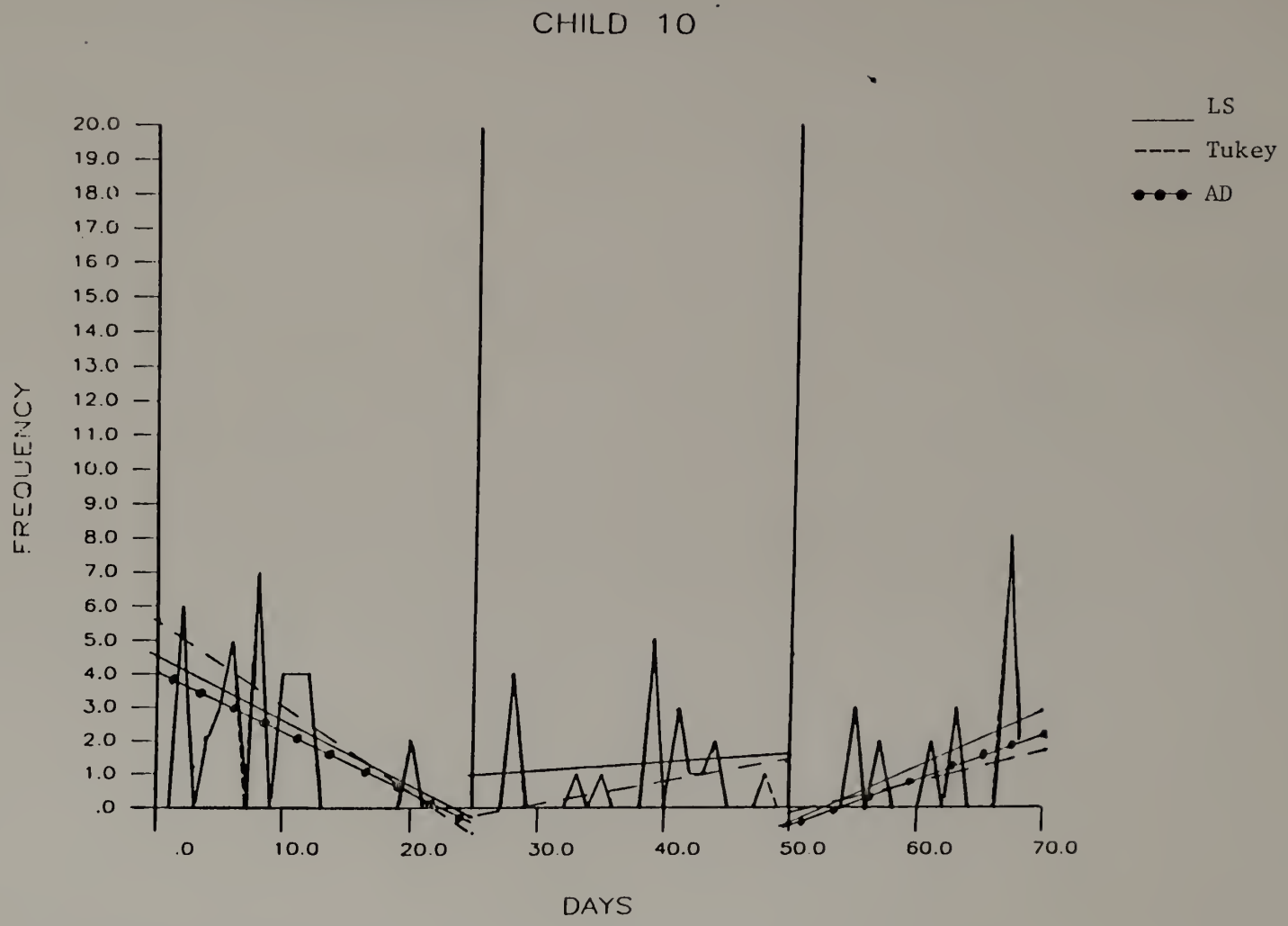

Figure 26. Median regression lines drawn for each phase for the Social Index for Individual 10.

APPENDIX B

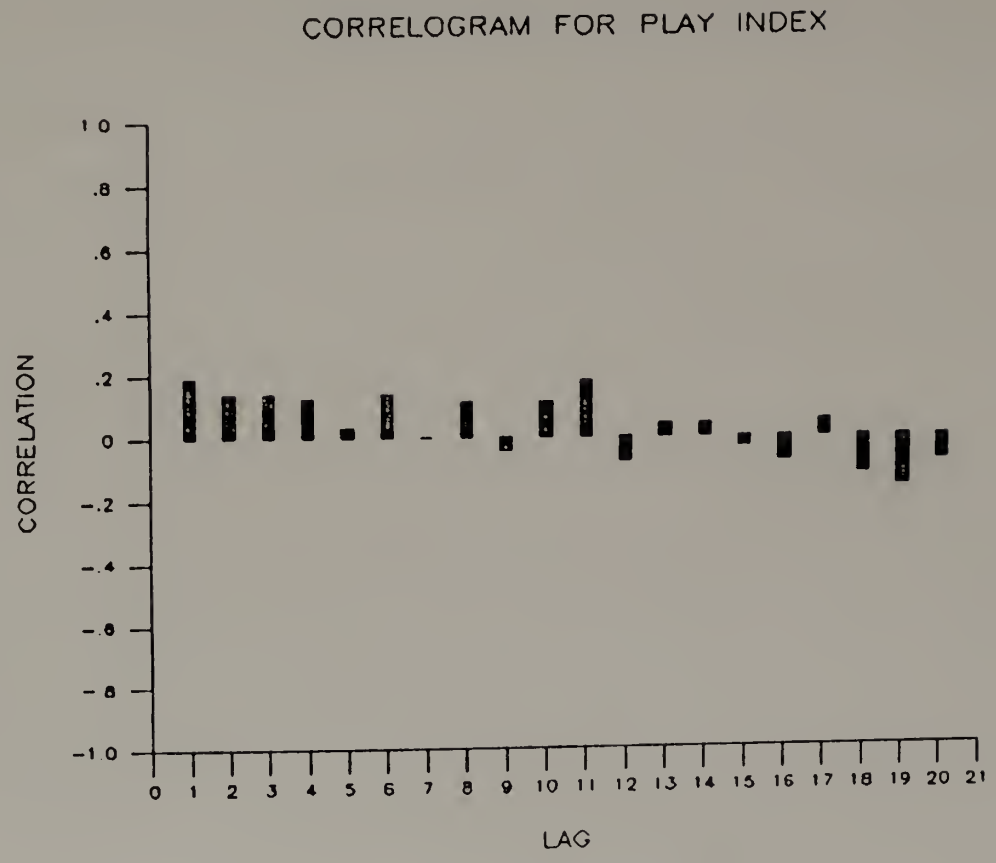

Figure 27. Correlogram of Play Index.

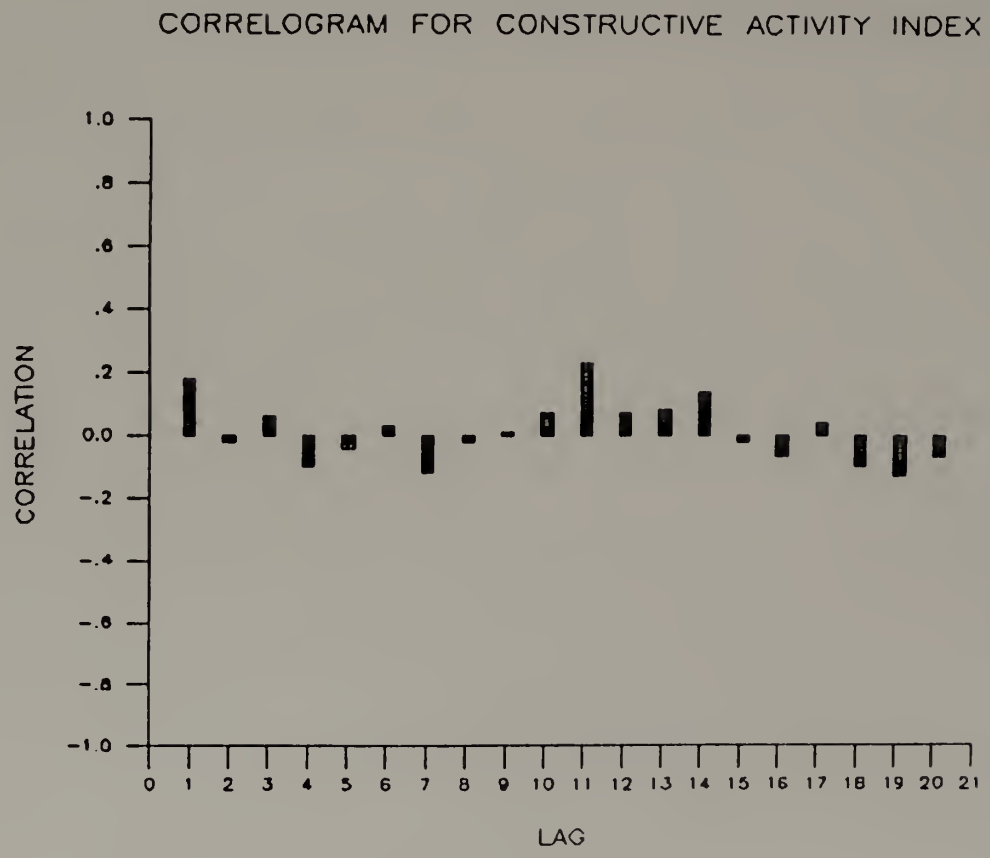

Figure 28. Correlogram of Constructive Activity Index.

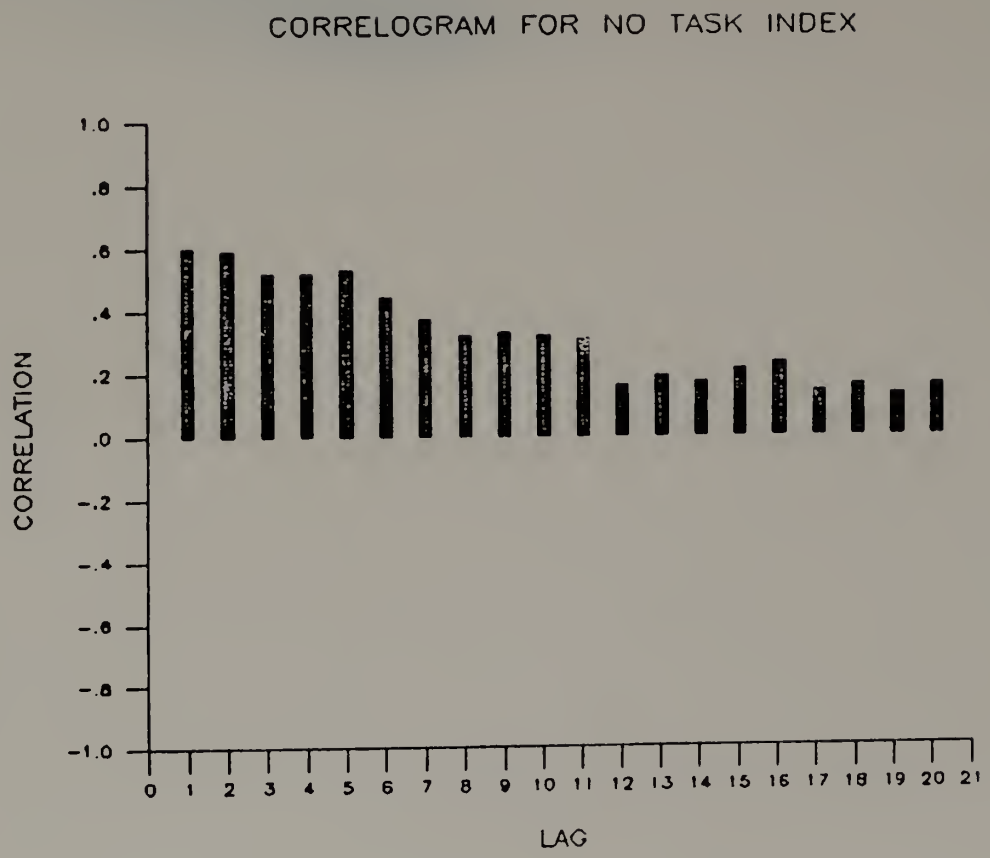

Figure 29. Correlogram of No Task Index.

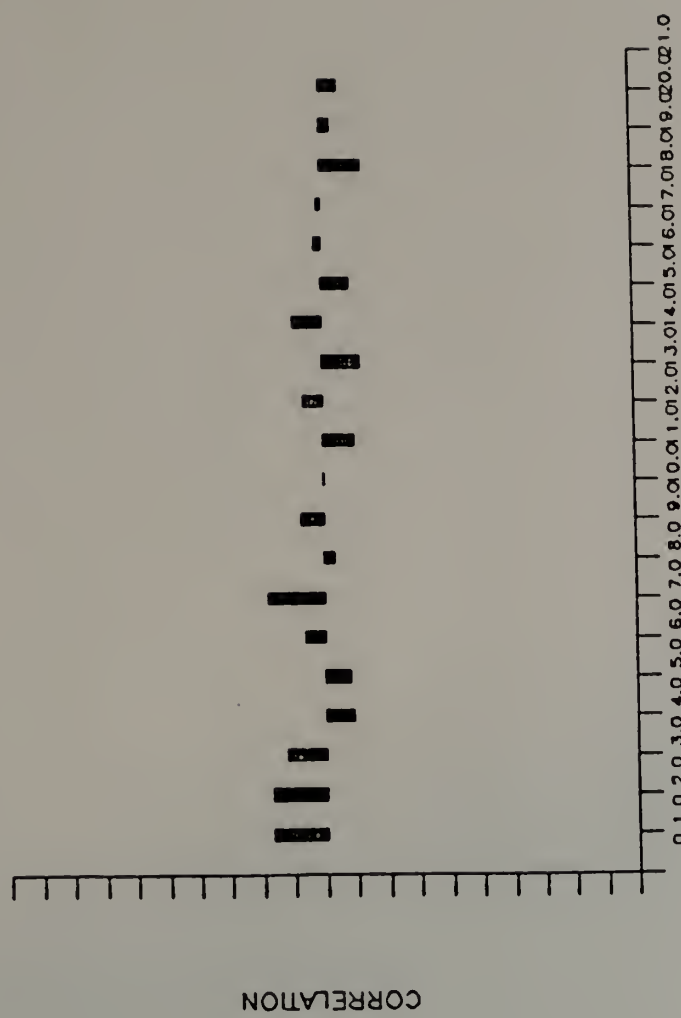

Figure 30. Correlogram of Social Index.

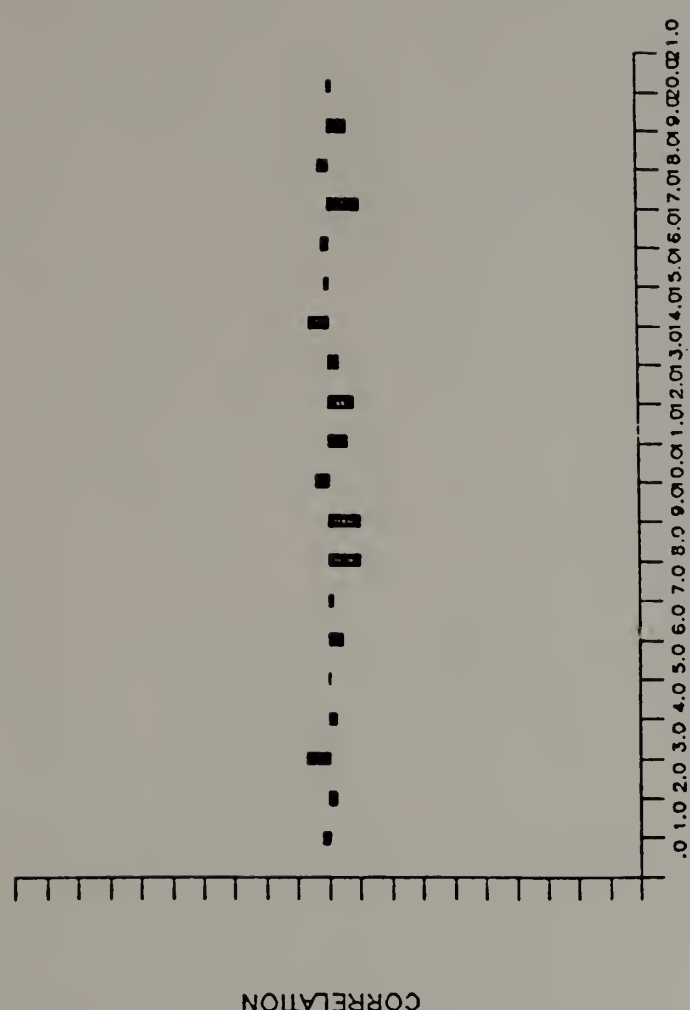

Figure 31. Correlogram of Teacher-directed Index.

Table 33

Autocorrelations for Average Daily Frequencies for Group Baseline (N=25)

Lag	Play	Constructive Activity	Non-task	Social	Teacher Directed
1	-.34	-.11	.39	.34	.03
2	.29	.08	.09	.09	.12
3	-.26	-.06	.01	.18	.37
4	.03	-.20	.17	-.23	-.01
5	-.39	.03	.16	-.23	.25
6	.22	-.13	.17	-.05	-.08
7	-.30	-.20	-.09	.04	0.00
8	.11	.17	-.23	-.08	.06
9	.05	-.06	-.08	.01	-.02
10	.10	0.00	.09	-.17	.04
11	.09	-.03	-.14	-.16	-.15
12	-.06	-.08	-.41	-.09	-.08
13	.09	.33	-.28	-.24	-.12
14	-.10	.02	-.19	.03	-.05
15	.07	.03	-.02	.04	-.05

Table 34

Autocorrelations for Average Daily Behavior for Group Intervention (N=25)

Lag	Play	Constructive Activity	Non-task	Social	Teacher Directed
1	.37	-.24	.28	.13	.35
2	.08	-.29	.32	.13	.14
3	.04	.08	.30	-.14	.01
4	.09	-.11	.02	-.16	.04
5	-.09	.08	.16	-.12	-.08
6	-.18	.22	0.00	-.09	-.24
7	-.15	-.19	-.11	-.01	-.10
8	-.16	-.16	-.05	-.18	.01
9	.02	.17	-.12	.07	.10
10	-.07	-.18	-.13	.15	-.02
11	-.04	.19	-.16	.14	-.21
12	-.17	-.03	-.22	.02	-.23
13	-.13	-.12	-.06	-.02	-.20
14	-.15	.04	-.20	-.15	-.14
15	-.07	.07	-.13	-.17	-.30

Table 35

Autocorrelations for Average Daily Frequencies for Group Post-intervention (N=18)

Lag	Play	Constructive Activity	Non-task	Social	Teacher Directed
1	.03	.28	-.16	-.38	.54
2	-.16	-.21	-.25	.18	.10
3	0.00	-.12	-.22	-.35	.08
4	-.13	-.12	-.11	.13	.08
5	-.14	-.14	-.05	-.27	-.10
6	-.08	-.06	-.46	.20	-.15
7	-.04	-.14	-.15	.06	-.10
8	.04	-.14	-.23	-.01	-.10
9	-.23	-.22	.26	-.23	-.22
10	.07	.07	-.01	.22	-.25