AN ABSTRACT OF THE THESIS OF

Mikyung Kim for the degree of Doctor of Philosophy in Education presented on March 3, 1987.

Title: Cognitive Development of Korean Kindergarten Children and its Relationship to Age, Gender, Social Class, and Maternal Attitude

Abstract approved: Redacted for Privacy
William R. Fielder

This study was designed to investigate whether the conservation of substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space are developed in sequence in the acquisition of conservation operations. More specifically, the purposes of the study are two-fold: (1) To assess the sequence and rate of conservation acquisition among children in the Korean culture; and (2) To assess whether the factors of age, gender, maternal attitude, and socioeconomic status are related to the performance of Korean children on conservation tasks.

The findings of this study were as follows:

1. The older group of children clearly performed better than the younger children on every task, indicating that there was an age-related developmental pattern.
2. There were no significant differences between the two gender groups, indicating that the development of cognition in children is not related to gender.

3. Conservation task scores differed significantly among three different social classes.
4. Children with mothers reflecting a possessive attitude obtained higher scores on conservation tasks.
5. There was a significant interaction effect between age and social class.
6. There was a significant interaction effect between age and maternal attitude.
7. There was a significant interaction effect between gender and social class.

Cognitive Development of Korean Kindergarten Children and its Relationship to Age, Gender Social Class, and Maternal Attitude

by

Mikyung Kim

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Completed March 3, 1987

Commencement June 1987

APPROVED:

Redacted for Privacy

Professor Education in charge of major

Redacted for Privacy

Head of Department of Elementary Education

Redacted for Privacy

Dean of Graduate School

Date thesis is presented March 3, 1987

Typed by B. McMechan for Mikyung Kim

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd) Page

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (cont'd)

COGNITIVE DEVELOPMENT OF KOREAN KINDERGARTEN CHILDREN AND ITS RELATIONSHIP TO AGE, GENDER, SOCIAL CLASS, AND MATERNAL ATTITUDE

CHAPTER I. INTRODUCTION

Cross-cultural studies are invaluable sources of information when investigating the development of cognitive processes. This is particularly true in the case of Jean Piaget's theory of cognitive development in which a major role is attributed to the unfolding of universal maturational states. Studies of children from very different environments offer an excellent way of testing for the existence of such universal developmental sequences.

Over the last 30 years children around the world have observed and responded to a variety of cross-cultural experiments and research undertaken to test Piaget's theory of genetic epistemology, which posits a hierarchical, universal, and invariant sequence of stages of cognitive development. To date, results of research in varying cultures have revealed both striking similarities and marked differences in performance on cognitive tasks, some of which are in apparent conflict with the basic assumptions of Piaget's stage theory.

Piaget (1950) postulated an invariance in sequence in the acquisition of conservation within the concrete operational stage. He maintained that the acquisition of conservation of volume is preceeded by acquisition of

conservation of weight, which, in turn is preceeded by acquisition of quantity conservation. This sequential development has been termed "horizontal *décalage*" and, for the most part, has been confirmed in Western studies (Elkind, 1961a; 1961b).

In support of the invariance of stages, Mohsensi (1966) observed the same sequence of development of conservation tasks for urban and rural children in Iran as well as in Europe. Moreover, children in Papua-New Guinea also exhibited the expected pattern sequence variance (Prince, 1968). However, contradictory evidence regarding the invariance in sequence of stages has been provided by Boonsong (1968), who found that the development of conservation of quantity and weight to be simultaneous in Thai children. Hyde (1959) offered additional opposition to Piaget's theory by demonstrating that some of her Arab, Indian, and Somali subjects conserved weight but not quantity. In another study (De Lemons, 1969), more Australian Aborigines succeeded in weight conservation tasks than they did in quantity conservation tasks.

Studies seeking validation of Piaget's theory have continued to flourish. However, in the face of findings apparently contradicting specific aspects of Piaget's theory, the validity of his assertions concerning universal cognitive structures remains ambiguous. The contradictions in the research have not only brought into question the validity of Piaget's theory that stage development is universally invariant in sequence, they have evoked questions regarding the nature of cultural and subcultural differences and the general conduct of cross-cultural research.

One of the weaknesses of cross-cultural research, limiting its complexity, has been the quality and nature of the methodology and the use of unsophisticated testing techniques. Uzgiris (1964) studied the degree to

which the ability to conserve in one situation is transferred or generalized to different situations and found that the appearance of conservation with one set of materials does not enable one to predict its appearance with other stimulus materials. He also investigated the conservation of substance, weight, and volume, finding that when different materials were used (e.g., plasticine balls, metal cubes, plastic wire, and wire coils) there was a significant difference in the conservation responses of children in the first through the sixth grades.

For the most part, developmental cross-cultural studies have been simply designed, generally involving a relatively small sample. This was true of the research of Lovell and Ogilvie (1961), Pratoomraj and Johnson (1966), and Smedslund (1961), in which it was demonstrated that variances for a single conservation task account for only a small proportion of the total variance in conservation concepts. Subsequently, Cole and Bruner (1971) have dramatically demonstrated the situation-specific nature of many experimental findings in cross-cultural settings and their findings have served to invalidate many of the sweeping generalizations regarding the cognitive deficiencies of non-Western cultures. Performance differences on a single task may be due to any number of causes not related specifically to cultural differences.

Goldschmid and Bentler offered an important contribution in this area by developing a set of standardized procedures which facilitate measurement of Piaget's conservation concepts (Wasik, B. & Wasik, J., 1971). Their Conservation Concept Diagnostic Kit has established satisfactory inter-item reliability on test area subscales in a 3 stage test-retest-reliability format. Its use in the present study has served to eliminate the use of inconsistent criteria.

This study has been designed to provide a detailed examination of a potential developmental sequence between the tasks most frequently cited in Piaget studies, namely substance, weight, continuous quantity, discontinuous quantity, number, area, length, distance, and two-dimensional space conservation, and to measure the effects of age, gender, social class, and maternal attitude on conservation tasks.

Statement of the Problem

The present study is designed to investigate whether conservation of substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space are developed in sequence in the acquisition of conservation operations. The purposes of this study are two-fold:

1) To assess the sequence and rate of conservation acquisition among young children in Korea, using nine different tasks involving conservation of substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space; and
2) To assess whether the factors of age, gender, maternal attitude, and socioeconomic status are related to the performance of Korean children on conservation tasks.

Objectives of the Study

The specific objectives of this study are as follows:

1) To compare age differences in the ability of five to six-year old children in performance of conservation tasks, including

substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space;

2) To determine if there are significant differences between the performance of boys and girls on conservation tasks;
3) To determine if there are significant differences between three socioeconomic groups on conservation tasks; and
4) To determine if there are significant differences between three maternal attitude groups on conservation tasks.

Significance of the Study

Studies of conservation in the cross-cultural context have continued to flourish. However, the import of research with respect to Piaget's assertions concerning universal cognitive structures remains ambiguous. A thorough sampling of the earlier studies, reviewed by Dasen (1972), clearly revealed the problem issues: There appear to be differential effects of culture and schooling on the rate of development and, perhaps even more important, on the ultimate attainment of the concepts examined. Indeed, both Greenfield (1966) and more recently, Lloyd (1971), have pointed out that most cross-cultural research has reflected a timetable approach, simply comparing performance of Western and non-Western children on standard conservation tasks. Subsequent research (Dasen, 1977), using methodological improvements, has reinforced the notion that a universal pattern of development does not appear to exist. However, the important issue of how variations in experience influence the acquisition of conservation has been left largely unanswered.

The theory of qualitative universality has recently been challenged, not by reference to empirical data, but on theoretical or ideological

grounds. The last stage of Piaget's sequence, that of formal operations, has been particularly criticized. Greenfield (1976), for example, in a thoughtful review, has spoken of the "paradox of the developmental end-point":

> Cross-cultural researchers have failed to follow Piaget's own demonstration that, to study development, one must first understand the end-state toward which the developmental process is veering. An implication of Piaget's example for cross-cultural research is to ascertain the characteristics of an ideal type in a non-Western culture.
>
> One major criticism of Piaget's theory of development for cross-cultural research is that his notion of development is really the development of a Western scientist. (pp. 324-325)

Since Western science does not necessarily represent the forms of thought valued in other cultures, nor in fact in some subcultures within the Western world, the sequence established by Piaget is thus likely to be ethnocentric.

Several studies have provided the basis for an understanding of the sequential development of role concepts. Piaget (1928) posed a series of questions concerning family relations to preschool and school-age children and found that with increasing years the children progressively defined family roles based upon relations between roles. Only the children over nine years of age were able to explain how one person could simultaneously occupy more than one role within the family. Other studies have concentrated on various components of role concepts, e.g., age, gender, kinship relations, role functions, the conservation of one role when another is added, and the semantic complexity of the terminology used. Watson

and Fisher (1980) reported a rough sequence of development that paralleled Piaget's findings, though the ages varied dependent upon the roles and tasks that were assigned.

Beyond the question of interaction with the general environment, certain specific types of activities, manipulations, or experiences may foster specific skills, but skills which may not be expected to generalize into a structure. One issue of both theoretical and methodological importance that has been addressed by cross-cultural investigators of conservation is the effect of stimulus familiarity on conservation performance. For example, the handling of clay in pottery-making can be expected to promote the conservation of substance. Price-Williams, Gordon, and Ramirez (1969) found that this was indeed the case in a group of Mexican children who had grown up in pottery-making families. The effect was limited to the conservation of substance in one sample, but it was also noticeable on the conservation of number, liquid, weight, and volume in another sample. The same authors also employed stimulus materials familiar in indigenous Nigerian culture and found conservation of quantity to be evident at the same age as reported for Western societies.

Adjei (1973) took up this interesting paradigm in his study of the conservation of number, liquid, substance, weight, and volume among rural Ghanaian children and adults selected according to their occupational experiences: pottery-making, farming, and marketing. Pottery-making was found to have a significant effect upon the conservation of substance, weight, and volume in the adult group and only on the conservation of weight in the children's group. The research activities included exercising, active manipulation, and experiencing, which could conveniently be

classified under Piaget's equilibration factors. Thus, the microscopic approach not only recognizes the central importance of the mechanism of equilibration or autoregulation in Piaget's cognitive theory, but it allows the researcher to uncover specific salient cognitive experiences inherent in indigenous non-Western cultures and those nurtured by Western cultural media. The relative lack of empirical knowledge of equilibration factors is therefore very unfortunate.

Piagetian theory does not present a clear account of how cultural and individual differences in conservation learning might develop. For the present study the work of Cole and Scribner (1974) provides a more useful theoretical framework. Based on the work done by Vygotsky (Cole, John-Steiner, Scribner, & Souberman, 1978), it was hypothesized that such capacities as incidental memory, the ability to form concepts and generalize, and to operate from abstractions and reason logically are universal. In response to the various problem-solving situations or tasks posed by a particular environment, the basic capacities are integrated to yield particular skills or functional learning systems. Functional learning systems are, therefore, the specialized adaptations of a culture or an individual.

In the last decade a number of new conceptualizations of cognitive development have appeared (Halford, 1982; Klahr & Wallace, 1976; Siegler, 1981). Accompanying this conceptual restructuring there have been a number of methodological reassessments (Halford, 1984; Miller, 1976), one example of which is the conservation concept. Piaget (1950, 1952) claimed that it is "concrete operational" and therefore unattainable until the age of seven to eight years. On the other hand, Bryant (1972) produced evidence that even preschool children understand conservation. Consequently, this

reconceptualization has made it both necessary and possible to reexamine these claims, and that is the purpose and significance of this study.

Limitations of the Study

It is recognized that this study has certain limitations. First, the study was limited to a group of 200 Korean kindergarten children between the ages of five and six. Second, this study could not be matched on the basis of age with studies of children in Western cultures. Finally, the parent attitude instrument used in this study was translated from English into the Korean language. In the process of translation a small number of items were dropped from the original instrument when meaningful and satisfactory equivalent statements could not be constructed in the Korean language.

Hypotheses

Main Effects

The central problem of this study was to investigate the main effect of age, gender, social class, and maternal attitude in the conservation scores of five and six-year old Korean kindergarten children. The specific hypotheses are given below and the case for the expected differences stated in these hypotheses is discussed in Chapter II, the review of literature.

First, would the age of Korean kindergarten children have any effect upon performance in the nine conservation tasks?

Hypothesis 1 (H^1): Children six or more years of age are significantly better performers than children less than six years of

age on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

The second question in this study concerned gender differences that might exist among Korean kindergarten children on various conservation tasks.

Hypothesis 2 (H^2): Male subjects are significantly better performers than female subjects on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

The third central question of this study dealt with the effect of the social class of Korean kindergarten children upon performance scores for nine conservation tasks. Would the conservation scores obtained from the subjects reflect differences among the sample in social class background?

Hypothesis 3 (H^3): Children of families from a higher social class are significantly better performers than the children of families from a lower social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

The fourth question explored performance differences that might exist among subjects from families with different maternal attitudes toward their children.

Hypothesis 4 (H^4): Children whose mothers are classified as "possessive" are significantly better performers on each of

the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks than are subjects whose mothers are classified as "dominant" or "ignoring."

Interactive Effects

The collateral object of this study was to determine if there were any interaction effects among age, gender, social class, and maternal attitude.

Hypothesis 5 (H^5): There is no significant interaction effect between age and gender on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 6 (H^6): There is no significant interaction effect between age and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 7 (H^7): There is no significant interaction effect between age and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 8 (H^8): There is no significant interaction effect between gender and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number,

area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 9 (H^9): There is no significant interaction effect between gender and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 10 (H^{10}): There is no significant interaction effect between social class and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 11 (H^{11}): There is no significant interaction effect between age, gender, and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 12 (H^{12}): There is no significant interaction effect between age, gender, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 13 (H^{13}): There is no significant interaction effect between age, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 14 (H^{14}): There is no significant interaction effect between gender, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Hypothesis 15 (H^{15}): There is no significant interaction effect between age, gender, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Definition of Terms

The terms used in this study are defined as follows:

1) Conservation: Recognition that properties of objects remain the same, despite any rearrangement, realignment, or deformation which may change the appearance of the object.
2) Cognitive Universals: The basic attributes of organization and adoption which apply to all biological characteristics and therefore to intelligence as a biological characteristic of human beings.
3) Conservation Behavior: Refers to the child's judgment of the relative quantity of two objects, one of which has just been manipulated by the examiner (Goldschmid & Bentler, 1968b).

Social Class Definition

Children from different socioeconomic backgrounds have parents who differ in amount of education, occupational level, income size, and the

type of neighborhood in which they live. The first three of the above characteristics have been used to determine the social class designations of the sample in this study. Table 1 indicates factors used to determine individual sample scores:

Table 1. Family Socioeconomic Scale.

Factor Item	Scale Classification	Score Index
Occupation	Higher executive	5
	Business manager	4
	Administrative personnel	3
	Skilled manual employee	2
	Machine operator or semi-skilled employee	1
	Unemployed	0
Education	Graduate professional training	5
	Standard college or university	4
	High school graduate	3
	Junior high school graduate	2
	Elementary school graduate	1
	Less than 6 years of school	0
Income	$1724-2298 (1.5-2.0 mil. Korean *won*)	5
	$1149-1724 (1.0-1.5 mil. Korean *won*)	4
	$574-1149 (0.5-1.0 mil. Korean *won*)	3
	$287-574 (0.25-0.5 mil. Korean *won*)	2
	$114-287 (0.1-0.25 mil. Korean *won*)	1
	Less than $114 (<0.1 mi. Korean *won*)	0

Socioeconomic status was determined by scores on the above index:

1) Social Class I: Upper class, scores ranging from 12 to 15 points on the scale in Table 1.
2) Social Class II: Middle class, scores ranging from 9 to 11 points on the scale in Table 1.
3) Social Class III: Lower class, scores ranging from 0 to 8 points on the scale in Table 1.

Parent Attitude Variable Definition

Possessive: The possessive variable refers to a tendency on the part of the parent to "baby" the child, to overemphasize the affectional bonds between parent and child, to value highly the child's dependence on the parent, or to restrict the child's activities to those which can be carried on in his own family group.

Dominant: The dominant variable consists of items reflecting a tendency on the part of the parent to put the child in a subordinate role, to fully take him or her into account, but always as one who should conform completely to parental wishes under penalty of severe punishment.

Ignoring: The ignoring variable refers to a tendency on the part of the parent to disregard the child as an individual member of the family, to regard the "good" child as one who demands the least amount of parental time, and to disclaim responsibility for the child's behavior (Shoben, 1949).

CHAPTER II

REVIEW OF LITERATURE

The literature related to this study is divided into five component areas: (1) cross-cultural research in cognitive development; (2) age differences and conservation; (3) gender differences and conservation; (4) social classes and conservation; and (5) maternal attitudes and conservation.

Cross-Cultural Research in Cognitive Development

Piaget (1968) was very cautious in his interpretation of the first cross-cultural results. He warned that

> cross-cultural studies are difficult to carry out because they presuppose a good psychological training in the techniques of operational testing, namely with free conservation and not standardization in the manner of tests, and all psychologists do not have this training; a sufficient ethnological sophistication, and a complete knowledge of the language are also prerequisites. We know only a few attempts of this quality. (p. 99)

The growing fund of literature for cross-cultural studies of Piagetian tasks reflects a primary interest in testing the universality of Piaget's stages of cognitive development. A substantial amount of research in other countries has been completed which tests the universality of the Piagetian stages. Because cognitive development is supposedly logical and

inevitable, children in Europe, Africa, China or Australia should all undergo the same sequence despite any individual or cultural differences in rates of development. Piaget maintained that only the rate of acquisition might be influenced by the cultural surroundings, and not the order of acquisition. Dasen and Seagrim's (1971) inventory of existing cross-cultural research is perhaps the best demonstration of concern with Piaget's theory. LeVine (1970) suggested that both the critics of Piaget's theory and his supporters have embarked on testing various populations in order, respectively, to either refute Piaget's stage formulations or to demonstrate their universality. Whatever the ends of the researchers, children in nonindustrial societies have been found, on the whole, not only to score lower on traditional Western intelligence tests, but also to demonstrate a slower or even curtailed rate of development on Piagetian tasks (Bruner & Oliver, 1966; LeVine, 1970).

Piaget's findings have been supported by a number of replications in Western countries, such as those by Dodwell (1960), Almy, Chittenden, and Miller (1966), and Goldschmid (1967). For contrasting studies of other cultures, there is the work of Hyde (Lovell, 1966), involving children in Aden, that of Greenfield (1966) on Senegalese Wolof children, and that of Prince (1968) on subjects in the Territory of Papua and New Guinea. Heron (1974) provides a suitable summary for those studying non-Western cultures who have posed reservations regarding Piaget's stage theory:

> I find myself increasingly inclined to the view that the apparent unity of the [concrete operational] stage has been generated by the cognitively-relevant cultural homogeneity and development of the children serving as subjects in most European and North American studies.

Moreover, Heron and Dodwell (1974) maintained that "there seems a good case for not regarding the concrete operations stages as a formal unity: it may be more productive to view it as a set of structures without necessary interdependence" (p. 8).

The most detailed study of conservation in a non-Western culture (testing the concept of conservation of continuous quantities) was done by Greenfield (1966), using Wolof subjects from Senegal (at the time a part of French West Africa). Greenfield found that schooled Wolof children differed more on conservation tests from unschooled Wolof children than they did from European children. Additionally, several studies have found that European children do better on Piagetian tasks that do Australian Aborigines (De Lacey, 1971; De Lemos, 1969), but in these instances environmental differences played a significant role. Cole and Bruner (1971) emphasized the importance of the situation, i.e., its significance "for the person's ability to cope with life in his own milieu" (p. 874). Only a few cross-cultural studies (Dasen, 1974; Price-Williams, Gordon, & Ramirez, 1969) have tried to evaluate the significance of Piagetian tasks with respect to the particular milieu of a given sample.

However, not all cross-cultural studies have revealed similar contrasts in the levels of cognitive development. Lloyd's (1971) results among the Yoruba of Nigeria suggested that in some cases there may be minimal differences between two cultural groups. Using a modification of the methods used by Almy, Chittenden, and Miller (1966) to assess conservation of liquids and numbers, Lloyd studied Yoruba children ranging in age from three and one-half to eight years from both "elite" and traditional homes. He found no significant differences in performance between "elite" Yoruba subjects in Nigeria and the subjects studied by Almy et al.

in the United States. Lloyd's results also showed that while traditional Yoruba subjects performed significantly lower than children from the United States on conservation-of-number tasks, they scored significantly higher on conservation-of-liquid tasks.

The cross-cultural application of Piaget's tests has generated a tangled controversy due to the fact that Western children appear to undergo a more rapid cognitive development that their non-Western peers (Bruner, Oliver & Greenfield, 1966; Price-Williams et al., 1969). Participants in the controversy tend to fall into two groups: psychological universalists, who stress the subjective universality of human psychology, and cultural relativists, who emphasize the objective, cultural, and environmental variables in psychological development. Susan Buck-Morss (cited in Evans, 1968, pp. 75-83) spoke recently with psychologists in several African countries where Piaget's tests have been administered frequently to children of the first post-independence generations and where, with education a major issue of national policy, the controversy has an implicit political content. Yet, she found this content obscured by the fact that the ideological implications of the two professional postures were not unequivocal.

The psychological-universalist theory, which with certain qualifications was the posture adopted by Piaget (1966), assumes that a general theory of cognition is possible. This position appears to stand squarely opposed to ideologies of biological racism. However, it cannot account for the frequent chronological "lag" in test performances by non-Western samples and the fact that members of some cultures never attain certain levels of logical operations, at least not without implying another kind of ethnocentrism, namely the cultural superiority of the West. Cultural relativists, sensitive to this problem, point to a plethora of cultural variables

both within the tests (method of testing, equipment used, and language and translation) and among those tested (literacy level, child-rearing patterns, parental occupations) to claim that the test results are culturally biased.

Dasen (1972) suggested that these environmental and cultural influences lead to the following tentative hypotheses:

(1) Among certain groups, cognitive development in the skills of abstract thinking may be a priori impaired by these groups' exclusion from direct, conscious participation in the abstract levels of society. The child's imitation of parental models would function to perpetuate inequalities of cognitive development. Whereas, for the middle-class Western child or the children of the Third World urban elite, identification with parents and education in formal logic are mutually reinforcing experiences in socialization. This stands in contrast to the case of the out-groups, where satellization of parental models and the development of abstract cognitive competence leads in the opposite direction.

(2) Differences in cognitive style both reflects and perpetuates class distinctions within industrialized countries and reflects and perpetuates the dominance of urban elites in developing countries. To count on the socialization process as a self-regulating mechanism adjusting disparities between social and cognitive structures seems to be overly optimistic.

(3) Development of abstract cognitive skills among groups who presently lag behind demands socioeconomic and political reforms, as much as reforms in educational curriculum.

With respect to research standards, the implication of viewing Piaget's stress on abstract formalism as expressing a socioeconomic bias would suggest the importance of relating test results to the structure of the child's society and his or her place within it, as well as the child's cognitive grasp of that structure.

A number of the cross-cultural studies referred to above have based their conclusions at least in part on conservation tests. Others following this approach include studies among Canadian Indians, Eskimos and Whites (Vernon, 1965), Zambian (Heron & Simonsson, 1969), Yoruba (Lloyd, 1971), Lebanese (Zarour, 1971), and Arab, Indian, Somali, and European (Hyde, 1970) children. Finally, Furby (1971) has provided a theoretical framework for interpreting cross-cultural studies of conservation by distinguishing between manual and automated environments on the one hand, and empirical and magical types of reasoning on the other.

The most generally acceptable conclusion reached is that in many cultural settings, with the exception of hunting and gathering societies, attainment of the concrete operations is universal. While the majority of studies have been concerned with comparing the performance of Western and non-Western children on various Piagetian tasks, there has been relatively little attention to the particular problems which cultural diversity presents for psychological testing.

Age Differences and Conservation

In a study performed to investigate the development of the concept of conservation Piaget (1950) used two clay balls, equal in size, asking the subject whether the balls would still contain the same amount of clay if one of them was transformed into a sausage (a question of prediction).

One of the balls was then formed into a sausage and the subject was asked whether it and the other ball contained the same amount of clay (a question of judgment). Whatever the answer, the child was then asked "Why do you think so?" (a question of explanation).

Using such simple stimuli, Piaget concluded that there were relatively discrete age-bound levels of explanation, with older but not younger children manifesting conservation. He concluded that the type of conservation task (prediction, judgment, or explanation) did not appreciably alter the subjects' responses.

A number of experiments (Dodwell, 1962; Hood, 1962) have revealed age changes in concept formation similar to those found by Piaget. On the other hand, several of these studies (Dodwell, 1962; Lovell, Healy, & Rowland, 1962) have found that children's responses were more task specific than age specific. Elkind (1961a) dealt specifically with the concept of conservation, obtaining quantitative data supporting Piaget's basically qualitative material. He presented evidence showing that conservation increases with age and that there were no significant differences in response to the type of conservation task. However, Elkind, like many others, did not find the kind of age specificity that Piaget claimed. Furthermore, Elkind's conclusions regarding the equivalence of responses involving prediction, judgment, and explanation were based on an analysis of variance of the responses of 5 to 12-year old subjects. Since all age groups were combined in his analysis, it may be that the type of conservation task is an important variable at certain ages, but not at others. The research accomplished to date suggests that there is an age increase in conservation responses, but it does not support the notion that the attainment of conservation, such as that of mass, occurs only at a certain age

or is uniform between problems for a given subject. Across a wide age range, the type of conservation task does not influence results; however, it may at some age levels.

It is generally agreed that the most complete and systematic theory of cognitive development has been proposed by Piaget. In Piaget's (1950) presentation, a central role was assigned to the child's conceptualization of the principle of "conservation," i.e., the realization that a particular dimension of an object may remain invariant under changes in other irrelevant aspects of the situation. Although the concepts of the conservation of quantity and number have been extensively investigated, studies have generally been limited to children four years of age or older, with most studies dealing with children not younger than age five (Flavell, 1963; Mehler & Bever, 1967).

The primary reason for the exclusion of the younger ages appears to be that Piaget (1952) had concluded that the conservation of number and quantity was not usually present until the ages of six or seven; therefore, nearly all four-year olds were in the earliest stages of conservation. These conclusions, as well as more recent findings (Elkind, 1961a; Rothenberg, 1969; Wohlwill & Lowe, 1962), have continued to suggest that conservation is not commonly present until at least the age of six.

Piaget (1952) considered compensation to be a necessary condition for conservation. Cohen (1967) found that children as young as age four or five could anticipate the levels to which liquid would rise when poured into a container of different circumference. Piaget and Inhelder (1969) found that only five percent of the subjects tested conserved without also passing the anticipation-of-levels task. Halford (1970), in a series of studies, found that conservation subjects were superior to nonconservation

subjects in recognizing equal and unequal quantities in containers of varying dimensions and judging when changes in one dimension compensated for changes in another. Both conservation and nonconservation subjects over the age of five had developed at least a partial classification system corresponding to conjunctions of height and breadth.

Piaget (1952) theorized that reasoning became operational only around the age of seven, insofar as it included knowledge of the characteristics of logical and mathematical operations. Although such early operational reasoning is limited to concrete operations, it nevertheless is dependent upon the availability of invariant concepts or conservation. The most general of these concepts are the ideas of number, space, time, substance, weight, and volume. Prior to attaining operational reasoning, children evaluate such quantities by relying almost exclusively on their perceptual appearances. Procedures such as measuring, weighing, and enumerating are not used because children under the age of seven are not convinced that length, weight, and number remain invariant through every rearrangement of an object. Therefore, the study of logical thinking must examine the attainment of invariant concepts and the point at which children begin to recognize them as self-evident.

Much more comprehensive evidence in support of the concept that specific training cannot substitute for age-linked general experience has been derived from numerous experiments designed to teach conservation of mass, weight, or numbers to young children (Sigel & Hooper, 1968). These studies have suggested that the direct teaching of conservation through verbal instruction and reinforcement or through provision of observations of conservation examples does not lead to the formation of a gen-

eral or stable concept of conservation. In effect, little change is induced by the use of such methods.

Moreover, if specific experimental teaching seems to have only limited value in the attainment of conservation concepts, formal and general schooling appears to exercise no influence at all upon conservation. The conservation of numbers, mass, weight, and volume appears at the same age in schooled and unschooled subjects when other relevant variables are controlled. The most definitive study of this question is that of Mermelstein (1964), who compared the conservation responses on a number of tasks of six and nine-year old Black children in Prince Edward County who had been deprived of schooling with northern urban Black children who had attended school. No significant differences were found between the two groups.

An equally careful study by Goodnow and Bethon (1966) indicated no differences between unschooled children and schooled children of comparable IQ in Hong Kong on various types of conservation tasks. Kohlberg (1968) hypothesized that Montessori schooling for young children might accelerate conservation and transivity insofar as Montessori training tasks are directed at sensorimotor experiences of quantitative measurement and comparison. While Montessori schooling, over a period of nine months, did raise Standford-Binet IQ scores significantly, it failed to demonstrate any significant effect upon Piagetian conservation tasks.

According to Piaget (1952), the attainment of conservation of numbers, which is the ability to recognize that the number of objects in a group remains constant despite changes in the spatial arrangement of the objects, represents a significant advance in the intellectual development of a child. Subsequent investigation (Dodwell, 1960) indicated that children do

not demonstrate the conservation of numbers until the age of six or seven. This study is a further effort to clarify the theory of sequence development, based upon the Piagetian position that conservation is age-related and that at every age level older children will perform better than their younger peers.

Gender Differences and Conservation

Piaget's contention that gender differences are insignificant in conservation tasks has been substantiated by several studies (Almy et al., 1966; Braine, 1959). However, others studies have produced evidence to the contrary (Goldschmid, 1967; Sweetland, 1969). Conservation has also been examined with gender as the variable to determine whether there is significant difference in the intellectual ability of male and female subjects. Increasingly, studies among Western cultural groups have shown no significant differences in the academic or general cognitive performances of subjects of either gender (Almy et al., 1966; Dodwell, 1961; Singh, 1970). However, a more recent study by Brekke and Williams (1973) indicated that sex differences may be related to the conservation of substance. Goldschmid's (1967) examination of the relation of gender to types of conservation indicated that boys performed at a higher level than girls on all tested conservation tasks, including substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two and three-dimensional space.

Studies in developing countries have shown more profound gender differences in human cognitive skills. Etuk (1967), who used a standardized interview schedule based on Piaget's tasks, investigated the development of number concepts among Yoruba-speaking children of Nigeria and

concluded that boys surpassed girls at six and seven years of age, while girls tended to catch up at a later age. In another study, Uka (1962) examined the variations that occur within age, social status, and gender groups in the development of the concept of time among Ibo-speakers in Nigeria. Of the total of 202 pupils, between the ages of 6 and 12, participating in the study, he found that boys mastered the concepts of conservation of time earlier than did girls. Consequently, the most prevalent explanation for the instances of observed superior performance of boys over girls has been of a cultural nature.

Figurelli and Keller (1972) studied the effects of training and socioeconomic class on the acquisition of conservation concepts by Black American children. In the end they "admitted" that they had to give homogeneous statistical treatment to the scores of both boys and girls because they found a non-significant effect for the gender variable. However, Furth (1966) tested concepts of conservation of weight among eight-year old deaf children and found no significant gender differences, whereas there was considerable gender difference in the conservation performance of children with no hearing problems.

The study by Elkind (1961a), described in the section on age differences, reported a gender difference in the attainment of the volume concept among college students, with men performing at higher levels than women. Graves (1972), in a study of marginally educated adults, reported gender differences in favor of males in the acquisition of the concept of volume. In Hobbs' (1973) study of adolescents, it was reported that in all grades above 7 that boys performed at higher levels of volume conservation than did girls. Of students in grade 7, 60 percent of the boys comprehended the displacement law, while only 30 percent of the girls demon-

strated the same ability. By grade 12 nearly all of the boys had demonstrated understanding of the law, but the percentage of girls had reached only 50 percent.

The gender of the experimenter as a variable in Piagetian conservation assessment was examined by Parish and Wheatley (1973) in second grade subjects, who were administered length conservation tasks. All responses were recorded verbatim and the results of contingency table analysis of observed frequencies suggested that there are significantly more operational conservers under female test administration than under male test administration. Further analysis revealed no significant differences in the number of operational conservers for male and female subjects with either male or female examiners. The gender of the experimenter, therefore, does appear to be an important factor in conservation assessment at lower elementary levels.

The history, language, social traditions, and political environment of Korea has been hypothesized to yield different conceptual consequences. The traditional family system stresses conformity and respect behaviors according to a gender and age-grade hierarchy. The gender of a child as it relates to family name and lineage is consciously or unconsciously included in the parental appraisal of each child. From the moment of birth, Korean boys and Korean girls are perceived differently by parents (Choi, 1966). Girls are pressured to be nurturing, obedient, responsible, kind, well-mannered, quiet, and later to marry well and to raise children; boys are encouraged to be self-reliant, ambitious, willful and successful, to continue the family lineage, and to support their parents.

Social Class and Conservation

Views on the nature of intellectual development have changed considerably over the past 20 years. The studies of Skeels (Skeels, 1966; Skeels, Updegraff, Wellman, & Williams, 1938) on the effects of different institutional settings on IQ offered one of the first empirical challenges to the concept that intelligence was fixed by genetic factors. At present it is generally accepted that experience is crucial in shaping cognitive development and concern for children from deprived backgrounds stresses this factor. As Hess and Shipman (1965) have stated, "the outcome is well known: children from deprived backgrounds score well below middle class children in standard individual and group measures of intelligence (a gap which increases with age)" (pp. 869-876).

Intellectual performance has been shown to be highly correlated with social class. The study of environmental factors relating to decline in intellectual functions strongly implicates social status (Schaie, 1979). Individuals of high social status tend to be in good health and to be engaged substantially in a supportive environment: They thus tend to maintain intellectual competence. In previous studies, however, when such factors as birth complications and poor nutrition and health were excluded, social class differences in cognitive development were not found until the third year of life, when language becomes increasingly important for learning (Bayley, 1965; Hindley, 1960).

More recently, Malone (1963) and Pavenstedt (1965) have reported striking differences in cognitive and personality function between older preschool children from stable, low-income families and those from impoverished, socially disorganized families. The authors attributed this to

gross differences in the child-rearing environment. While the children from the low-income families were able to benefit from preschool enrichment programs, those from disorganized families already manifested serious learning problems by the time they entered nursery school at three years of age.

For many years the central theoretical issues in this field have dealt with the origin of these effects, argued in terms of the relative contribution of genetic as compared to environmental factors. Current interest in the effects of cultural deprivation tends to ignore this debate, focusing upon the more basic problem of understanding how cultural experience is translated into cognitive behavior and academic achievement.

In this study socioeconomic class was included as a variable because of the relative paucity of research in this area in Piagetian studies. Almy et al. (1966), in a series of studies, found the attainment of a number of conservation concepts occurred at a later age among children of the lower socioeconomic classes. Keller (1971) also measured a variety of conservation concepts and found significant socioeconomic class differences only with respect to children's understanding of rational terms and their explanation. Rothenberg (1969) found socioeconomic class differences, but she also found that training on the conservation of number to be effective among both lower and middle class children. Gaudia (1972) investigated conservation concepts in primary-grade children from different racial and social backgrounds. He found significant differences in the rate of acquisition of conservation concepts favoring children from more advantaged social backgrounds.

Typical findings in studies of disadvantaged children support the contention that children from lower socioeconomic classes perform poorly

on intelligence tests. Generally, studies of standardized test performance and social class status lead to what Stodolsky and Lesser (1967) have called a "deficit or less-than model" (p. 547). The current view of cognitive development thus holds that early experience has a cumulative effect and, in the absence of intervention, that the gap between the privileged and underprivileged increases.

Maternal Attitudes and Conservation

Evidence for early learning defects in children and the "cumulative deficit" (decline in IQ scores) resulting from deprived environments has been extensively reviewed by Bloom (1964) and several others (Bayley, 1965; Yarrow, 1964). Largely through the study of intellectual growth of separately raised twins, children separated from their parents in early childhood by adoption, and the effects of environmental deprivation in childhood, there has been mounting evidence pointing at the influence of early environment in shaping later cognitive abilities.

Individual differences in cognitive development are considered the result of interactions between a child's life experiences and his or her genetic endowment. A relationship has been found between cognitive ability and perceptual and cognitive style, on one side, and personality traits on the other, and some investigators have attempted to identify antecedent conditions in the home which might be responsible for children's personality as well as cognitive development. Thus, "democratic homes," "maternal acceleration," and a "warm, positive family atmosphere" have been reported to increase the rate of children's intelligence, especially their verbal ability. Results of investigation of the effect of institutionalization and prolonged hospitalization of infants, summarized by McCarthy (1954), uni-

formly indicate retardation in language development. On the other hand, there has been suggestive evidence that certain conditions disproportionately favor the development of verbal ability and possibly impede the development of nonverbal skills, such as numerical and spatial ability. Suggested antecedents for such differential development in favor of verbal ability were "growth restricting" child-rearing practices, such as excessive parental controls and overlimitation, "maternal overprotection," "emphasis on verbal accomplishments," and exercise of a demanding discipline with emphasis on academic achievement. Similarly, overanxious discipline and tense parent-child relationships were postulated to be responsible for low nonverbal abilities, particularly spatial relationships, in children.

The influence of the mother's pattern of interaction and communication with the child appears to play a pivotal role in developing cognitive skills levels, as evidenced in the work of Hess (1965). Utilizing an observational situation, Hess is presently conducting a series of studies of preschool children that require mother-child interaction in a problem-solving situation. His focus is on the manner in which the mother assists the child in solving problems and the nature of the "cognitive environment" which she provides. Results indicate that when mothers provide "restrictive language codes" (i.e., language providing a smaller number of alternatives for action, fewer choices to be made, and fewer possibilities for thought), the child's problem-solving abilities are diminished.

The role of specific maternal attitudes in the development of children's information processing skills was taken a step further by Hamilton (1971), who presented evidence that children of rejecting mothers showed a lower level of operational conservation than did children of accepting mothers. The children of the former also demonstrated conservation skill

limitations when a stress factor (maternal participation) was present during a conservation task.

Modgil's (1969) study attempted to determine the nature of empirical links among the cognitive, affective, and environmental factors in children's development. More specifically, Modgil tested the hypothesis that there is a positive relationship between emotional and social order in a child's life and the child's development of invariance concepts. The results indicated that emotional stability and social "order" have a facilitative effect on cognitive functioning. Furthermore, children who tended to score high on conservation tasks tended to possess parents with fewer dominating and ignoring attitudes. Over and above the association of low conservation with unfavorable parental attitudes, there is a specific association with high dominance: a finding also reported by Goldschmid (1968), using a different experimental design.

Thus, the mother or caretaker who is a primary source for a large part of early experience, is also potentially important for intellectual development. A mother's love is regarded as essential in healthy emotional development and extreme deprivation of such affection in early life might result in emotional problems which interfere with or prevent normal intellectual development. Therefore, this study is based upon agreement with Modgil (1969) and Goldschmid (1968), that a child's cognitive development will be significantly related to possessive maternal attitudes more than to dominant or ignoring maternal attitudes toward children.

Summary

This chapter has reviewed some basic aspects of Piaget's theory and placed them in a cross-cultural context. Specifically, the relevance of

different research approaches and the use of several independent variables to cross-cultural research was reviewed.

Age is perhaps the most obvious and widely acknowledged source of variation in children's conservation responses. Comparative studies of the ages at which logical thinking is acquired in various cultures could provide evidence concerning the role of maturation in cognitive development. If the ages of acquisition and stage transition in other cultures correspond to age norms in Western cultures, it would appear that maturation is a predominant influence in the determination of mental development. Conversely, if age trends vary across cultures, the importance of environmental influence as a determinant of mental development would be indicated and the task would then be to identify the environmental factors which account for differences in cognitive development.

Gender differences in cognitive development have not been shown in Western studies; however, studies in developing countries have indicated marked gender differences. In addition, cognitive performance has been shown to be highly correlated with social class and the quality or extent of a maternal behavior control system can interfere with the equilibration process in various and subtle ways. The result may be a child with clear cognitive deficiencies which are not directly explainable on the basis of his or her biological apparatus or his or her physical environment.

This review of the literature shows general agreement with Piaget's sequential theory of cognitive development among Western subjects. However, studies of non-Western cultures have, on the other hand, shown that the procedures, past and present, have enhanced the theory, contributing to the concept of development as a constructive process occurring through interaction with the environment. The speed of development of

cognitive processes seems to vary between different cultural and social environments and may be related to certain specific factors, the nature of which are still unknown. In a word, additional effort needs to be expended on research in cross-cultural cognition.

CHAPTER III. METHOD AND TREATMENT OF DATA

This chapter describes the subjects of this study, the two testing instruments used to furnish data for analyses, and the testing procedures, as well as the statistical procedures employed to implement the four major objectives of the study presented in Chapter I.

The Sample

The subjects for this study consisted of 200 Korean kindergarten children and their mothers from Seoul, Korea. In Korea it is generally accepted that fathers are responsible for earning the family living and mothers are in charge of housekeeping and child rearing. For this study, the mothers were selected because of the assumption that they have a greater opportunity to influence their children.

The mothers of 200 children from Chung-Ang University Kindergarten and 175 children from Sin Rim Kindergarten in Seoul were asked to respond to the Parent Attitude Survey included in Appendix A. The Parent Attitude Survey was sent to mothers through their children, who were asked to deliver the survey to their mothers and return the completed survey to their teachers. The mothers of 118 children from the Chung-Ang University Kindergarten and the mothers of 105 children from the Shin Rim Kindergarten responded. Subject selection was limited to children whose mothers submitted completed responses to the questionnaire and three and five of the responses, respectively, were eliminated from the two schools due to their incomplete nature. To balance the sample an

additional 15 responses by mothers of children from Chung-Ang University Kindergarten were eliminated by a random process, leaving the total sample at 100 subjects from each of the two schools, or a total of 200.

Chung-Ang University Kindergarten, designated herein as an upper-class school, is located in Huk Suk Dong, Seoul. Fathers of children in this kindergarten have an average monthly income of $1156 (1,006,000 Korean *won*) and 96 percent of the children have a father who is a university graduate or who has had professional training. The remaining 4 percent of the children have a father who is a high school graduate.

Shin Rim Kindergarten, designated herein as a lower-class school, is located in Shin Rim Dong, Seoul. Fathers of children in this kindergarten have an average monthly income of $342 (297,700 Korean *won*) and only 5 percent of the children have a father who is a university graduate. Of the remainder of the children, 40 percent have a father who is a high school graduate and 15 percent have a father who is an elementary school graduate. The remainder of the children have parents without formal education or professional training.

An additional Personal Information Questionnaire (Appendix A) was attached to the Parent Attitude Survey. This information from the families of the 200 subjects was used to determine the social class standing of each family. Due to cultural differences from Western models, a social class index was utilized for the determination process (Yoo, 1981) and three factors were used to determine the social position of an individual head of household or of a household as follows: (1) the precise occupational role of the head of the household; (2) the amount of monthly income of the household; and (3) the amount of formal schooling the head of the household had achieved. Each of these factors was scaled and weighted to

provide a single score, which was then used to assign a family to one of three social classes as indicated in the "definitions" section of Chapter I.

In every accepted sample in both schools the parent used to determine income level was the male head of household. The average monthly income was $1,724 (1,500,000 Korean *won*) for the upper class families and $276 (240,000 Korea *won*) for the lower class families (more than 75 percent of the latter families had a monthly income less than $344 (300,000 Korean *won*).

The children in the sample were drawn from families in which the fathers engaged in the following occupational classifications: higher executives, business managers, administrative personnel, skilled manual laborers, machine operators and semi-skilled laborers, or currently unemployed. The educational scale was divided into 6 positions: graduate professional training; standard college or university graduate; high school graduates; junior high school graduates; elementary graduates; and those with less than 6 years of schooling. Children from low-income backgrounds came from families in which the wage earners were semi-skilled workers, unskilled workers, or unemployed, whereas 55 percent of the children from the higher income families had a father engaged in professional, technical, or managerial work; 37 percent had a father engaged in business or skilled occupations; 8 percent had a father involved in semi-skilled work; and the fathers of the balance of the children were occupied in clerical or service work.

The ages of the children in the sample ranged from four years, two months, to six years, eight months, with a mean age of five years, seven months. The sample was composed of 109 boys (55 percent, mean

age: 66 months, 28 days) and 91 girls (45 percent, mean age: 67 months, 5 days).

The percentages of subjects designated by the maternal attitude variable were as follows: possessive attitude, 46.5 percent; dominant attitude, 31 percent; ignoring attitude, 22.5 percent. The percentages of subjects designated by socioeconomic classes were as follows: social class I, 30 percent; social class II, 32 percent; and social class III, 38 percent. With respect to age, 61 percent of the subjects were less than 72 months old and 39 percent were 72 or more months old. The specific distributions of the sample by age, sex, socioeconomic class, and parent attitude may be found in Appendix B.

The research setting was in Seoul, Korea. Korea is a peninsula thrusting from the northeast Asian mainland in a southerly direction for about 1,000 km. The shortest distance between Korea and Japan is 206 km and it is about 190 km to the Shantung Peninsula in China to the west. The area of the peninsula is 221,325 sq km (about 86,000 sq mi). At present the land is divided into the People's Republic of Korea in the north and the Republic of Korea in the south. The Republic of Korea effectively administers an area of 98,992 sq km, or about 45 percent of the peninsula. In 1980 the population of the Republic of Korea was 37,449,000, with a population density of 378 persons per square kilometer. Rapid economic growth and industrialization have accelerated urbanization in Korea.

Seoul is the capital of the Republic of Korea. Its population has increased about 5.6 times during the last 32 years, from 1.5 million in 1949 to 8.4 million in 1980. The urban landscape has also changed, particularly since the late 1960s. Prior to 1960 no buildings of more than 10 stories existed in Seoul, but by the early 1970s dozens of buildings with more than

20 stories had begun to appear in the business district of Seoul. Consequently, the streets have been widened and freeways and subways have been constructed. Seoul has always been the center of educational opportunity in Korea, a place that aspiring people look to for professional preparation and leadership.

Variables

Age, gender, social class position, and maternal attitude are the independent variables, based on the assumption, as stated in the hypotheses, that these variables are related to the acquisition of conservation skills. The conservation scores of substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space are the dependent variables, based upon the assumption that these variables have a relationship to the individual levels of conservation concept maturity.

Instruments

The instruments used in this study were the Conservation Concept Diagnostic Kit (Goldschmid & Bentler, 1968b) and the University of Southern California Parent Attitude Survey (Shoben, 1949). The Conservation Concept Diagnostic Kit was used to measure the conservation of the children and the Parent Attitude Survey was used to measure maternal attitudes. Both documents were translated from English into the Korean language. The following procedure was used to check the translation. Four Korean professors, each of whom had earned a Ph.D. in either Early Childhood Education or Psychology from institutions in the United States, independently monitored the English-Korean translation. Final approval of

the instrument items in the translations was jointly determined at a conference of the four professors.

The Conservation Concept Diagnostic Kit

The Goldschmid and Bentler (1968b) Concept Assessment Kit--Conservation measures nine conservation areas: substance, weight, continuous quantity, discontinuous quantity, number, distance, area, length, and two-dimensional space. The extent to which the items within each task successfully measured that conservation area was determined by reference to the Kuder-Richardson 20 internal consistency reliability coefficients in Goldschmid and Bentler's study. The Loevinger index of homogeneity for the items in a task was calculated to determine the extent to which the items formed an ordinal scale. A matrix coefficient of homogeneity was also calculated.

The homogeneity of the three scales was maintained on cross-validation with a new sample. The Bentler indices, for example, were .97 for the combined behavior and explanation items of the conservation tests. The same holds true for the high Kuder-Richardson 20 internal consistency reliabilities, which for the same conservation tests were .95. It is clear that all three scales are highly homogeneous and demonstrate high internal consistency.

Validity studies which have employed the scales in the Conservation Diagnostic Kit were correlated with traditional indices of intelligence. In a sample of 102 first and second graders the correlations between conservation on one hand, and mental age, IQ, and WISC vocabulary on the other, were .49, 31, and .40, respectively (Goldschmid, 1967). The nine test areas and the types of transformations are summarized below.

1) Substance. After the child had agreed that two dough balls contained the same amount of dough, one of the balls was transformed into the following shapes: a hot dog, a pancake, and then little balls of approximately the same size. For the Korean children *bindedug* was substituted for the pancake and a snake for the hotdog. The child was instructed to compare the transformed ball with the original ball and in each case estimate the relative amount of dough contained in the two balls.

2) Weight. A procedure similar to the substance task was used, except that the child had to judge the relative weights of the two balls.

3) Continuous quantity. Two identical beakers were first filled with an equal amount of water and the child was asked to compare the quantity of water in the glasses. Water was then added to one beaker, equalized again, and successively poured into containers of the following shapes: a tall and thin glass, a flat and extended glass, and five small glasses. After each manipulation, the child was asked to compare the amount of water in the original beaker with the amount of water in the other beaker.

4) Discontinuous quantity. The procedure employed in the previous task was used, except that corn grains were used in place of water.

5) Number. In the "provoked or natural correspondence" experiment six eggs and six egg cups were lined up. The child was asked to put the eggs into the cups, thereby establishing that there were an equal number of cups and eggs. The eggs were then bunched together and the cups separated widely from each other. The child was asked to compare the number of eggs and cups.

In the "unprovoked correspondence" experiment, six red chips were lined up parallel to six white chips. Once the child had confirmed that

there were an equal number of red and white chips, the red chips were bunched together and the white chips were separated. The child was then asked to compare the number of white and red chips.

In a third variation of the number experiment, the child was asked to pick up 12 beads, 2 at a time (1 with each hand), and drop them simultaneously into two identical beakers for a total of 6 beads in each. Having compared the number of beads in each glass, the child was next told to pour the beads from 1 of the standard glasses into a tall thin glass. After another comparison of the number of beads in the two glasses, the child was then asked to pick up 12 beads, 1 at a time with each hand, and to drop them into 2 differently shaped glasses, the tall thin one and the standard beaker.

6) Area. Two identical green boards (10 × 15 × .05 in) were presented to the child. A cow (1 in tall by 1.5 in long) was then placed in the center of each board. After the child had confirmed that both cows had the same amount of grass to eat, she was told that a farmer wanted to build a barn on each field. A barn (1 in tall by 1.5 in long) was placed on each field and the child had to compare the amount of grass available to the two cows. One, four, and six barns were added successively to each field; on one field the barns were bunched together (in one corner, next to each other) and on the other they were spread out over the entire board. After each addition of barns, the child was asked whether the cows in the two fields had the same amount of grass to eat.

7) Distance. The child was shown two car tracks which were painted on a board; one track formed a straight line (A——————B) and the other was segmented at right angles (A⌐¬⌐¬B). The latter line, while much longer, represented the same distance from A to B as the

first track. The experimenter then moved one car on the first track over two segments and the child was asked to move his car on the second track a distance equal to that travelled by the first car. This procedure was repeated by varying the number of segments covered by the experimenter's car.

In another variation of the distance experiment, 2 toy figures were placed on the table about 25 inches apart. The child was asked whether the dolls were "near each other" or "far apart." A thin screen was then placed between the two figures and the child was asked to compare the distance between the dolls with their previous distance from each other. Finally, a thin screen was again placed between the two figures, but this time a little "window" was cut out at the bottom of the screen (in order that the dolls were visible from either side) and the same question was repeated.

8) Length. Two sticks of identical length were laid side by side so that their extremities corresponded. After the sticks were matched, the red stick was moved to the right by one inch. The sticks were then again placed parallel to each other. After the child confirmed that they were of equal length, one of the two sticks was moved by an inch so that its leading end was to the right of the other stick. The child was once again asked if they were of identical length. After matching the sticks once more, one of them was placed between two Mueller-Lyer illusion arrowheads (90 degrees, with ends 2 in long).

9) Two-dimensional space. There were 32 small square pieces of wood placed on a table and forming two large squares of 16 pieces each. The child was asked to confirm that the 2 squares contained the same number of blocks. The experimenter then successively changed 1 of the

squares into an elongated rectangle (2 rows of 8, a pyramid (with a base of 5 pieces and successive levels of 4, 3, 2, and 1), and a long single string of blocks (16 pieces). After each manipulation, the child had to compare the number of blocks in the transformed figure to the number in the original square.

University of Southern California Parent Attitude Survey

The U.S.C. Parent Attitude Survey is an inventory-type test of parent attitudes toward their children. It is a self-inventory scale designed to assess parent attitudes with respect to the behaviors of their children. For the original instrument a pool of 148 items was formed and administered to a group of 50 mothers of problem children and to 50 mothers of non-problem children. On the basis of this preliminary administration, the items were analyzed for significance by the chi-square method and the 85 items which differentiated between groups at the five percent level of confidence or better were retained. Subscales were then extracted by five expert judges who classified the items according to the categories "dominant," "possessive," and "ignoring." The Parent Attitude score was derived from this survey.

Subscales for the Parent Attitude Survey were extracted by having parents express either of four degrees of agreement (strongly agree, mildly agree, mildly disagree, strongly disagree) with the statements included in the survey (see Appendix A). The reliability of the survey was determined by the split-half method, raised by the Spearman-Brown formula: Total scale, .95; Dominant, .91; Possessive, .90; Ignoring, .84. The reliability values are all of sufficient magnitude to permit the interpretation of a high degree of consistency in the survey.

The validity coefficients were computed for the original group and a new group of 20 mothers of problem children and 20 mothers of non-problem children. The validities on the new group were as follows: Total scale, .769; Dominant, .623; Possessive, .721; and Ignoring, .624. This means that roughly half the variance in the criterion of child adjustment may be predicted from the attitude scores (Shoben, 1949).

Due to cultural differences, 10 items were eliminated based on agreement between the four Korean professors. For example: "The shy child is worse off than the one who masturbates." In Korea, the shy child is considered as a good child. Test-retest reliability for the Korean translation of the 71-item U.S.C. Parent Attitude Survey was established for Korean mothers.

Analysis Procedures

The conservation tasks (as specified in the Conservation Concept Diagnostic Kit Form, as devised by Goldschmid and Bentler, 1968b, and subsequently modified for use in this study) and the U.S.C. Parent Attitude Survey, with accompanying socioeconomic questionnaire, were administered in April, 1986, to all Korean kindergarten children (and their families) in the Chung-Ang University Kindergarten and the Shin Rim Kindergarten in Seoul, Korea. Each subject was individually administered all of the conservation tasks in a private room at his or her kindergarten and the testing was completed during May and April, 1986.

Examiners Training

The examiners were two Korean female students of advanced standing, both of whom were majors in Early Childhood Education at Chung Ang

University in Seoul. To eliminate possible contaminating effects of examiners' expectations or bias, no information regarding either age or social class was given to the examiners prior to testing the subjects. Examiners were trained in the administration of the conservation tasks and conducted all of the testing sessions as follows:

1) Rapport. Before the testing has begun, it is essential for the examiner to establish rapport with the child. The test is best introduced by a statement, such as "Hi (name of subject), I am (name of examiner). We are going to play some games together, OK?" During the test administration the examiner should assure that the child listens to the instructions and pays attention to the test material. It is important that the examiner adapts the administration of the test to the child's speed.

2) Manipulation of test materials. In order to familiarize the examiner with the proper test procedures, the examiner was administered the test in several practice sessions. Though the manipulations are simple, the examiner was asked to pay careful attention to the instructions. On all scored items the specified equality of the two objects must be established before the manipulation and care should be exercised not to lose or spill any of the materials during the manipulation. This problem arises, for example, in items requiring the pouring of corn or water. Only the materials being manipulated by the examiner should be on the table in front of the child at any given moment.

3) Questions and explanations. The verbal instructions were formulated to correspond to the vocabulary level of children four years of age and older. If children ask for clarification or do not respond to a question, the examiner may repeat but not rephrase the instructions, with only one exception. If the child does not respond to the question "why?"

the examiner may ask "what makes you say that . . ." (they are the same; this one is larger; etc.).

4) Pointing. The examiner should coordinate gestures with statements so that the child's attention is directed to all of the objects she is talking about.

5) Recording. After the examiner has checked off the conservation behavior in the appropriate box, the child's response to the question "why?" should be recorded verbatim. Any explanatory gestures by the child should also be carefully noted.

Scoring

The child's judgment of conservation or nonconservation and the explanation of his response were scored separately (see Appendix C). The two judges, each rating the subjects' explanation responses independently, achieved agreement in 97.5 percent of the cases in a pilot sampling of 200 responses, indicating that interobserver reliability was sufficiently high to warrant proceeding with classification of the remainder of the childrens' responses to the 9 conservation tasks. Scores on the remaining 2.5 percent were determined by the two judges in conference. The mean experimental time for each subject was approximately 45 minutes.

For each area the subject was first asked to recognize that two objects were equivalent along the tested dimension (e.g., weight or number), then he or she was asked to offer a judgment on their equivalence after an object had been modified or transformed. The subject was then asked to explain why the two objects were equal or unequal. The materials used for each test area and the nature and stages of their transformation are included in the scoring sheets in Appendix C.

The following test scoring methods were used for each child examined:

1) Behavior scores: Two points were given for each correct response on the comparisons; zero points were assigned for incorrect responses.

2) Explanation scores: Two points were given for an abstract conceptual response (e.g., "nothing was added to or subtracted from" the substance of the object); one point was scored when the subjects gave a "perceptual" response (e.g., "it looks like they are the same"); zero points were given for "magical" answers (e.g., "my teacher told me so" or "I don't know") or when no explanation was given.

Thus, there was a possibility of 12 points for the each test and 108 points for the total examination on 9 areas.

The Parent Attitude score was determined from the U.S.C. Parent Attitude scale. The score was weighted according to the differential contribution to discrimination of each of the three categories. The check on the usefulness of these categories was made by determining their independence by calculating the degree to which the obtained scores were correlated. Determined categories intercorrelations were as follows:

1) Possessive mother attitude ($r = .88$): dominant ($r = .38$), ignoring ($r = .20$);

2) Dominant mother attitude ($r = .86$): possessive ($r = .40$), ignoring ($r = .31$); and

3) Ignoring mother attitude ($r = .80$): possessive ($r = .34$), dominant ($r = .26$).

Treatment of the Data

The statistical analyses related to the proposed hypotheses were calculated on the Oregon State University CDC Cyber 170/720 computer, using the *Statistical Package for Social Science* (SPSSX) program. A univariate analysis of variance for each test was calculated for the principle factors of age, gender, social class, and maternal attitude. The F-statistic was used in testing each general hypothesis and data were analyzed to determine if conservation task scores were related to age, gender, social class, and maternal attitude. The a priori hypotheses set forth for the interactive effects of age, gender, social class, and maternal attitude on conservation tasks were tested with a multivariate analysis of variance (MANOVA). In order to control for possible statistical dependencies among the nine dependent variables, data were analyzed using a 2 (age: below 6, 6 and above) × 2 (gender: male, female) × 3 (social class: upper, middle, low) × 3 (maternal attitude: possessive, dominant, ignoring) MANOVA.

The .05 level of confidence and .01 level of confidence were used as the criterion of significance. If F was found to be in the critical region when testing the hypotheses, then a multiple comparison test was used to determine where significant differences existed for the means. The Student's Newman-Keuls were calculated at the .05 level.

CHAPTER IV

RESULTS

Analysis of Data

This study was conducted and the results analyzed to provide data about the cognitive development of Korean kindergarten children and its relationship to age, gender, social class, and maternal attitude. In this chapter the statistical findings of this investigation are presented, with the data tabulated and analyzed from the perspective of the following four objectives:

1) To compare age difference in the ability of five to six-year old children in performance of conservation tasks measuring substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space;
2) To determine if there are significant differences between the performance of boys and girls on the conservation tasks;
3) To determine if there are significant differences between three socioeconomic groups on the conservation tasks; and
4) To compare the performance differences in the abilities of children with different parental attitudes on conservation tasks.

The hypotheses set forth for the effects of age, gender, social class, and maternal attitude on conservation tasks were tested with a mul-

tivariate analysis of variance (MANOVA) procedure. In order to control for possible statistical dependencies among the nine dependent variables, data were analyzed using a 2 (age: below 6, 6 or more) × 2 (gender: male, female) × 3 (social class: upper, middle, low) × 3 (maternal attitude: possessive, dominant, ignoring) MANOVA. Multiple comparisons were calculated at the .05 level, using the Student's Newman-Keuls procedure. The hypotheses presented in Chapter I were tested at both one and five percent levels of confidence.

Testing the Hypotheses

Where the MANOVA procedure was used in this study, it was necessary to test for the interaction effects before the main effects could be properly analyzed.

Interactive Effects

H^5: There is no significant interaction effect between age and gender on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained between age and gender (Wilks' $\lambda = .93$, $F = 0.90$, $P < .534$) and the hypothesis was retained. Results given in Tables 11 through 21 (Appendix D) show that the F value did not reach the .05 level of significance. The conservation of the nine tasks appeared to have no interactive effect between age and gender.

H^6: There is no significant interaction effect between age and social class on each of the substance, weight, continuous quan-

tity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were obtained for between age and social class (Wilks' λ = .17, F = 1.83, $P < .01$). The results showed a significant interaction effect between age and social class, as may be seen in Tables 11 through 21 (Appendix D). In the univariate F tests, four of the nine variables, weight (F = 3.13, $P < .05$), number (F = 3.58, $P < .05$), area (F = 4.13, $P < .05$), and two-dimensional space (F = 3.81, $P < .05$), showed a significant interaction effect and the hypothesis was rejected. Additionally, a significant mulivariate effect was indicated between age and social class for the conseration of behavior and explanation. A multiple comparison on the effect between age and social class was not significant for their mean differnces on the conservation of weight. However, significant mean differences were indicated between older and younger children in social class III for the conservation of number, area, and two-dimensional space (see Appendix D, Table 22). In social class III, children six or more years of age had significantly higher mean scores than did the younger children on these conservation tasks.

H': There is no significant interaction effect between age and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were obtained between age and maternal attitude (Wilks' λ = .79, F = 1.68, $P < .05$) and the hypothesis was rejected. The multivariate interactions between age and maternal attitude approached significance because of four

univariate interactions. The univariate analysis for the conservation scores of number ($F = 3.43$), area ($F = 4.22$), length ($F = 3.48$), and two-dimensional space ($F = 3.48$) showed a significant interaction effect between age and maternal attitude at the .05 level of confidence (Tables 15, 16, 18, & 19, Appendix D). Additionally, there was a significant univariate analysis effect between age and maternal attitude for explanation at the .0001 level of significance. There were no significant mean differences among maternal attitude scores for children less than six years of age in the conservation of number, area, length, and two-dimensional space. However, significant mean differences in maternal attitude were indicated among children six or more years of age for the conservation of number, area, and length (Table 23, Appendix D). Older subjects had higher mean scores than children with either ignoring or dominant mothers. Older subjects had lower mean scores than children with possessive mothers.

H^8: There is no significant interaction effect between gender and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were obtained between gender and social class (Wilks' $\lambda = .11$, $F = 1.59$, $P < .05$) and the hypothesis was rejected. A significant interaction effect was found between gender and social class for the two-dimensional space ($F = 3.90$, $P < .05$) conservation score (Table 19, Appendix D). When the mean differences among male subjects were compared, significant differences were found between the total mean score for male subjects and the mean scores for male subjects in social classes I and III. The total mean

score for male subjects was lower than the mean score of males in social class I, whereas it was higher than the mean score for males in social class III. No significant differences were found for male subjects in social class II. In addition, when the mean differences among female subjects were compared, significant differences were found only between the mean score for all female subjects and the mean score of female subjects in social class I. The total mean score for female subjects was lower than the mean score of female subjects in social class I.

H^9: There is no significant interaction effect between gender and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained between gender and maternal attitude (Wilks' λ = .87, F = 1.00, P < .46). Therefore, the hypothesis was accepted.

H^{10}: There is no significant interaction effect between social class and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained between social class and maternal attitude (Wilks' λ = .71, F = 1.23, P < .15) for any of the conservation tasks. Therefore, the hypothesis was accepted.

H^{11}: There is no significant interaction effect between age, gender, and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, dis-

tance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained among age, gender, and social class (Wilks' λ = .91, F = .675, P < .86) for any of the conservation tasks. Therefore, the hypothesis was accepted.

$H^{1\,2}$: There is no significant interaction effect between age, gender, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained among age, gender, and maternal attitude (Wilks' λ = .81, F = 1.49, P < .075) and the hypothesis was accepted.

$H^{1\,3}$: There is no significant interaction effect between age, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained among gender, social class, and maternal attitude (Wilks' λ = .83, F = 0.63, P < .97) and the hypothesis was accepted.

$H^{1\,4}$: There is no significant interaction effect between gender, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained among gender, social class, and maternal attitude (Wilks' λ = .72, F = 1.17, P < .21). Therefore, the hypothesis was accepted.

$H^{1\,5}$: There is no significant interaction effect between age, gender, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Statistically significant multivariate interaction effects were not obtained among age, gender, and maternal attitude (Wilks' λ = .81, F = 0.96, P < .53). Therefore, the hypothesis was accepted.

Summary, interaction effects MANOVA. Of the 11 relative multivariate effects hypotheses for the 9 conservation variables tested, only 3 of the hypotheses indicated a significant interaction effect. Therefore, it may be concluded that the interaction effects were not generally influential in the testing of the main effects.

Main Effect

Hypothesis One

H^{1}: Children six or more years of age are significantly better performers than children less than six years of age on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

The subjects of 6 or more years of age (mean age = 76 months, 21 days; N = 77) in two Korean kindergartens were compared on conservation tasks with those less than 6 years of age (mean age = 61 months, 2 days;

N = 123). It was expected that higher conservation task scores would be found for the older age range than for the younger age range; the multivariate main effect for age was significant and the data indicated in Table 2 supports this hypothesis.

The results of the univariate ANOVA are indicated in Table 3. Statistically significant multivariate effects were obtained for age (Wilks' $\lambda = .34$; $F(11,154) = 26.70$; $P < .0001$). The obtained univariate F scores indicate that there is a significant difference between the two selected age groups at the .001 level of confidence (see Table 3). Therefore, an age-related developmental pattern does exist and the results shown in Tables 2 and 3 confirm that H^1 should be accepted since the older Korean children performed consistently better on each task than did the younger Korean children. However, conservation of distance did not reach significance, although older children had higher mean scores.

That conservation increases with age is an indirect confirmation of the postulate that conservation develops sequentially. The probability of a correct response on each of the subscales of the conservation tasks across the two different age groups is shown in Figure 1. It is clear in this display that the possibility of a correct response increases with age on each of the conservation variables used in this study.

The number of responses for subjects at each age level indicating conservation of tasks involving behavior and explanation are also shown in Table 3. The univariate F scores for each age level indicate that the behavior and explanation means were significantly different for children of six or more years of age. Consequently, the results indicate that behavior indicating conservation and the ability to provide an explanation develops at a relatively later age and the hypothesis was supported. In addition, the

200 children were pooled and the distribution for each area of conservation was normalized in order to rank them by their relative level of difficulty (Table 4). The conservation of weight, length, and continuous quantity appear much more difficult. However, the conservation of distance and two-dimensional space, particularly distance, appear easier than the other areas of conservation.

Table 2. Conservation Task Performance, By Age Group.

Variable	Less Than 72 Months		72 Months or More	
	Mean	SD	Mean	SD
Substance	1.12	3.47	3.93	4.57
Weight	Ø.48	2.11	2.64	4.37
Continuous Quantity	Ø.Ø9	Ø.76	2.69	4.34
Discontinuous Quantity	Ø.58	2.Ø9	2.76	4.66
Number	Ø.78	2.51	6.54	5.52
Area	Ø.39	1.99	3.5Ø	4.9Ø
Distance	9.92	3.Ø9	1Ø.24	2.93
Length	Ø.53	2.17	2.49	4.49
Two-dimensional Space	1.32	3.39	6.15	5.5Ø
Behavior score	9.85	6.15	25.55	11.97
Explanation score	5.39	4.52	15.55	11.88

Table 3. Total Conservation Tasks, MANOVA: Effect for Age.

Variable	SS	MS	F
Substance	372.18	372.18	31.78*
Weight	221.37	221.37	22.00*
Continuous Quantity	328.17	328.17	46.39*
Discontinuous Quantity	229.57	229.57	20.91*
Number	1533.23	1533.23	117.93*
Area	454.57	454.57	46.50*
Distance	7.09	7.09	0.85
Length	189.10	189.10	19.02*
Two-dimensional Space	1131.29	1131.29	81.68*
Behavior score	11771.62	11771.62	195.89*
Explanation score	4948.94	4948.94	102.30*

Notes: * = P < .001; df = 1,164

Table 4. Ranking of Conservation Tasks.

Rank	Conservation Area	Mean	SD	%
1	Distance	10.05	3.03	84
2	Two-dimensional Space	3.18	4.92	27
3	Number	3.00	4.84	25
4	Substance	2.21	3.69	18
5	Area	1.59	3.74	13
6	Discontinuous Quantity	1.43	3.48	12
7	Weight	1.32	3.34	11
8	Length	1.29	3.39	11
9	Continuous Quantity	1.10	3.03	9

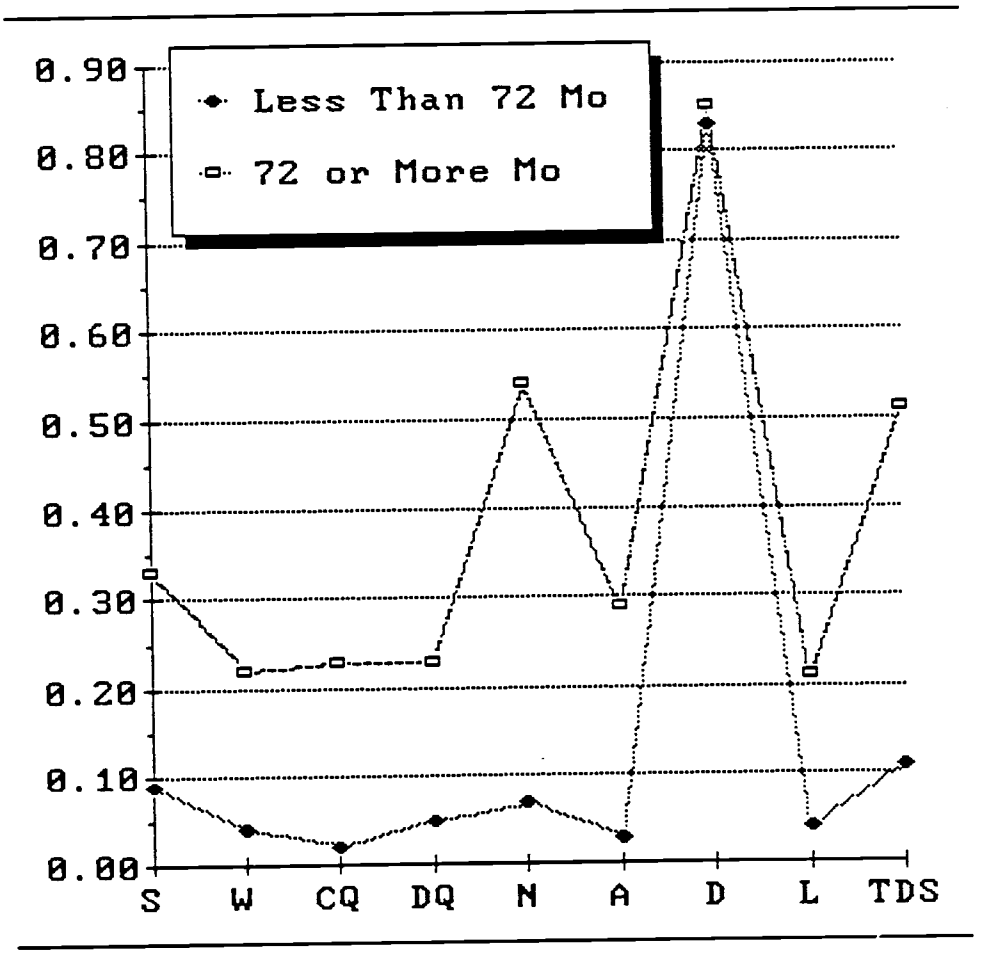


Figure 1. Conservation Scale, Probability of Correct Responses by Age Group.

Hypothesis Two

H^2: Male subjects are significantly better performers than female subjects on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

The expectation for H^2 was that male children would have higher conservation test scores than female children. As may be seen in the data in Table 5, there were no significant differences between males and females in this study, except for the conservation of number. Statistically significant multivariate effects were not obtained for gender (Wilks' $\lambda = .88$; $F(11,154) = 1.82$; $P < .054$). The results of the F test are listed in Table 6, indicating the distribution of subjects falling under each conservation category according to sex. Most of the obtained univariate F scores confirm that there is no significant difference between the two genders among Korean kindergarten children. However, females were better performers on the conservation of number ($F = 4.32$, $P < .05$) than were males. Figure 2 displays the probability of a correct response on each of the different subscales of the conservation tasks across the two different gender groups.

The hypothesis that there will be significant association between scores on the conservation tasks and different gender groups was not supported by the findings of this study. The number of conservation responses to tasks involving behavior and explanation by subjects according to gender is also shown in Table 6. The behavior mean was not significantly different from the explanation mean for male or female subjects.

Table 5. Conservation Task Performance, By Gender Group.

Variable	Male		Female	
	Mean	SD	Mean	SD
Substance	2.20	3.62	2.33	3.80
Weight	1.34	3.35	1.30	3.36
Continuous Quantity	1.37	3.42	0.77	2.44
Discontinuous Quantity	1.59	3.61	1.23	3.33
Number	2.53	4.57	3.60	5.13
Area	1.48	3.57	1.73	3.94
Distance	10.37	2.66	9.63	3.41
Length	1.59	3.70	0.93	2.97
Two-dimensional Space	3.57	5.17	2.73	4.60
Behavior score	16.51	12.70	15.26	10.37
Explanation score	9.61	10.39	8.97	8.52

Table 6. Total Conservation Tasks, MANOVA: Effect for Gender.

Variable	SS	MS	F
Substance	Ø.Ø4	Ø.Ø4	Ø.ØØ4
Weight	Ø.11	Ø.11	Ø.Ø1
Continuous Quantity	18.31	18.31	2.59
Discontinuous Quantity	6.49	6.49	Ø.59
Number	56.21	56.21	4.32*
Area	3.ØØ	3.ØØ	Ø.3Ø
Distance	27.2Ø	27.2Ø	3.26
Length	21.66	21.66	2.17
Two-dimensional Space	35.16	35.16	2.53
Behavior score	76.66	76.66	1.27
Explanation score	2Ø.7Ø	2Ø.7Ø	Ø.42

Notes: * = P < .Ø5; df = 1,164

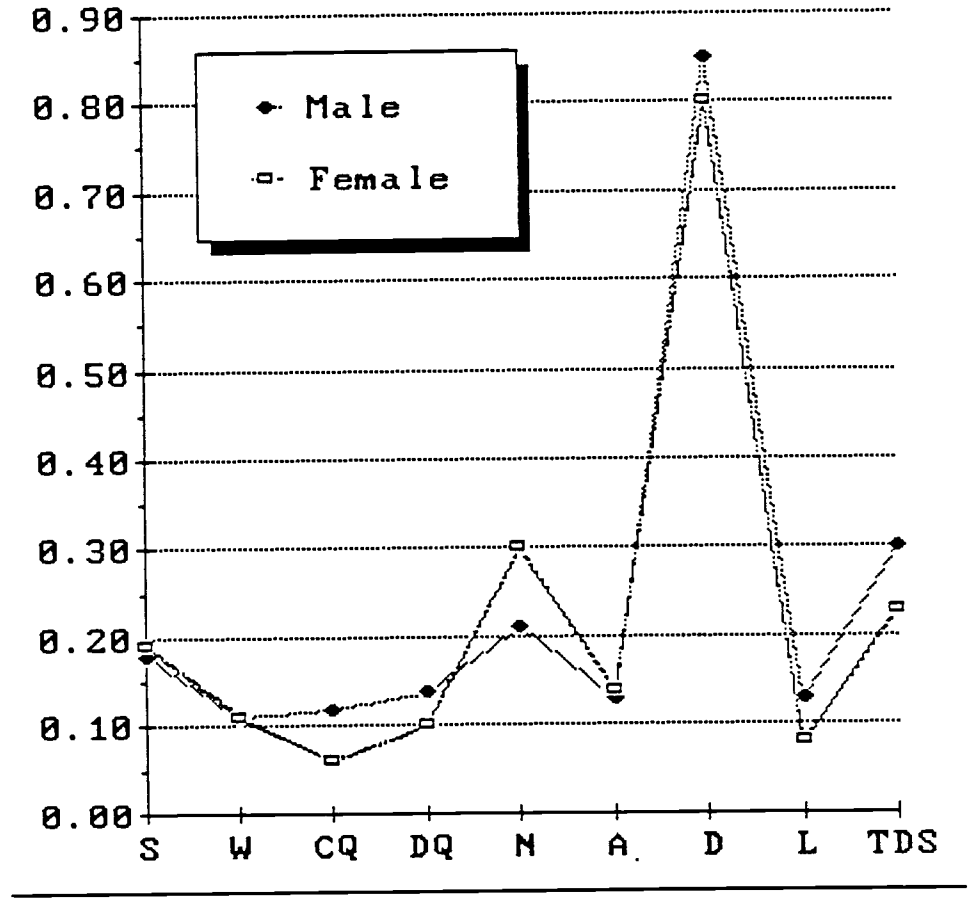


Figure 2. Conservation Scale, Probability of Correct Responses by Gender Group.

Hypothesis Three

H^3: Children of families from a higher social class are significantly better performers than the children of families from a lower social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

Table 7 presents the response mean scores on the nine conservation tasks for Korean children from social classes I, II, and III and Table 8 reflects the results of the univariate ANOVA. Statistically significant multivariate effects were obtained for social class (Wilks' λ = .57, F (22,308) = 4.38, P < .0001). The univariate F scores obtained among the three social classes indicate significant differences between them on six of the subscales; the exceptions are weight, continuous quantity, and discontinuous quantity.

A Student's Newman-Keuls test of the differences between the means revealed that the differences between social classes I and II were not significant for the Substance, Number, Area, and Length subscales; conversely, the differences were significant for the Distance and Two-dimensional Space subscales. Between social classes I and III, the differences between the means were significant on all of the subscales. The same comparison between social classes II and III indicated significant differences for the Substance, Number, and Two-dimensional Space tasks; conversely, there were no significant differences for the Distance and Length tasks. Though the difference on the Distance subscale was not

significant, 80 percent of the children from Social Class I better understood the conservation of distance than did children from Social Class II (see Table 8).

The probability of a correct response to the conservation tasks is displayed in Figure 3. In addition, a Student's Newman-Keuls test of the differences between the behavior score means were not significant between children from social classes I and II. There were, however, significant differences between the children from social classes I and III and between the children from social classes II and III. The mean scores of social classes I and II were both significantly higher than the mean scores of social class III. Furthermore, there were significant explanation score mean differences among the children from social classes I and II, I and III, and II and III. Overall, the hypothesis that there will be significant association between the scores on the conservation tasks and position within the different social classes is supported by the findings of this study.

Table 7. Conservation Task Performance, By Social Class.

Variable	S.C. I		S.C. II		S.C. III	
	Mean	SD	Mean	SD	Mean	SD
Substance	2.84	4.Ø7	3.18	4.3Ø	Ø.87	2.12
Weight	1.42	3.53	1.93	3.84	Ø.71	2.59
Continuous Quantity	1.83	3.74	1.56	3.56	Ø.12	1.Ø3
Discontinuous Quantity	2.33	4.17	1.56	3.86	Ø.59	2.13
Number	5.18	5.73	3.73	4.97	Ø.67	2.42
Area	3.35	5.Ø1	1.84	3.81	Ø.ØØ	Ø.ØØ
Distance	11.23	2.46	9.27	3.54	9.78	2.69
Length	2.44	4.47	1.56	3.71	Ø.16	Ø.97
Two-dimensional Space	6.5Ø	5.6Ø	3.78	4.92	Ø.Ø8	Ø.69
Behavior score	21.96	12.63	18.92	12.28	8.6Ø	4.42
Explanation score	14.96	11.34	9.83	9.84	4.46	3.23

Table 8. Total Conservation Tasks, MANOVA: Social Classes.

Variable	SS	MS	F	Group	$x_1 - x_2$	Q
Substance	86.80	43.40	3.70[a]	G1xG2	0.34	< 1.70
				G1xG3	1.97	> 1.64
				G2xG3	2.30	> 1.57
Weight	21.78	10.89	1.08			
Continuous Quantity	27.54	13.77	1.94			
Discontinuous Quantity	26.06	13.03	1.18			
Number	173.96	86.98	6.69[b]	G1xG2	1.45	< 1.79
				G1xG3	4.51	> 1.73
				G2xG3	3.06	> 1.68
Area	160.02	80.01	8.18[c]	G1xG2	1.51	< 1.55
				G1xG3	3.35	> 1.50
				G2xG3	1.84	> 1.46
Distance	111.56	55.78	6.69[b]	G1xG2	1.96	> 1.44
				G1xG3	1.45	> 1.38
				G2xG3	0.51	< 1.35
Length	86.35	43.17	4.34[a]	G1xG2	0.88	< 1.28
				G1xG3	2.28	> 1.24
				G2xG3	1.40	< 1.48
Two-dimensional Space	751.02	375.50	27.10[c]	G1xG2	2.72	> 1.85
				G1xG3	6.42	> 1.79
				G2xG3	3.70	> 1.74
Behavior score	2197.63	1098.81	18.28[c]	G1xG2	3.00	< 3.86
				G1xG3	13.36	> 3.73
				G2xG3	10.32	> 3.63
Explanation score	1467.82	733.91	15.17[c]	G1xG2	5.13	> 3.46
				G1xG3	10.50	> 3.34
				G2xG3	5.37	> 3.25

Notes: [a] = $P < .05$; [b] = $P < .01$; [c] = $P < .001$; df = 2,164
Gn = Group (n = 1, 2, or 3)
$x_1 - x_2$ = mean of Group 1 or 2 - mean of Group 3
Q = Q test

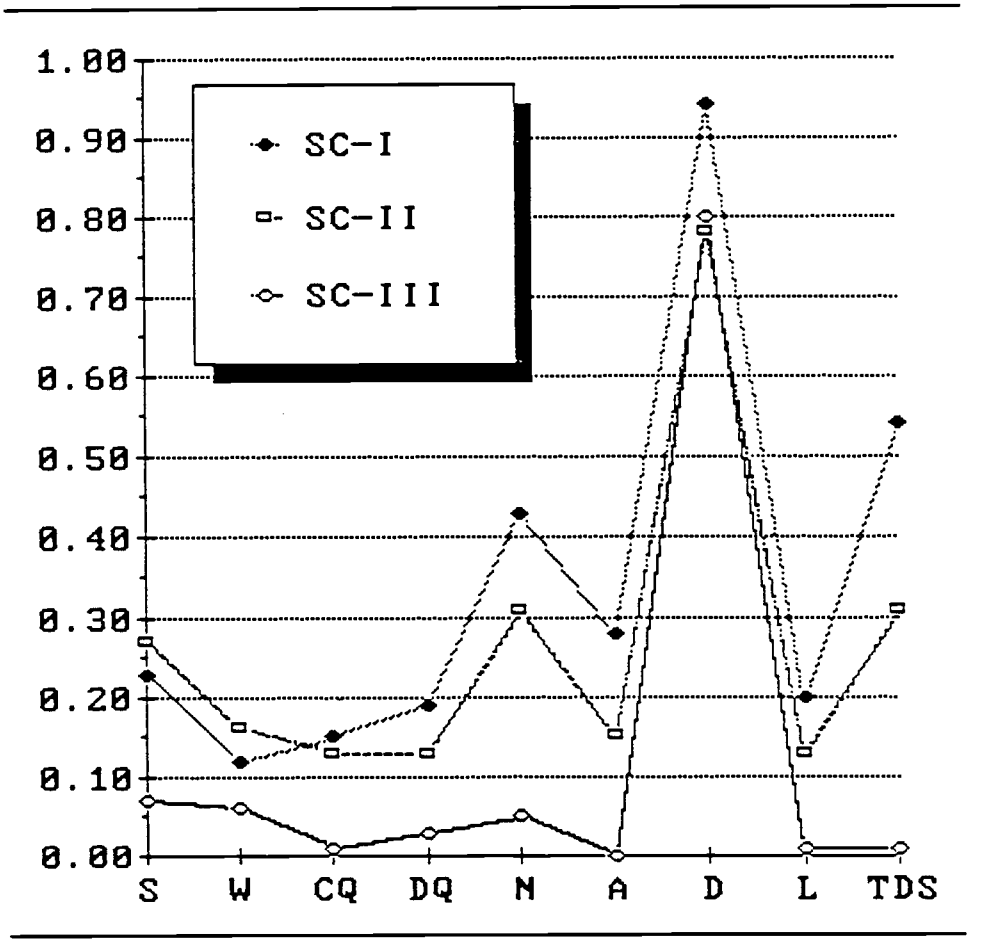


Figure 3. Conservation Scale, Probability of Correct Responses by Social Class.

Hypothesis Four

H_4: Children whose mothers are classified as "possessive" are significantly better performers on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks than are subjects whose mothers are classified as "dominant" or "ignoring."

This hypothesis, which tested the degree to which subjects would reflect differing scores on conservation tasks in direct relation to their mothers' attitudes, was based on the expectation that the children of possessive mothers would show higher conservation scores.

The data in Table 9 indicates that the children of mothers with possessive attitudes obtained higher scores on conservation tasks. Statistically significant multivariate effects were not obtained for maternal attitude (Wilks' $\lambda = .81$, $F = 1.48$, $P < .07$). However, the obtained univariate F scores, shown in Table 10, indicate that there is a significant difference between subjects with possessive, ignoring, and dominant mothers on the Number, Area, and Length subscales. However, at the .05 level of confidence significant differences were not apparent for the remaining subscales, Substance, Weight, Continuous Quantity, Discontinuous Quantity, Distance, and Two-dimensional Space.

A Student's Newman-Keuls (see Table 10) of the differences between the means revealed that was a significant difference between subjects with possessive or dominant mothers and between subjects with possessive or ignoring mothers on the Number, Area, and Length subscales.

Significant differences between the mean scores did not exist among subjects with mothers who were either dominant or ignoring on the Number, Area, and Length subscales. The nature of these findings indicates that subjects with possessive mothers appeared to have been more effective in achieving conservation tasks than were subjects with dominant or ignoring mothers.

The probability of a correct response on each conservation task subscale across subjects with either possessive, ignoring, or dominant mothers is displayed in Figure 4. This graphic indicates that children who are not dominated by their mothers tend to have higher conservation scores; conversely, children whose mothers reported strongly dominating attitudes tended to do poorly on conservation tasks.

The mean scores for behavior and explanation tasks for children from families classified by differing maternal attitudes is presented in Table 10. A Student's Newman-Keuls test of the difference between the mean scores of subjects with differing maternal attitudes showed a significant difference for subjects with possessive mothers compared to subjects with either dominant or ignoring mothers on behavior and explanation tasks.

The overall findings of this study support hypothesis four. Children whose mothers were classified as "possessive" were significantly better performers on the Number, Area, and Length subscales. However, statistically significant multivariate effects were not obtained for maternal attitude.

Table 9. Conservation Task Performance, By Maternal Attitude.

Variable	Possessive		Dominant		Ignoring	
	Mean	SD	Mean	SD	Mean	SD
Substance	2.61	4.13	1.74	3.14	2.ØØ	3.38
Weight	1.45	3.53	Ø.68	2.2Ø	1.93	4.1Ø
Continuous Quantity	1.54	3.74	Ø.53	1.84	Ø.93	2.54
Discontinuous Quantity	1.87	3.95	Ø.72	2.59	1.46	3.42
Number	4.45	5.42	2.Ø3	4.Ø5	1.33	3.59
Area	2.71	4.56	Ø.58	2.35	Ø.67	2.63
Distance	1Ø.19	3.Ø4	9.82	3.31	1Ø.Ø6	2.64
Length	2.19	4.4Ø	Ø.58	2.Ø9	Ø.4Ø	1.51
Two-dimensional Space	4.39	5.46	2.Ø3	4.Ø5	2.26	4.29
Behavior score	19.16	13.65	12.39	8.19	14.ØØ	9.57
Explanation score	12.3Ø	12.Ø9	6.43	5.12	7.Ø6	5.87

Table 10. Total Conservation Tasks, MANOVA: Maternal Attitude.

Variable	SS	MS	F	Group	$x_1 - x_2$ Q
Substance	6.79	3.39	Ø.29		
Weight	33.47	16.73	1.66		
Continuous Quantity	15.92	7.96	1.12		
Discontinuous Quantity	22.55	11.27	1.Ø2		
Number	216.Ø7	1Ø8.Ø3	8.31[c]	G1xG2	2.42 > 1.64
				G1xG3	3.12 > 1.81
				G2xG3	Ø.7Ø < 1.95
Area	114.92	57.46	5.87[b]	G1xG2	2.13 > 1.42
				G1xG3	2.Ø4 > 1.57
				G2xG3	Ø.Ø9 < 1.69
Distance	Ø.21	Ø.1Ø	Ø.Ø1		
Length	88.59	44.29	4.45[a]	G1xG2	1.61 > 1.43
				G1xG3	1.79 > 1.53
				G2xG3	Ø.18 > 1.71
Two-dimensional Space	55.89	27.94	2.Ø1		
Behavior score	675.19	337.59	5.61[b]	G1xG2	6.77 > 3.52
				G1xG3	5.16 > 3.89
				G2xG3	1.61 < 4.2Ø
Explanation score	722.71	361.35	7.46[b]	G1xG2	5.87 > 3.16
				G1xG3	5.24 > 3.49
				G2xG3	Ø.63 < 3.77

Notes: [a] = P < .Ø5; [b] = P < .Ø1; [c] = P < .ØØ1; df = 2,164
Gn = Group (n = 1, 2, or 3)
$x_1 - x_2$ = mean of Group 1 or 2 - mean of Group 3
Q = Q test

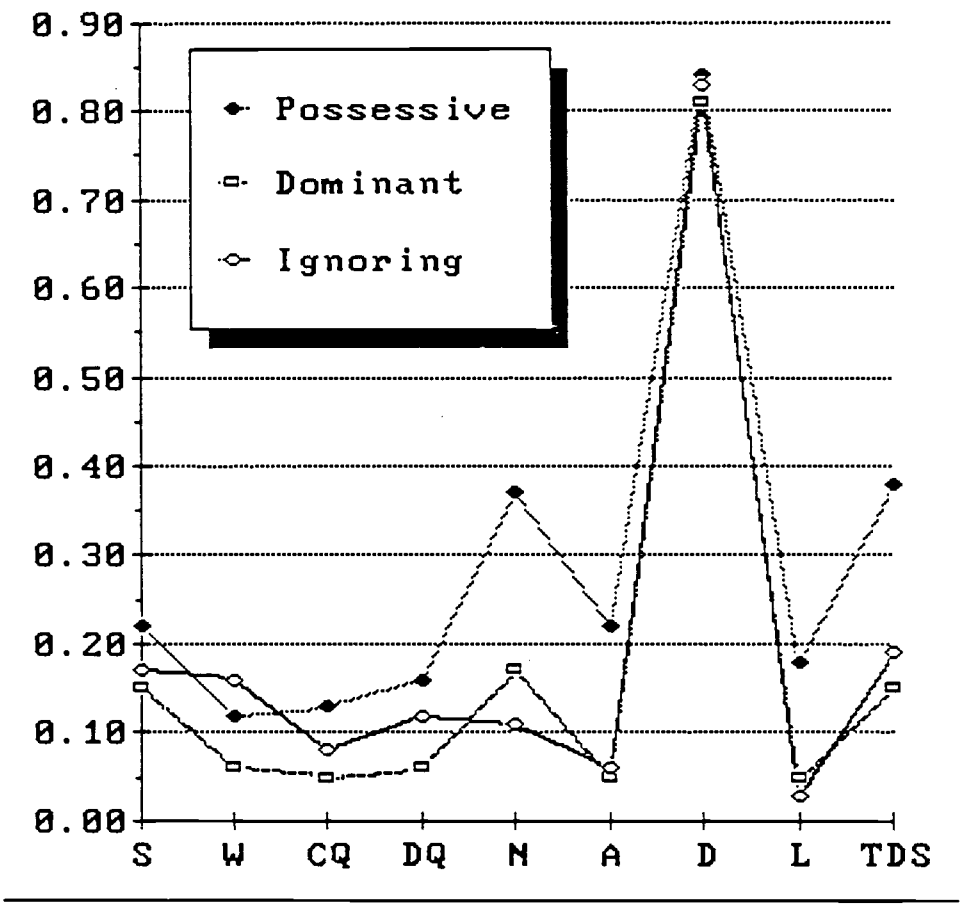


Figure 4. Conservation Scale, Probability of Correct Responses by Maternal Attitude.

CHAPTER V

DISCUSSION OF THE FINDINGS

There is a strong degree of similarity between the results of this study and the findings of prior research presented in Chapter II. Most of the hypotheses of this study have been supported by an analysis of the data. In some cases, where predictions were made regarding several subgroups, only a single aspect of the main effect hypothesis was not confirmed. Consequently, it is concluded that in general the findings of this study support the basic assumptions upon which the main effect hypotheses were based and in some cases suggest directions for further research. Furthermore, the conservation tasks assessed in this study were affected by the ages of the subjects, the social classes of the subject's families, and the maternal attitudes displayed toward the subjects.

Main Effect

Hypothesis One

The results of this study are in solid agreement with the predicted outcomes: older children attained higher mean scores than did younger children (Wilks' $\lambda = .34$, $F = 26.70$, $P < .0001$). Since Piaget (1952) stated that 75 percent of all children grasp the concepts of conservation of number, mass, and continuous quantity between 7 and 8 years of age, this percentage was adopted as the criterion for the subjects used in this study.

These children exceeded the 75 percent criterion only on the conservation of distance task and the results indicate that the conservation of two-dimensional space, number, substance, area, discontinuous quantity, weight, length, and continuous quantity can not be shown to develop in Korean children younger than seven years of age. Generally, then, this study strongly supports Piaget's sequential development theory and is in agreement with Piaget's conclusion that children demonstrate the concept of conservation more frequently as their age increases. Specifically, Piaget concluded that the conservation of number and quantity are not usually operative until the age of six or seven and that nearly all four-year old children were in the earlier stages of conservation. More recent investigations (Elkind, 1961a; Hood, 1962; Rothenberg, 1969; Wohlwill & Lowe, 1962) have demonstrated that conservation is not commonly operative until at least the age of six and that the conservation of substance, continuous quantity, weight, length, number, distance, area, two-dimensional space, and discontinuous quantity develop about the age of seven or eight years. In brief, Korean kindergarten children in Seoul indicated the development of conservation abilities with increasing age in agreement with Piaget's theory and other prior findings.

The issue of the sequence of development of various types of conservation tasks was addressed by Piaget (1969), Flavell (1963), and Goldschmid (1967). Piaget reported that the conservation of continuous quantity and matter developed earlier than the conservation of area, weight, distance, and volume. Goldschmid found that, in general, the conservation of length and distance were more difficult tasks than others. This sequence was not observed in this study. Rather, performance of the conservation of distance task was clearly superior to other forms of conservation, both

for children six or more years of age and for those less than six years of age. It may be argued that Korean children have more experience than Western children in direct distancing concepts, since they always walk to school and engage in children games (*yut, gonggi*, or rubber string play) which require knowledge of the concept of distance.

In some respects Uzgiris (1964) found that performance varied with changes in stimulus materials for several conservation tasks (substance, weight, and volume) and suggested that past experiences may account for discrepancies in the sequence of development of conservation as advanced by the Geneva school. Furthermore, Price-Williams et al. (1969) reported that children from pottery-making families in Mexico conserved matter tasks using clay at earlier ages than did children from similar, non-pottery making families.

Although Piaget did not focus on the effects of specific environmental variables on development, he did not deny their importance, as had sometimes been suggested (Wohlwill & Lowe, 1962), but described the schemata as evolving and differentiating in contact with the environment. Encounters with the environment are thought to be desirable and necessary, except that the internal satisfaction of recognition or the confirmation of an expectation is substituted for external reward. It may well be that when a schema is developing, specific contrasts with the environment will lead it to accommodate more in certain areas than in others, producing situational specificity with respect to individual past experiences. However, after a certain number or a certain variety of encounters, a schema may develop independence and start to be applied universally. This leads to the expectation that schema would be in a greater state of flux while developing, showing situational specificity, but once they are consolidated, the sit-

uational variability would be expected to disappear. Thus, these data suggest that the sequence of development of conservation is both a function of the stimulus materials used and the general level of familiarity with the problem. Individual past experience may well underlie situational differences and account for the observed inconsistency across the various materials.

A Korean-American comparison. Prior to valid cross-cultural comparisons in studies such as this, it is essential to have common ground in the nature of the tasks and categorization criteria. As most of the materials in this study were adapted from Goldschmid (1967), a segment of his results will be used to comparatively analyze the results of this study. Since Goldschmid's study included both normal and emotionally disturbed children and the present study used only normal Korean kindergarteners, for comparative purposes the Goldschmid data for emotionally disturbed children were dropped. The mean ages for subjects in the two studies are comparable (M = 6.7 [Goldschmid]; M = 6.4 [Kim]). The instruments and testing procedures used in both studies are the same except for the necessity of a Korean-to-English translation. Both studies were conducted in urban settings and involved subjects from upper, middle, and lower social classes.

The percentage of Goldschmid's subjects conserving substance, weight, continuous quantity, discontinuous quantity, and length were, respectively, 64, 43, 47, 57, and 68, which were strikingly higher than the corresponding results of this study (33, 14, 23, 25, and 22). However, in the distance and two-dimensional space tasks, the 25 and 38 percent of Goldschmid's subjects who were successful were markedly lower than the corresponding results of this study (85 and 52 percent). The results of

the number and area tasks in Goldschmid's study, 51 and 32 percent, were similar to the corresponding results of this study.

In some respects the subjects' behavior results in the present investigation, 47 percent, may be compared to the results in Goldschmid's study, 51 percent. Goldschmid's percentage for explanation scores was 38 percent, which is considerably higher than the 29 percent recorded for this study.

The question is why are Korean kindergarten children lagging behind the American children of Goldschmid's study? The explanation score data shows that the Korean child is not accustomed to expressing and maintaining his or her own opinion. Relations among family members are not based on the concept of equality, but are strictly hierarchical. The fundamental ethical ideals of Confucian philosophy are summed up in the so-called Three Principles and Five Rules. These moral rules purport to regulate the conduct between superiors and inferiors and personal relations are conceived in terms of hierarchical order, not in terms of egalitarian love. One maxim of this culture has it that "inferiors have mouths but no words." The result of this Confucian influence is that Korean people on one hand develop authoritarian attitudes and on the other fail to develop as self-reliant individuals (Paik, 1968). Although in many aspects urban family life has been changing in Korea, this is not clearly manifested in parental interest in the development of pre-school children. They are not recognized as independent individuals and are raised in the repressive traditional patterns of socialization by the family. In Korean culture children are brought up to regard their teachers as "masters" who must be respected and at all times admired. The result is that children rarely

question the expositions or the expertise of teachers and tend to learn their subject matter by rote.

It is arguable that learning styles engendered by master-disciple relationships are not conducive to active responses to problem situations or the "constructionist" way of thinking. It has been demonstrated by various investigations (Dasen, 1974; Greenfield, 1966) that cultural traditions and the conventions of a given society can influence and even determine children's responses on the cognitive tasks of conservation. Greenfield mentioned the prevalence of belief among illiterate Wolof children that the experimenter was capable of changing the quantity of water through magical means. These researchers have alerted us to the very real problem of perceptions and interpretations given by children to the probing questions of the investigators. Children's responses, therefore, may not reflect their true competencies (i.e., cognitive abilities), but might rather demonstrate their ability to please the person in authority, particularly in traditional cultures which value authoritarian relationships. This path, it would seem, has demonstrated that Korean children do not show conservation progress comparable to American children when the testing methods do not call for explanatory remarks by the Korean kindergarten children.

Hypothesis Two

The hypothesis was rejected (Wilks' $\lambda = .88$, $F = 1.82$, $P < .054$). Surprisingly, the results of this study revealed no significant gender differences in the conservation of substance, weight, continuous quantity, discontinuous quantity, area, distance, length, or two-dimensional space. Moreover, the results of this study indicate that female children performed significantly better than male children on the conservation of number.

Brekke and Williams (1973) found that girls performed at higher levels of conservation operativity on substance tasks, which is supported by the evidence of the present study. It is generally accepted that Korean girls are allowed much more role play than boys. Moreover, most mothers encourage girls to play with manipulative toys and to play quietly. Boys, in contrast, are encouraged to engage in active play. However, these findings do not contradict other studies based on Piaget's work which have shown gender differences to be insignificant (Braine, 1959; Danzinger, 1957; Dodwell, 1962; Kooistra, 1964). The only important contrast was Goldschmid's (1967) study, which indicated that boys performed significantly better than girls on the conservation of substance and discontinuous quantity.

It is generally accepted that Korean boys are allowed greater freedom of exploration and play than girls. The preference for male children is characteristic of Korean culture and mothers emphasize employment and advanced education for boys and marriage for girls. This is why it was predicted that male children will perform better than female children on the conservation tasks. It may be that in the present study the material used was equally familiar to both genders. It also may be that culture does not make its impact known until later childhood and, therefore, there are not as many differences at younger ages. However, the great majority of the studies on conservation either have not approached the problem of gender differences or have reported a lack of evidence to show that it influences conservation abilities.

Hypothesis Three

The hypothesis was retained (Wilks' λ = .57, F = 4.58, P < .0001). The findings of this study reveal similarities and differences in the cognitive performance of children from social class I, II, and III families. On the conservation of distance and weight, univariate F tests showed no statistical difference in the performance of Korean children from social classes II and III. This was also true of children from social classes I and II with respect to the conservation of substance, continuous quantity, discontinuous quantity, number, and length. However, there was a significant difference in the performance of Korean children from social classes I and III on the conservation of substance, continuous quantity, discontinuous quantity, number, area, length, and two-dimensional space.

There was also a significant difference in the performance of six-year olds on all conservation tasks which favored children from the upper-middle class families. Overall, the results of this study suggest strong support for the third hypothesis. Children from the lowest social class progressed at a slower pace in conservation tasks than did children from upper-middle class families. These findings support those of Almy et al. (1966) and Sigel (1966) concerning differences between children of two social classes. Individuals of high status tend to be in good health and to be substantially engaged in a supportive environment. Thus, they tend to maintain cognitive competence. Furthermore, mothers in social class III were more often dominant parents than were mothers in social classes I and II. The fact that 80 percent of the Korean children from social class III families could conserve distance earlier than Piagetian norms, suggests

that certain stimuli in the environment accelerated the development of this dimension of conservation, irrespective of social class influences.

Hypothesis Four

This hypothesis were conditionally supported by the findings of this study (Wilks' k = .81, F = 1.48, P < .07). However, in point of fact the conservation scores of children with possessive mothers were significantly higher than those with ignoring or dominant parents on the Number, Area, and Length subscales. The scores of children with ignoring mothers were also higher than those with dominant mothers, but not to a statistically significant degree. Piaget's (1951) views with regard to the indissolubility of cognition and affective life contribute to an understanding of the relations discovered in this study. He asserted that "affect life, like intellectual life, is a continual adaptation, and the two are not only parallel but interdependent, since feeling expresses the interest and value given to actions of which intelligence provides the structure" (p. 205). A previous study (Goldschmid, 1967) indicated the possibility that emotionally unstable or disturbed children develop conservation later than normal children of the same age, suggesting that disruptive personality characteristics may delay cognitive development.

Starting with the effect of the home environment, a number of mother-child interactions and child-rearing practices affect the cognitive development of children. Bing (1963) concluded from her study that some of the antecedents of high spatial and numerical abilities included opportunity and freedom of exploration and permissiveness for object experimentation. Moreover, overanxious discipline and excessive control were suggested as factors contributing to low non-verbal ability in children.

As concerns the relation between cognitive and social variables, there are undoubtedly environmental conditions which serve either to enhance or inhibit development of the child's cognitive structures. In this study, it was found that children who are not dominated by their mothers tend to have higher scores on the conservation of number, area, and length. Children whose mothers expressed dominant attitudes tended to do poorly on the conservation tasks. The results obtained in the present investigation lend empirical support to the theoretical and clinical conviction that maternal attitudes play a crucial role in the development of the child's conservation skills.

Interactive Effects

Hypotheses 5 and 9 through 15 were accepted. Though there were in several instances measurable differences in the conservation scores of the subjects of this study, particularly in the case of the three and four-way MANOVA procedures for the interactive effects of age, gender, social class, and maternal attitude, they were not found to be statistically significant differences. In the absence of extensive prior research in this area, there were obvious difficulties in predicting the significance of these variables, in defining suitable criteria for the evaluation of conservation development, and in evaluating the findings regarding the interactive effects of these independent variables. This study has not demonstrated that the interactive effects of age, gender, social class, or maternal attitude have any measurable influence on children's conservation task scores. However, it would be useful if future research was directed at further delineation of their interactive effect upon cognitive development.

Hypothesis Six

This hypothesis was rejected. There was a significant interactive effect between age and social class for the Weight, Number, Area, and Two-dimensional Space subscales, suggesting that age and social class influence conservation task performance. Nelson (1980) found that five-year old children from the middle and lower class groups reflected no obvious differentiations on conservation tests, but that at six years of age there was a significant difference in the conservation of number, mass, and continuous quantity which favored children from middle income families. From these results and from the results of this study it is indicated that age and social class have an important bearing on conservation task performance. These results also suggest that the lack of significant differences in the performances of children less than six years old points at preschool experiences and multimedia exposure as common stimulants to learning.

Hypothesis Seven

The hypothesis was rejected. There was a significant interactive effect between age and maternal attitude on the Number, Area, Length, and Two-dimensional Space subscales. Age dependence has become a variable of recent concern. Variations in the consequences of parental practices, as a function of the child's age level at the time the practices are introduced, have been termed the "sleeper effect" by Kagan and Moss (1962). The evidence presented has postulated periods in the child's development when a particular practice may be more effective in shaping later cognitive development than the "optimum age" previously thought to be the sig-

nificant for the development of cognitive skills. In any case, the findings of this study support the prior findings of Kagan and Moss.

Hypothesis Eight

The hypothesis was not accepted. Gender differences were found to be related to the performance of conservation tasks by children from different social classes. However, none of the individual conservation tasks revealed a significant interaction between gender and social class. The overall results reinforce the generally accepted theory that there is a relationship between gender and social class, showing that children from each social class developed differential according to gender. These findings are in contradiction to those of Nelson (1974), which determined that conservation task performance was not gender related so far as the children of lower and middle income families were concerned.

Summary

The most general conclusion that may be derived from the results of this study is that there are major differences in the rate of acquisition of conservation skills between children of different social class backgrounds, maternal attitudes, and age. One of the major purposes of this study was to obtain data regarding influences on conservation development in Korea; the other was to compare Korean and Western patterns of development. Not surprisingly, since the same results have been obtained in the United States and in many other national/cultural groups, the older, upper social scale children and those with possessive maternal attitudes scored higher on conservation tasks.

Despite substantial cultural differences, the present data support the existence of the developmental sequence described in Piagetian stages in Korea as well as in Western cultures. From the evidence of this study, social class background would seem to be the variable most closely related to conservation performance differences, followed by maternal attitude. Gender was not found to be related to the cognitive development of Korean kindergarten children. There were, however, some cultural differences.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

The purpose of this study was to investigate whether the conservation of substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space are developed in sequence in the acquisition of conservation operations. The specific objectives of this study were to determine: (1) an age difference in the ability of five to six-year old children in the performance of conservation tasks, (2) if there are significant differences between the performances of boys and girls on conservation tasks, (3) if there are significant differences between three socioeconomic groups on the conservation tasks, and (4) if there are conservation task performance differences in the abilities of children who experience different maternal attitudes.

The population sample which provided the data for this study was composed of Korean kindergarten children and their families in Seoul, Korea, from which sample data were obtained on 200 subjects. The data indices used were: (1) scores on the Conservation Concept Diagnostic Kit, (2) scores on the U.S.C. Parent Attitude Survey, (3) scores on an index of social class position prepared for this study, (4) the gender of the subjects, and (5) the age of the subjects.

The subjects were assigned to categories on the basis of their mothers' attitudes, their gender, age, and social class position. The sample was composed of 109 boys (55 percent) and 91 girls (45 percent). The percentages of subjects designated by the maternal attitude variable were possessive attitude, 46.5 percent, dominant attitude, 31 percent, and ignoring attitude, 22.5 percent. The percentages of subjects designated by socioeconomic class were social class I, 30 percent, social class II, 32 percent, and social class III, 38 percent. With respect to age, 61 percent of the subjects were less than 72 months old and 39 percent were 72 or more months old.

The statistical analyses of the proposed hypotheses were calculated on the Oregon State University Cyber computer, using the SPSSX program. The hypotheses set forth for the effects of age, gender, social class, and maternal attitude on conservation tasks were tested with a multivariate analysis of variance (MANOVA). In order to control for possible statistical dependencies among the nine dependent variables, data were analyzed using a 2 × (age) × 2 (gender) × 3 (social class) × 3 (maternal attitude) MANOVA. Multiple comparisons were calculated at the .05 level, using Student's Newman-Keuls procedure. The hypotheses were tested as follows:

H^1: Children six or more years of age are significantly better performers than children less than six years of age on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^2: Male subjects are significantly better performers than female subjects on each of the substance, weight, continuous quantity,

discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^3: Children of families from a higher social class are significantly better performers than the children of families from a lower social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^4: Children whose mothers are classified as "possessive" are significantly better performers on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks than are subjects whose mothers are classified as "dominant" or "ignoring."

H^5: There is no significant interaction effect between age and gender on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^6: There is no significant interaction effect between age and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^7: There is no significant interaction effect between age and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^8: There is no significant interaction effect between gender and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^9: There is no significant interaction effect between gender and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^{10}: There is no significant interaction effect between social class and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^{11}: There is no significant interaction effect between age, gender, and social class on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^{12}: There is no significant interaction effect between age, gender, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

H^{13}: There is no significant interaction effect between age, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, dis-

tance, length, and two-dimensional space measurement conservation tasks.

$H^{1\,4}$: There is no significant interaction effect between gender, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

$H^{1\,5}$: There is no significant interaction effect between age, gender, social class, and maternal attitude on each of the substance, weight, continuous quantity, discontinuous quantity, number, area, distance, length, and two-dimensional space measurement conservation tasks.

The results of the tests of the above hypotheses were as follows:

Hypothesis 1: The results of this study provided support for the hypothesis. The findings clearly indicated that the older group did consistently better on each task than did the younger group, thus indicating there was an age-related developmental pattern. Children six or more years of age demonstrated the attainment of the number concept in over half of their responses and both groups of subjects appeared to show a general understanding of the conservation of distance.

Hypothesis 2: The results of this study failed to support this hypothesis, finding no significant difference in conservation task performance on the basis of gender. Therefore, it appears that the development of cognition in children is not related to gender.

Hypothesis 3: The results of this study supported this hypothesis. The scores on conservation tasks were found to differ significantly among social classes I, II, and III.

Hypothesis 4: The results of this study provided support for this hypothesis. The children of mothers with a possessive attitude toward their children obtained higher conservation task scores.

Hypothesis 5: The results of this study supported this hypothesis. There appeared to be no interaction effect between age and gender on the nine conservation tasks.

Hypothesis 6: The results of this study failed to support this hypothesis. There was a significant interaction effect between age and social class on the Weight, Number, Area and Two-dimensional Space subscales. These findings suggest that there is an interaction effect between age and social class on conservation tasks.

Hypothesis 7: The hypothesis was rejected. There was a significant interaction effect between age and maternal attitude on the Number, Area, Length, and Two-dimensional Space subscales.

Hypothesis 8: The results of this study provide support for this hypothesis. There was no significant interaction effect between gender and social class.

Hypothesis 9: This hypothesis was retained. There was no significant interaction effect between gender and maternal attitude on any of the nine conservation tasks.

Hypothesis 10: The results of this study provided support for this hypothesis. There was no significant interaction effect between social class and maternal attitude.

Hypothesis 11: The hypothesis was retained. There was no significant interaction effect between age, gender, and social class.

Hypothesis 12: The hypothesis was retained. There was no significant interaction effect between age, gender, and maternal attitude.

Hypothesis 13: The hypothesis was retained. There was no significant interaction effect between gender, social class, and maternal attitude.

Hypothesis 14: The hypothesis was retained. There was no significant interaction effect between age, social class, and maternal attitude.

Hypothesis 15: The hypothesis was retained. There was no significant interaction effect between age, gender, social class, and maternal attitude.

Conclusions

The results of this study do not challenge Piaget's age-dependent theory of cognitive development, but they do demonstrate significant individual differences in conservation within a given age group. The particular relationships that were found suggest that specific environmental aspects coexist with conservation and are likely to foster its development. The results of this study have indicated the following:

1. The differential growth rate of the conservation of length, weight, and continuous quantity, as suggested in other studies, is confirmed. The ranking of the relative ease of the conservation of distance and two-dimensional space indicated in this study, is not in agreement with prior research. Specifically, the conservation of distance is developed earlier than the age of seven for most Korean children. Individual past experiences may well underlie situational differences.
2. There is a significant relationship among different conservation tasks and the total conservation score, confirming the underlying cognitive construct or the schema of conservation.

However, findings that the ability to explain develops later than the ability to conserve are of particular interest. This finding is in opposition to Piaget's contention that children's behavior and explanations may be used interchangeably as signs of conservation or nonconservation.

3. Age clearly differentiates the subjects with respect to their level of conservation. Older subjects consistently performed at a higher level than younger subjects, a finding which substantiates Piaget's theory of age-related cognitive development. The measures tested exhibited a developmental progression of performance scores across age in accordance with Piaget's theory of cognitive development.
4. The findings failed to reveal gender differences in conservation task performance. However, the results indicated that gender differences are related to the conservation of number. The lack of significant gender differentiation supports related Piagetian research.
5. There was a significant difference in the performance of children on all conservation tasks which favored children from upper and middle class families. Therefore, differences found between the lower and middle class children are likely due to differences in their environment.
6. The subjects of mothers with possessive attitude had higher conservation scores. The results obtained in this investigation lend empirical support to the theoretical and clinical conviction that parent attitudes play a crucial role in the cognitive development of the child.

7. There was a significant interaction effect between age and social class, which may be an indication of a relationship between age and social class in determining the development of cognitive functions. The effects of socioeconomic variables appear to be cumulative and in this study were not apparent until the child had attained a chronological age of six-years or more.
8. There was a significant interaction effect between age and maternal attitude, suggesting that there may be critical periods in the development of a child when a particular practice may be more effective in shaping later cognitive development.
9. There was a significant interaction effect between gender and social class. The results indicate that children from each social class developed differentially according to gender.

Implications

Since this investigation has failed to signal any departures in knowledge concerning cognitive development and has supported theories advanced in prior research, further study is needed where there may be greater control exercised over some of the independent variables, e.g., in the extreme groups of the age, social class, and maternal attitude variables. Furthermore, data should be gathered on the degree of assimilation and on language dominance. With such controls, the nature of the relationship between neo-Piagetian measures and traditional measures of capacity and achievement, and the influence of the former variables on the relationship, could be assessed with greater precision.

Second, additional research is needed to determine the reliability of the order of acquisition posited in this study. Why, for instance, have Korean children so clearly indicated early acquisition of the conservation of distance, when studies of other cultures have confirmed that distance was a concept more difficult to acquire than others? Additional research should counterbalance the order of presentation and use a control group of Korean children matched with the children of the same age from the dominant Western culture to test the order of acquisition.

Finally, it is hoped that future research will serve to explicate the experiential conditions responsible for the development of conservation and, in general, contribute to the development of a comprehensive theory of maturation through the clarification of the relations among different facets of child development.

BIBLIOGRAPHY

Adjei, K. (1973). *Maternal behaviors and cognitive development.* Unpublished Ph.D. dissertation, University of Strathclyde, Glasgow, United Kingdom.

Almy, M., Chittenden, E., & Miller, P. (1966). *Young children's thinking.* New York: Teachers College Press.

Bayley, N. (1965). Comparisons of mental and motor test scores for ages 1-15 months by sex, birth order, race, geographical location, and education of parents. *Child Development, 36,* 379-411.

Bing, E. (1963). Effects of child rearing practices on development of differential cognitive abilities. *Child Development, 34,* 631-648.

Bloom B. (1964). *Stability and change human characteristics.* New York: Wiley.

Boonsong, S. (1968). *The development of conservation of mass, weight, and volume in Thai children.* Unpublished master's thesis, College of Education. Bangkok, Thailand.

Braine, M. (1959). The ontogeny of certain logical operations: Piaget's formulation examined by nonverbal methods. *Psychological Monographs: General and Applied, 73*(5), 475, whole number.

Brekke, W. and Williams, J. (1973). Conservation and sex. *Perceptual and Motor Skills, 37,* 14.

Bruner, J., Oliver, R., & Greenfield, P. (Eds.). (1966). *Studies in cognitive growth.* New York: Wiley.

Bryant, P. (1972). The understanding of invariance by very young children. *Canadian Journal of Psychology/Revue Canadienne de Psychologie, 26,* 76-78.

Choi, J. (1966). *A study of the Korean Family.* Seoul, Korea: (In Korean with an English language summary)

Cohen, G. (1967). Conservation of quantity in children: The effect of vocabulary and participation. *Quarterly Journal of Experimental Psychology, 19,* 150-154.

Cole, M. & Bruner, J. (1971). Cultural differences and inferences about psychological processes. *American Psychologist, 26,* 867-876.

Cole, M. & Scribner, S. (1974). *Culture and Thought.* New York: John Wiley.

Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). *L. S. Vygosky: Mind in society.* Cambridge, MA: Harvard University Press.

Danzinger, K. (1957). The child's understanding of kinship terms: A study in the development of relational concepts. *Journal of Genetic Psychology, 91,* 213-232.

Dasen, P. (1972). Cross-cultural Piagetian research: A summary. *Journal of Cross-Cultural Psychology, 3,* 23-39.

Dasen, P. (1974). The influence of ecology, culture and European contact on cognitive development in Australian Aborigines. In J. Berry & P. Dasen (Eds.), *Culture and cognition: Readings in cross-cultural psychology.* London: Methuen.

Dasen, P. (1977). *Piagetian psychology: Cross-cultural contributions.* New York: John Wiley.

Dasen, P. & Seagrim, G. (1969-1976). *Inventory of cross-cultural Piagetian research.* Published annually, privately circulated.

De Lacey, P. (1971). Classificatory ability and verbal intelligence among high contact aboriginal and low socioeconomic white Australian children. *Journal of Cross-Cultural Psychology, 2*(4), 393-396.

De Lemos, M. (1969). The development of conservation in aboriginal children. *International Journal of Psychology, 4,* 255-269.

Dodwell, P. (1960). Children's understanding of number and related concepts. *Canadian Journal of Psychology, 14,* 191-205.

Dodwell, P. (1961). Children's understanding of number concepts: Characteristics of an individual and a group test. *Canadian Journal of Psychology, 15*(1), 29-36.

Dodwell, P. (1962). Relations between the understanding of the logic of classes and of cardinal numbers in children. *Canadian Journal of Psychology, 16,* 152-160.

Elkind, D. (1961a). Children's discovery of the conservation of mass, weight, and volume: Piaget's replication study II. *Journal of Genetic Psychology, 98,* 219-227.

Elkind, D. (1961b). The development of the additive composition of classes in the child: Piaget replication study III. *Journal of Genetic Psychology, 99,* 51-57.

Etuk, E. (1967). *The development of number concepts: An examination of Piaget's theory with Yoruba-speaking Nigerian children.* Unpublished Ph.D. dissertation, Columbia University, New York.

Evans, J. (1968). *Children in Africa: A review of psychological research.* New York: Teachers College Press.

Figurelli, J. & Keller, H. (1972). The effects of training and socioeconomic class upon the acquisition of conservation concepts. *Child Development, 43,* 293-298.

Fisher, R. & Yates, F. (1953). *Statistical tables for biological, agricultural and medical research* (Table VII). London: Longman.

Flavell, J. (1963). *The developmental psychology of Jean Piaget.* Princeton, NJ: Van Nostrand.

Furby, L. (1971). A theoretical analysis of cross-cultural research in cognitive development: Piaget's conservation tasks. *Journal of Cross-Cultural Psychology, 2*(3), 241-255.

Furth, H. (1966). *Thinking without language. Psychological implications of deafness.* New York: Free Press.

Gaudia, G. (1972). Race, social class, and age of achievement of conservation on Piaget's tasks. *Developmental Psychology, 6*(1), 158-165.

Goldschmid, M. (1967). Different types of conservation and non-conservation and their relation to age, sex, IQ, MA and vocabulary. *Child Development, 38,* 1229-1246.

Goldschmid, M. (1968). The relation of conservation to emotional and environmental aspects of development. *Child Development, 39,* 579-589.

Goldschmid, M. & Bentler, P. (1968a). The dimensions and measurement of conservation. *Child Development, 39,* 787-802.

Goldschmid, M. & Bentler, P. (1968b). *Manual: Concept assessment kit--conservation.* San Diego, CA: Educational and Industrial Testing Service.

Goodnow, J. & Bethon, G. (1966). Piaget's tasks: The effects of schooling and intelligence. *Child Development, 37,* 573-582.

Graves, A. (1972). Attainment of conservation of mass, weight and volume in minimally educated adults. *Developmental Psychology, 7*(2), 223-24.

Greenfield, P. (1966). On culture and conservation. In J. Bruner, R. Oliver, & P. Greenfield (Eds.), *Studies in cognitive growth.* London: Wiley.

Greenfield, P. (1976). Cross-cultural research and Piagetian theory: Paradox and progress. In K. Riegel & J. Meacham (Eds.), *The developing individual in a changing world* (pp. 322-333). The Hague: Mouton,

Halford, G. (1970). A theory of the acquisition of conservation. *Psychological Review, 77*, 302-316.

Halford, G. (1982). *The development of thought*. Hillsdale, NJ: Erlbaum.

Halford, G. (1984). Can young children integrate premises in transitivity and serial order tasks? *Cognitive Psychology, 16*, 65-93.

Hamilton, V. (1971). Effect of maternal attitude on development of logical operations. *Perceptual and Motor Skills, 33*, 63-69.

Heron, A. (1974). Cultural determinants of concrete operational behavior. In J. Dawson & W. Lonner (Eds.), *Readings in cross-cultural psychology* (pp. 94-101). Hongkong: Hongkong University Press.

Heron, A. & Dodwell, W. (1974). The questionable unity of the concrete operations stage. *International Journal of Psychology, 9*(1), 1-9.

Heron, A. & Simonsson, M. (1969). Weight conservation in Zambian children. *International Journal of Psychology, 4*, 281-292.

Hess, R. (1965, September). *Effects of maternal interaction on cognitions of pre-school children in several social strata*. Paper presented at the meeting of the American Psychological Association. Chicago, IL.

Hess, R. & Shipman, V. (1965). Early experience and the socialization of cognitive modes in children. *Child Development, 36*, 869-886.

Hindley, C. (1960). The Griffiths scale of infant development: Scores and predictions from 3 to 18 months. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 1*, 99-112.

Hobbs, E. (1973). Adolescents' concepts of physical quantity. *Developmental Psychology, 9*(3), 431.

Hood, B. (1962). An experimental study of Piaget's theory of the development of numbers in children. *British Journal of Psychology, 53*, 273-285.

Hyde, D. (1959) *An investigation of Piaget's theories of the development of the concept of number*. Unpublished Ph.D. dissertations, University of London.

Hyde, D. (1970). *Piaget and conceptual development*. London: Holt, Rinehart and Winston, 1970.

Kagan, J. & Moss, H. (1962). *Birth to maturity, a study in psychological development.* New York: Wiley.

Keller, H. (1971). *The lack of generality of middle and lower-class children's performance on conservation and transitivity tasks.* Paper presented at meeting of the Society for Research in Child Development, Minneapolis, MI.

Klahr, D. & Wallace, J. (1976). *Cognitive development: An information processing view.* Hillsdale, NJ: Erlbaum.

Kohlberg, L. (1968). The Montessori approach to cultural deprivation. A cognitive-development interpretation and some research findings. In R. Hess & R. Bear (Eds.), *Preschool education, theory, research and action.* Chicago: Aldine.

Kooistra, W. (1964). *Developmental trends in the attainment of conservation, transitivity, and relativism in the thinking of children: Replication and extension of Piaget's ontogenetic formulation.* Dissertations in cognitive processes (abstract), Center for Study of Cognitive Processes, Wayne State University.

LeVine, R. (1970). Cross-cultural study in child psychology. In P. Mussen (Ed.), *Carmichael's manual of child psychology* (pp. 559-610). New York: John Wiley.

Lloyd, B. (1971). Studies of conservation with Yoruba children of differing ages and experiences. *Child Development, 42,* 415-428.

Lovell, K. (1966). *The growth of basic mathematical and scientific concepts of children.* London: University of London Press.

Lovell, K., Healey, D. & Rowland, A. (1962). The growth of some geometrical concepts. *Child Development, 33,* 751-767.

Lovell, K. & Ogilvie, E. (1961). The growth of the concept of volume in junior school children. *Journal of Child Psychiatry and Psychology, 2,* 118-226.

McCarthy, D. (1954). Language development in children. In L. Carmichael (Ed.), *Manual of child psychology* (2nd Ed., pp. 492-630). New York: Wiley.

Malone, C. (1963). Some observations on children of disorganized families and problems of acting out. *Journal of the American Academy of Child Psychiatry, 2,* 22-49.

Mehler, J. & Bever, T. (1967). Cognitive capacity of very young children. *Science, 158,* 141-142.

Mermelstein, E. (1964). *The effect of lack of formal schooling on number development, a test of Piaget's theory and methodology.* Unpublished Ph.D. dissertation, Michigan State University.

Miller, S. (1976). Nonverbal assessment of Piagetian concepts. *Psychological Bulletin, 83*, 405-430.

Modgil, S. (1969). *The relation of emotional adjustment to the conservation of numbers.* Unpublished master's thesis, University of Manchester.

Mohsensi, N. (1966). *La comparaison des reactions aux epreuves d'intelligence en Iran et en Europe.* These de l'universite, University of Paris.

Nelson, L. (1980). The development of conservation concepts in children from low-income families. *Journal of Psychology, 106*, 77-90.

Paik, Hyun-Ki. (1968). The social structure of Korea and its implications for Korean education. *Korea Journal, 8*(3), 11-15.

Palmer, E. (1966). *How elementary school children resolve experimentally produced conflicts in thinking.* Tallahassee, FL: Florida State University.

Parish, C. & Wheatley, G. (1973). Sex of experimenter as a variable in Piagetian conservation assessment. *Journal of Genetic Psychology, 123*, 273-278.

Pavenstedt, E. (1965). A comparison of the child-rearing environment of the upper-lower and very low-lower class families. *American Journal of Orthopsychiatry, 35*, 89-98.

Piaget, J. (1928). *Judgment and reasoning in the child.* London: Routledge & Kegan Paul.

Piaget, J. (1950). *The psychology of intelligence.* London: Routledge & Kegan Paul.

Piaget, J. (1951). *Judgment and reasoning in the child.* London: Routledge & Kegan Paul.

Piaget, J. (1952). *The child's concept of numbers.* London: Routledge & Kegan Paul.

Piaget, J. (1966). Necessite et signification des recherches comparatives en psychologie genetique. *International Journal of Psychology, 1*, 3-13.

Piaget, J. (1968). *Six psychological studies.* New York: Vintage.

Piaget, J. (1969). *The mechanisms of perception.* New York: Basic Books.

Piaget, J. & Inhelder, B. (1969). *The psychology of the child.* London: Routledge & Kegan Paul.

Pratoomraj, W. & Johnson, R. (1966). Kinds of questions and types of conservation tasks as related to children's conservation responses. *Child Development, 37*, 343-353.

Price-Williams, D., Gordon, W., & Ramirez, M. (1969). Skill and conservation: A study of pottery-making children. *Developmental Psychology, 1*(6), 769.

Prince, J. (1968). The effect of Western education on science conceptualization in New Guinea. *British Journal of Educational Psychology, 33*, 64-74.

Republic of Korea, Ministry of Culture and Information, Korean Overseas Information Service. (1982). *A handbook of Korea*. Seoul, Korea.

Rothenberg, B. (1969). Conservation of numbers among four and five-year old children: Some methodological considerations. *Child Development, 40*, 338-406.

Schaie, K. (1979). The primary mental abilities in adulthood: An exploration in the development of psychometric intelligence. In P. Baltes & O. Brim, Jr. (Eds.), *Life span development and behavior* (Vol. I). New York: Academic Press.

Shoben, J. (1949). The assessment of parental attitudes in relation to child development. *Genetic Psychology Monographs, 39*, 101-148.

Siegler, R. (1981). *Developmental sequences within and between concepts* (Monographs of the Society for Research in Child Development, 46[2, Serial No. 189]).

Sigel, I. (1966). A teaching strategy derived from some Piagetian concepts. In *Child development and social science education* (Part 4). Detroit: Merrill-Palmer Institute.

Sigel, I. & Hooper, F. (Eds.). (1968). *Logical thinking in children: Research based on Piaget's theory*. New York: Holt, Rinehart & Winston.

Singh, B. (1970). *Conservation of volume: The development and analysis of an adjective group test*. Paper presented at the annual convention of the American Educational Research Association, Minneapolis, MI.

Skeels, H. (1966). Adult status of children with contrasting early life experiences. *Monographs of the Society for Research in Child Development, 31*(3), 105.

Skeels, H., Updegraff, R., Wellman, B., & Williams, H. (1938). A study of environmental stimulation: An orphanage preschool project. *University of Iowa Studies in Child Welfare, 15*(4).

Smedslund, J. (1961). Th acquisition of conservation of substance and weight in children. I: Introduction. *Scandinavian Journal of Psychology, 2*, 11-20.

Stodolsky, S. & Lesser, G. (1967). Learning patterns in the disadvantaged. *Harvard Educational Review, 37*, 546-593.

Sweetland, R. (1969). The use of mental imagery among young children in the acquisition of Piaget's principles of conservation. *Dissertation Abstracts International, 29*. (University Microfilms No. 2624B)

Uka, N. (1962). *The development of time concepts in children of primary school age*. Ibadan: Ibadan University Press.

Uzgiris, I. (1964). Situational generality of conservation. *Child Development, 35*, 831-841.

Vernon, P. (1965). Ability factors and environmental influence. *American Psychologist, 20*, 723-733.

Wasik, B. & Wasik, J. (1971). Performance of culturally deprived children on the Concept Assessment Kit--Conservation. *Child Development, 42*, 1586-1950.

Watson, M. & Fischer, K. (1980). Development of social roles in elicited and spontaneous behavior during the preschool years. *Developmental Psychology, 16*, 483-494.

Wohlwill, J. & Lowe, R. (1962). Analysis of the development of the conservation of numbers. *Child Development, 33*, 153-167.

Yarrow, L. (1964). Separation from parents during early childhood. In M. Hoffman & L. Hoffman (Eds.), *Review of child development research* (pp. 89-136). New York: Russell Sage Foundation.

Yoo, Kyung Aae. (1981). *The study of mother conservation type in social class differences*. Unpublished master's thesis, Chung Ang University. Seoul, Korea.

Zarour, G. (1971). The conservation of numbers and liquid by Lebanese school children in Beirut. *Journal of Cross-Cultural Psychology, 2*, 165-172.

APPENDICES

Appendix A

U. S. C. Parent Attitude Survey

Dear Mother:

We are enclosing a survey for the purpose of doctoral research study at Oregon State University in the United States.

Our research is concerned with maternal attitudes toward children and this survey will be used only for the purposes of doctoral research. Please complete the questionnaire. This survey is intended only for the use of the mother.

Please read each of the statements below. Rate each statement as to whether you strongly agree, mildly agree, mildly disagree, or strongly disagree. There are no right or wrong answers, so answer according to your own convictions. Work as rapidly as you can read. Give your first reaction. If you read and reread the statements it tends to be confusing. Please indicate your rating on each item using the scale below.

4--Strongly Agree
3--Mildly Agree
2--Mildly Disagree
1--Strongly Disagree

1.___Parents should sacrifice everything for their children.

2.___Quiet children are much nicer than little chatter boxes.

3.___Babies are more fun for parents than older children are.

4.___Children should be taught the value of money early.

5.___Children should not be coaxed or petted into obedience.

6.___Children should not annoy their parents with their unimportant problems.

7.___Parents should supervise a child's selection of playmates very carefully.

8.___A good way to discipline a child is to cut down his allowance.

9.___A child should never keep a secret from his parents.

10.___Parents should never enter a child's room without permission.

11.___Children should have as much freedom as their parents allow themselves.

12.___A child should be taught that his parents always know what is best.

13.___A child should always love his parents above everyone else.

14.___When they can't have their own way, children usually try to bargain or reason with parents.

15.___Children who fight with their brothers and sisters are generally a source of great irritation and annoyance to their parents.

16.___A child should not plan to enter any occupation his parents don't approve of.

17.___A child should have strict discipline in order to develop a fine strong character.

18.___The mother rather than the father should be responsible for discipline.

19.___Independent and mature children are less lovable than those children who openly and obviously want and need their parents.

20.___Jealousy is just a sign of selfishness.

21.___No one should expect a child to respect parents who nag and scold.

22.___A child should be shamed into obedience if he won't listen to reason.

23.___It is important for children to have some kind of religious upbringing.

24.___Parents are generally too busy to answer all a child's questions.

25.___It is best to give children the impression that parents have no faults.

26.___No child should ever set his will against that of his parents.

27.___Children should not be punished for disobedience.

28.___Strict discipline weakens a child's personality.

29.___Children should always be loyal to their parents above anyone else.

30.___Children should not be punished for doing anything they have seen their parents do.

31.___Children should be allowed to do as they please.

32.___Children need some of the natural meanness taken out of them.

33.___Children should be "babied" until they are several years old.

34.___A good way to discipline a child is to tell him his parents won't love him any more if he is bad.

35.___A child should have strict discipline in order to develop a fine, strong character.

36.___Children should be forbidden to play with youngsters whom their parents do not approve of.

37.___Severe discipline is essential in the training of children.

38.___Children have the right to play with whomever they like.

39.___Parents cannot help it if their children are naughty.

40.___Children should be allowed to go to any Sunday School their friends go to.

41.___A child should feel a deep sense of obligation always to act in accord with the wishes of his parents.

42.___Children who are gentlemanly or ladylike are preferable to those who are tomboys or "regular guys."

43.___The weaning of a child from the emotional ties to its parents begins at birth.

44.___Children should not be required to take orders from parents.

45.___Children should not interrupt adult conversation.

46.___The most important consideration in planning the activities of the home should be the needs and interests of children.

47.___Children resent discipline.

48.___Children should not be permitted to play with youngsters from the "wrong side of the tracks."

49.___When the parent speaks, the child should obey.

50.___Mild discipline is best.

51.___The best child is one who shows lots of affection for his mother.

52.___It is better for children to play at home than to visit other children.

53.___Most children should have more discipline than they get.

54.___A child should do what he is told to do, without stopping to argue about it.

55.___A parent should see to it that his child plays only with the right kind of children.

56.___Parents should always have complete control over the actions of their children.

57.___A child should always believe what his parents tell him.

58.___Children should fear their parents to some degree.

59.___Children should usually be allowed to have their own way.

60.___A good whipping now and then never hurt any child.

61.___Children who readily accept authority are much nicer than those who try to be dominant themselves.

62.___A child should always accept the decision of his parents.

63.___In the long run it is better, after all, for a child to be kept fairly close to his mother's apron strings.

64.___The children who make the best adults are those who obey all the time.

65.___Children should be allowed to manage their affairs with little supervision from adults.

66.___The child should not question the commands of his parents.

67.___Children should give their parents unquestioning obedience.

68.___Children should be trained from the cradle in habits of independent though and action.

69.___A child should be punished for contradicting his parents.

70.___Children should do nothing without the consent of their parents.

71.___A child should be seen and not heard.

Child's age (birth date) _____

Parents' age: father _____ mother _____

Parents' occupation:

father _____ mother _____

Parents' monthly income _____

Child's sex (female, male) _____

The last grade that father finished in school was _____

a) 6th grade
b) 7th grade
c) 8th grade
d) 9th grade
e) 1Øth grade
f) 11th grade
g) 12th grade
h) 1st year college
i) 2nd year college
j) 3rd year college
k) college graduate
l) graduate school or professional training

Appendix B

Sample Description, Social Class, Age, Maternal Attitude, and Gender Groups

	Soc Cl I				Soc Cl II				Soc Cl III				
	72B		72U		72B		72U		72B		72U		PA
	M	F	M	F	M	F	M	F	M	F	M	F	T
Possessive		37				34				22			
	15		22		18		16		22		Ø		93
	1Ø	5	14	8	6	12	6	1Ø	14	8	Ø	Ø	
Dominant		11				2Ø				31			
	5		6		11		9		25		6		62
	4	1	2	4	5	6	3	6	15	1Ø	2	4	
Ignoring		11				11				23			
	5		6		5		6		17		6		45
	4	1	3	3	2	3	4	2	11	6	4	2	
Totals		59				65				76			
	M		F		M		F		M		F		
Gender Totals:	37		22		26		39		46		3Ø		
	B		U		B		U		B		U		
Age Totals:	25		34		34		31		64		12		

Notes:

B = below 72 months of age
U = 72 or more months of age
M = Male
F = Female

Appendix C

Conservation Concept Diagnostic Kit

CONCEPT ASSESSMENT KIT—CONSERVATION

Marcel L. Goldschmid and Peter M. Bentler

RECORDING FORM

SCORES			
Task	Behavior	Explanation	Total
A			
B			
C			
D			
E			
F			
Total			

NAME_____ DATE_____

DATE OF BIRTH_____ AGE_____ SEX_____

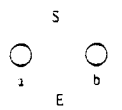
SCHOOL_____ GRADE_____

EXAMINER_____

COMMENTS_____

(A) SUBSTANCE

I. 2 equal balls



Make two equal balls of play doh (each 3 oz.), saying:

If the subject says they are both the same, go on to (II)

If the subject says one ball is larger, say:

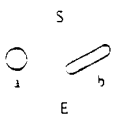
Continue to adjust the two balls until the subject says they are the same.

Here are two balls of play doh. There is the same amount of play doh in each ball. They are both alike. Is there as much play doh in this ball as in that one, or does one have more?

Let's make them the same. I am taking a little bit away from this one and adding it to that one.

Now, is there as much play doh in this one as in that one?

II. ball vs. hotdog



Roll one ball into a hotdog (6 inches long – use ruler), saying:

When finished, ask:

Record, and ask:

Record.

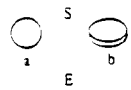
Now watch what I do. See, I am making this ball into a hotdog.

Now, is there as much play doh in this one, as in that one, or does one have more?

Why?

Same ☐
a has more ☐
b has more ☐ ____

III ball vs. pancake



Make the right ball into a pancake. Flatten the ball until the diameter is 4 inches (use ruler), saying:

When finished, ask:

(Do not allow the subject to pick up the ball or pancake)

Record, and ask:

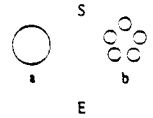
Record.

Watch what I am doing. See, I am making one of the balls into a pancake.

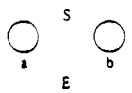
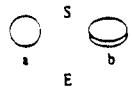
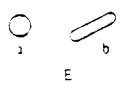
Now, is there as much play doh in this one, as in that one, or does one have more?

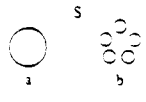
Why?

Same ☐
a has more ☐
b has more ☐ ____

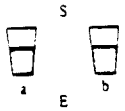
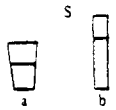
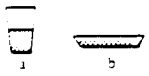
IV ball vs. 5 little balls 	*Make the right ball into 5 little balls of approximately the same size, and arrange them in a circle, saying:* *When finished, ask:* *(Do not allow the subject to pick up the balls.)* *Record, and ask:* *Record.*	Watch what I am doing. I am going to make little balls out of this ball. Now, is there as much play doh in this one as in that one? Why?	Same ☐ a has more ☐ b has more ☐	___

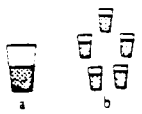
(B) WEIGHT

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 equal balls 	*Make two equal balls of play doh (each 3 oz.), saying:* *Give the balls to the child, and say:* *(Be sure that the subject picks up the balls and weighs them in his hands.)* *If the child says they weigh the same, go on to (II).* *If the subject says one weighs more, say:* *Give balls back to subject and ask:* *Continue to adjust the two balls until he says they weigh the same.*	Here are two balls of play doh. One ball is as heavy as the other ball. Is one ball as heavy as the other, or is one ball heavier than the other? Let's make them the same. I am taking a little bit away from this one and adding it to that one. Now are they the same? Is one ball as heavy as the other?		
II. ball vs. pancake 	*Make the right ball into a pancake. Flatten the ball until the diameter is 4 inches (use ruler), saying:* *When finished, ask:* *(Do not allow the subject to pick up the ball or pancake.)* *Record, and ask:* *Record.*	Watch what I am doing. See, I am making one of the balls into a pancake. Now, is the ball as heavy as the pancake, or is one heavier? Why?	Same ☐ a has more ☐ b has more ☐	___
III ball vs. hotdog 	*Roll one ball into a hotdog (6 inches long – use ruler), saying:* *When finished, ask:* *Record, and ask:* *Record.*	Now watch what I do. See, I am making this ball into a hotdog. Now, is the ball as heavy as the hotdog, or is one heavier? Why?	Same ☐ a has more ☐ b has more ☐	___

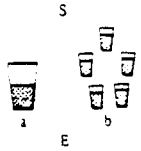
IV ball vs. 5 little balls  	*Make the right ball into 5 little balls of approximately the same size, and arrange them in a circle, saying:* *When finished, ask:* *(Do not allow the subject to pick up the balls.)* *Record, and ask:* *Record.*	Watch what I am doing. I am going to make little balls out of this ball. Now, is this ball as heavy as all these balls together or is one side heavier? Why?	Same ☐ a has more ☐ b has more ☐ ___

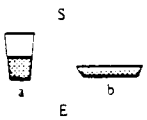
(C) CONTINUOUS QUANTITY

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. 2 large glasses  	*Place the two large glasses filled with an equal amount of water (150 ml) before the child, saying:* *Then, ask:* *If the subject says they both have the same amount, go on to (II).* *If the subject says one has more, adjust the water level, saying:* *Then, ask:* *Continue to adjust the water in the two glasses until he says that they both have the same.*	See, here are two glasses both filled with the same amount of water. Is there as much water in this glass as in that one, or does one have more? Let's make them the same. See, I am pouring a little from this glass into that one. Now, is there as much water in this one as in that one or does one have more?		
II. large glass vs. tall glass  	*Pour the water from the large glass into the tall glass, saying:* *When finished, say:* *Record, and ask:* *Record.*	Watch what I do. Is there as much water in this one as in that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐ ___	
III large glass vs. dish  	*Pour the water from right glass into the dish, saying:* *Remove empty glass, but leave it on the table, and ask:* *Record, and ask:* *Record.*	Watch what I do. Is there as much water in this one as in that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐ ___	

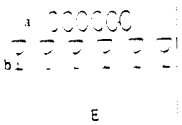
II. large glass vs. 5 small glasses S  E	*Pour the water from the large glass into the small glasses (arranged in a circle, close together) in equal amounts, saying:* *When finished, ask:* *Record, then ask:* *Record.*	Watch what I do. See, I am pouring the water from this glass into all of these glasses. Now, is there as much water in this one as in all of these together, or does one side have more? Why?	Same ☐ a has more ☐ b has more ☐	___

(D) DISCONTINUOUS QUANTITY

I. 2 large glasses S  E	*Place the two glasses, filled with an equal amount of corn (150 ml), in front of the child, saying:* *(Level the surface in both glasses.)* *If the subject says they both have the same, go on to (II).* *If the subject says one has more, say:* *Continue to adjust the corn in the two glasses, until he says they both have the same amount.*	See, here are two glasses both filled with the same amount of corn. Is there as much corn in this glass as in that one, or does one have more? Let's make them the same. See, I am pouring some corn from this glass into that one. Now, is there as much corn in this one as in that one, or does one have more?		
II. large glass vs. 5 small glasses S  E	*Pour the corn from the large glass into the small glasses (arranged in a circle, close together) in equal amounts, saying:* *When finished, ask:* *Record, then ask:* *Record.*	Watch what I do. See, I am pouring the corn from this glass into all of these glasses. Now, is there as much corn in this one as in all of these together, or does one side have more? Why?	Same ☐ a has more ☐ b has more ☐	___

II. large glass vs. tall glass  	*Pour the corn from the large glass into the tall glass, saying:* *When finished, say:* *Record, and ask:* *Record.*	Watch what I do. See, I am pouring the corn from this glass into that one. Now, is there as much corn in this one as in that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐ ___
III. large glass vs. dish  	*Pour the corn from the large glass into the flat dish, saying.* *When finished, ask:* *Record, and ask:* *Record.*	Watch what I do. Now, does this one have as much corn as that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐

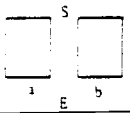
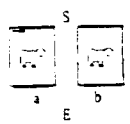
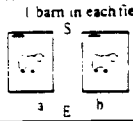
(E) NUMBER

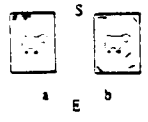
ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. Parallel egg-cups & eggs  	*Place 6 egg cups in a straight line about 4 inches apart. Parallel to these, stand 6 eggs in corresponding position, also in a straight line, saying:* *When finished, say:* *Remove eggs from cups.*	Watch what I do. Now, I want you to put each one of these eggs into the egg cup next to it.		
II. eggs vs. egg-cups  	*Restore the two lines of eggs and cups, but spread out cups (6 inches apart) and move eggs closer together (2 inches apart), saying:* *Then, ask:* *Record, then ask:* *Record.*	Watch what I do. Now, are there as many eggs as cups or are there more of one kind? Why?	Same ☐ a has more ☐ b has more ☐	___

NUMBER

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I. parallel red and white chips S a ●●●●●● b ○○○○○○ E	*Place 6 red chips in a straight line about 4 inches apart. Parallel to and below the red chips, place 6 white chips in corresponding position, also in a straight line, saying:* *When finished, say:* *If subject says there are as many red as white chips go on to (II)* *If he says one line has more than the other, say:* *Demonstrate to subject by pointing that they are the same, then, when he agrees, go on to (II)*	Watch what I do. Are there as many red chips as white chips or are there more red chips than white chips? No, look. There is one red chip for every white chip. Do you see now that there are as many red chips as white chips?		
II. red vs white chips S a ●●●●●● b ○○○○○○○ E	*Leave the two lines of chips in a horizontal position, one line below the other, but spread out the white chips (6 inches apart), and move the red chips closer together (2 inches apart), saying:* *When finished, ask:* *Record, and ask:* *Record.*	Watch what I do. Now, are there as many red chips as white chips, or is there more of one kind? Why?	Same ☐ a has more ☐ b has more ☐	____
2 equal large glasses S a b E	Place the two identical glasses and beads, and saying. One with each hand, and to drop them simultaneously into two identical glasses for a total of 6 beads in each Then ask : If the subjects they both have the same beads, go on to (II) If the subject says one has more, adjust the beads number, saying:	See; here are a lot of beads. Can you pick up 12 beads, two at a time. Is there as many beads in this glass as in that one, or does one have more ? Let's make the same. See, I am counting the beads. Now, is there as many bead in this one, or does one have more ?		
II. large glass vs. tall glass a b	Pour the beads from the glass into the tall glass, saying: When finished say: *Record, and ask:* *Record.*	Watch, what I do. See, I am pouring the beads from the glass into that one. Now, is there as much water in this one is in that one, or does one have more ? Why?	Same ☐ a has more ☐ b has more ☐	____

(F) AREA

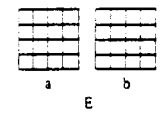
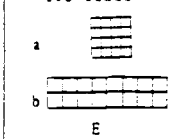
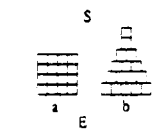
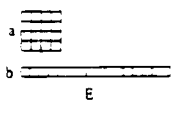
ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
(a) Presentation of boards 	*Place the 2 boards before S with the long sides parallel, about 2 inches apart, saying:*	Let's pretend that these boards are two fields of grass.		
	Superimpose the boards for a moment, saying:	See, they are the same size.		
	Then, replace boards as before.			
(b) 1 cow in each field. 1 barn in left field 	*Place one cow in the center of each board, saying:*	If we put a cow in each field, each cow has just as much grass to eat as the other cow.		
	Place a barn on left field, 2 inches from upper left corner, saying:	Now, Farmer Jones builds a barn on this* field. He has to take some of the grass away to make room for the barn.		
	Then, ask:	Now, show me which cow has more grass to eat.		
	Depending on subject's response, say:	Yes (or no), that *(point to b)* cow has more grass to eat, because the barn covers up part of this cow's grass.		
(c) 1 cow in each field 1 barn in each field 	*Hand a barn to S, saying:*	Take this barn, and put it in the field so this cow has just as much grass to eat as that one.		
	Give help if necessary, then, say:	Now, every time I put a barn in one field, I will also put a barn in the other field.		
1 2 barns vs. 2 barns 	*Taking up a barn in each hand, place a second barn in each field. On the left board, put second barn close beside first one. On right board put second barn in diagonally opposite corner from the first, saying:*	Watch what I do.		
	When finished, ask:	Now, does this cow have just as much grass to eat as that one, or does one have more grass to eat?	Same ☐ a has more ☐ b has more ☐	
	Record, and ask:	Why?		
	Record.			
4 barns vs. 4 barns 	Taking up a barn in each hand, place a four barn in each field. On the left board, put four barn close in one row of four barns in opposite corner, saying: When finished, ask:	Watch what I do. I am putting some more barns in each field.		
	Record, and ask:	Now, does this cow have as much grass to eat as that one, or does one have more grass to eat?	Same ☐ a has more ☐ b has more ☐	
		Why?		

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
III 6 vs. 6 barns 	*Place 4 barns, one at a time on each board simultaneously, picking up one with your left, and one with your right hand. On left board, place barns next to each other in two rows of 3 barns each. On right board, scatter barns over entire area except near edges, as in graph, saying:* *When finished, ask:* *Record, and ask:*	Watch what I do. You see, I am putting some more barns in each field. Now, does this cow have as much grass to eat as that one, or does one have more grass to eat? Why?	Same ☐ a has more ☐ b has more ☐	____

(G) DISTANCE

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
a —————— b — — — —	Place two car tracks which were painted on a board: One track formed a straight line, the other was segmented at right angles. The latter line, represent the same distance from A to B as the first track. Two toy cars place at the starting point of each track. Saying: Then moved one car on the first track over two segments, and then ask: and say: Record, and ask Record	You see these two car tracks. Watch what I do. Move your car on the second track? Now, is the B track as long as the A track, or is it longer or shorter? Why?		
a b	Two cow toy figures place on the table about 25 inches apart, then ask: A thin screen then place between the two figures, and ask: Record, and ask: Record *Record, and ask:* *Record.*	Whether the dolls "near each other" or far apart" Now, the distance between the dolls are same or is it longer or shorter? Why?	Same ☐ a has more ☐ b has more ☐	____
a b				

(I) TWO-DIMENSIONAL SPACE

ITEM	DIRECTIONS	VERBAL INSTRUCTIONS	RESPONSE	SCORE
I . 2 equal squares  	*Build 2 squares with 16 blocks of wood each, saying:* *When finished, ask:* *If the subject says they are the same, continue with (IV).* *If the subject says they are not the same, say:* *Demonstrate to subject by pointing that they are the same, then, go on to (IV).*	Watch what I do. Is there as much wood here as there, or does one have more? Look. This one is just as big as that one. See, they are both the same.		
II. square vs two lines  	Then take the blocks from the right square and build a two lines, each with 8 blocks of wood, saying When finished, ask: *Record. Then ask:* *Record, and say:*	Look. I am putting these blocks here. Now tell me. Is there as much wood here as there, or does one have more? Why? O.K. Let's do something else.	Same ☐ a has more ☐ b has more ☐	
III square vs. pyramid  	*Then, take the blocks from the right square and build a pyramid with a base of 5 blocks and successive levels of 4, 3, 2, 1 and 1 blocks, saying:* *When finished, ask:* *Record, then ask:* *Record.*	Watch what I do. Now, is there as much wood in this one as in that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐	
IV. square vs. single line  	*Then, take the blocks from the right square and build a single line with all 16 blocks, saying:* *When finished, ask:* *Record, then ask:* *Record.*	Watch what I do. Now, is there as much wood in this one as in that one, or does one have more? Why?	Same ☐ a has more ☐ b has more ☐	

Appendix D

Supplementary Tables

Table 11. Conservation of Substance: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	372.18	372.18	31.78***
Gender (B)	1	Ø.Ø4	Ø.Ø4	Ø.ØØ4
Social Class (C)	2	86.8Ø	43.4Ø	3.7Ø*
Maternal Attitude (D)	2	6.79	3.39	Ø.29
A × B	1	8.2Ø	8.2Ø	Ø.7Ø
A × C	2	3.13	1.56	Ø.13
A × D	2	18.67	9.33	Ø.79
B × C	2	2.47	1.23	Ø.1Ø
B × D	2	12.35	6.17	Ø.53
C × D	4	18.ØØ	4.5Ø	Ø.38
A × B × C	2	5.34	2.67	Ø.23
A × B × D	2	129.87	64.93	5.54**
A × C × D	4	72.69	18.17	1.55
B × C × D	4	2Ø.Ø3	5.ØØ	Ø.43
A × B × C × D	4	26.2Ø	8.73	Ø.75
Error	164	192Ø.88	11.71	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 12. Conservation of Weight: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	221.37	221.37	22.ØØ**
Gender (B)	1	Ø.11	Ø.11	Ø.Ø1
Social Class (C)	2	21.78	1Ø.89	1.Ø8
Maternal Attitude (D)	2	33.47	16.73	1.66
A X B	1	5.49	5.49	Ø.55
A X C	2	63.Ø7	31.53	3.13*
A X D	2	17.75	88.75	Ø.88
B X C	2	16.53	8.26	Ø.82
B X D	2	25.88	12.94	1.29
C X D	4	19.78	4.94	Ø.49
A X B X C	2	23.25	11.62	1.15
A X B X D	2	33.Ø4	16.52	1.64
A X C X D	4	48.75	12.18	1.21
B X C X D	4	11.17	2.79	Ø.28
A X B X C X D	4	32.41	1Ø.8Ø	1.Ø7
Error	164	1649.85	1Ø.Ø6	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 13. Conservation of Continuous Quantity: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	328.17	328.17	46.39***
Gender (B)	1	18.31	18.31	2.59
Social Class (C)	2	27.54	13.77	1.94
Maternal Attitude (D)	2	15.92	7.96	1.12
A X B	1	23.30	23.30	3.29
A X C	2	31.44	15.71	2.22
A X D	2	6.87	3.44	0.49
B X C	2	28.85	14.42	2.03
B X D	2	45.08	22.54	3.18*
C X D	4	14.42	3.60	0.51
A X B X C	2	16.97	8.48	1.19
A X B X D	2	41.18	20.59	2.91
A X C X D	4	25.49	6.37	0.90
B X C X D	4	13.49	3.37	0.48
A X B X C X D	4	22.57	7.52	1.06
Error	164	1160.31	7.07	
Total	199			

Notes: * = P < .05
** = P < .01
*** = P < .001

Table 14. Conservation of Discontinuous Quantity: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	229.57	229.57	2Ø.91***
Gender (B)	1	6.49	6.49	Ø.59
Social Class (C)	2	26.Ø6	13.Ø3	1.18
Maternal Attitude (D)	2	22.55	11.27	1.Ø2
A X B	1	3.59	3.59	Ø.32
A X C	2	1Ø.31	5.16	Ø.47
A X D	2	24.13	12.Ø6	1.Ø9
B X C	2	19.99	9.99	Ø.91
B X D	2	23.49	11.74	1.Ø7
C X D	4	57.65	14.41	1.31
A X B X C	2	19.51	9.75	Ø.89
A X B X D	2	63.44	31.72	2.89
A X C X D	4	5Ø.71	12.67	1.16
B X C X D	4	3Ø.74	7.68	Ø.7Ø
A X B X C X D	4	2Ø.35	6.78	Ø.62
Error	164	18ØØ.17	1Ø.97	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 15. Conservation of Number: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	1533.23	1533.23	117.93***
Gender (B)	1	56.21	56.21	4.32*
Social Class (C)	2	173.96	86.98	6.69**
Maternal Attitude (D)	2	216.Ø7	1Ø8.Ø3	8.31***
A X B	1	23.74	23.74	1.83
A X C	2	93.23	46.61	3.58*
A X D	2	89.42	44.71	3.43*
B X C	2	56.94	28.47	2.19
B X D	2	12.49	6.24	Ø.48
C X D	4	95.28	23.82	1.83
A X B X C	2	33.1Ø	16.55	1.27
A X B X D	2	12.72	6.36	Ø.49
A X C X D	4	98.78	24.69	1.9Ø
B X C X D	4	15.99	3.99	Ø.31
A X B X C X D	4	9.58	3.19	Ø.25
Error	164	2132.11	13.ØØ	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 16. Conservation of Area: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	454.57	454.57	46.5Ø***
Gender (B)	1	3.ØØ	3.ØØ	Ø.3Ø
Social Class (C)	2	16Ø.Ø2	8Ø.Ø1	8.18***
Maternal Attitude (D)	2	114.92	57.46	5.87**
A X B	1	Ø.Ø7	Ø.Ø7	Ø.ØØ7
A X C	2	8Ø.9Ø	4Ø.45	4.13*
A X D	2	82.55	41.27	4.22*
B X C	2	15.Ø9	7.54	Ø.77
B X D	2	18.85	9.42	Ø.96
C X D	4	53.ØØ	13.25	1.35
A X B X C	2	24.1Ø	12.Ø5	1.23
A X B X D	2	29.Ø2	14.51	1.48
A X C X D	4	29.55	7.38	Ø.76
B X C X D	4	76.1Ø	19.Ø2	1.95
A X B X C X D	4	22.8Ø	7.6Ø	Ø.78
Error	164	16Ø3.22	9.77	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 17. Conservation of Distance: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	7.Ø9	7.Ø9	Ø.85
Gender (B)	1	27.2Ø	27.2Ø	3.26
Social Class (C)	2	111.56	55.78	6.69**
Maternal Attitude (D)	2	Ø.21	Ø.1Ø	Ø.Ø1
A X B	1	7.46	7.46	Ø.89
A X C	2	41.2Ø	2Ø.6Ø	2.47
A X D	2	41.64	2Ø.82	2.49
B X C	2	23.8Ø	11.9Ø	1.42
B X D	2	11.67	5.83	Ø.7Ø
C X D	4	32.84	8.21	Ø.99
A X B X C	2	6.87	3.43	Ø.41
A X B X D	2	1.44	Ø.72	Ø.Ø9
A X C X D	4	82.53	2Ø.63	2.48*
B X C X D	4	33.ØØ	8.25	Ø.99
A X B X C X D	4	32.69	1Ø.89	1.31
Error	164	1366.41	8.33	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 18. Conservation of Length: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	189.1Ø	189.1Ø	19.Ø2***
Gender (B)	1	21.66	21.66	2.17
Social Class (C)	2	86.35	43.17	4.34*
Maternal Attitude (D)	2	88.59	44.29	4.45*
A X B	1	1Ø.61	1Ø.61	1.Ø6
A X C	2	24.21	12.1Ø	1.21
A X D	2	69.36	34.68	3.48*
B X C	2	5.53	2.76	Ø.27
B X D	2	16.2Ø	8.1Ø	Ø.815
C X D	4	44.45	11.11	1.12
A X B X C	2	8.44	4.22	Ø.42
A X B X D	2	52.88	26.44	2.66
A X C X D	4	27.79	6.94	Ø.7Ø
B X C X D	4	13.81	3.45	Ø.35
A X B X C X D	4	4.11	1.37	Ø.14
Error	164	163Ø.35	9.94	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 19. Conservation of Two-Dimensional Space: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	1131.29	1131.29	81.68***
Gender (B)	1	35.16	35.16	2.53
Social Class (C)	2	751.Ø2	375.5Ø	27.1Ø***
Maternal Attitude (D)	2	55.89	27.94	2.Ø1
A X B	1	5.63	5.63	Ø.4Ø
A X C	2	1Ø5.79	52.89	3.81*
A X D	2	96.11	48.Ø5	3.46*
B X C	2	1Ø8.21	54.1Ø	3.9Ø*
B X D	2	34.82	17.41	1.26
C X D	4	17.87	4.47	Ø.32
A X B X C	2	2.Ø4	1.Ø2	Ø.Ø7
A X B X D	2	37.27	18.63	1.35
A X C X D	4	67.6Ø	16.9Ø	1.22
B X C X D	4	27.14	6.78	Ø.49
A X B X C X D	4	6Ø.Ø9	2Ø.Ø3	1.45
Error	164	2271.35	13.84	
Total	199			

Notes: * = P < .Ø5
** = P < .Ø1
*** = P < .ØØ1

Table 20. Behavior Score: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	1171.62	1171.62	195.89***
Gender (B)	1	76.66	76.66	1.27
Social Class (C)	2	2197.63	1098.81	18.28***
Maternal Attitude (D)	2	675.19	337.59	5.61**
A X B	1	42.50	42.50	0.70
A X C	2	503.60	251.80	4.19*
A X D	2	280.03	140.01	2.33
B X C	2	318.36	159.18	2.64
B X D	2	69.39	34.69	0.57
C X D	4	275.48	68.87	1.14
A X B X C	2	61.77	30.88	0.51
A X B X D	2	436.48	218.24	3.63*
A X C X D	4	303.80	75.95	1.26
B X C X D	4	93.72	23.43	0.38
A X B X C X D	4	138.44	46.14	0.76
Error	164	9854.75	60.09	
Total	199			

Notes: * = P < .05
** = P < .01
*** = P < .001

Table 21. Explanation Score: MANOVA, By Age, Gender, Social Class, and Maternal Attitude.

Source	df	SS	MS	F
Age (A)	1	4948.94	4948.94	102.30***
Gender (B)	1	20.70	20.70	0.42
Social Class (C)	2	1467.82	733.91	15.17***
Maternal Attitude (D)	2	722.71	361.35	7.46**
A X B	1	0.00	0.00	0.00
A X C	2	780.49	390.24	8.06***
A X D	2	965.97	482.98	9.98***
B X C	2	269.05	134.52	2.78
B X D	2	141.28	70.64	1.46
C X D	4	38.74	9.68	0.20
A X B X C	2	19.83	9.92	0.20
A X B X D	2	362.02	181.01	3.74*
A X C X D	4	252.78	63.19	1.30
B X C X D	4	28.23	7.05	0.14
A X B X C X D	4	175.26	58.42	1.20
Error	164	7933.50	48.37	
Total	199			

Notes: * = P < .05
** = P < .01
*** = P < .001

Table 22. Student's Newman-Keuls Q Test by Age, Social Class.

CG	Weight	Number	Area	T-D Space	Behavior Score	Explanation Score
			Age 1 x Social Class			
I	Ø.24<1.92	Ø.42<2.19	Ø.57<1.89	2.53<2.26	2.87<4.71	2.53<4.22
II	Ø.13<1.7Ø	Ø.72<1.93	Ø.51<1.67	Ø.63<1.99	2.15<4.16	Ø.1Ø<3.73
III	Ø.17<1.35	Ø.55<1.53	Ø.39<1.33	1.31<1.58	2.26<3.31	Ø.94<2.96
			Age 2 x Social Class			
I	Ø.35<1.8Ø	1.57<2.Ø5	1.59<1.78	2.32<2.12	3.21<4.42	4.62>3.96
II	1.Ø3<1.86	Ø.35<2.12	1.18<1.84	Ø.35<2.19	Ø.96<4.57	Ø.73<4.Ø9
III	1.64<2.72	3.54>3.Ø9	3.5Ø>2.68	5.65>3.19	11.5>6.66	11.Ø>5.97

Table 23. Student's Newman-Keuls Q Test by Age, Maternal Attitude.

CG	Number	Area	Length	T-D Space	Behavior Score	Explana-tion Score
			Age 1 x Maternal Attitude			
P	Ø.55<1.63	Ø.27<1.41	Ø.24<1.42	Ø.13<1.68	1.15<3.5Ø	Ø.11<3.14
D	Ø.36<1.78	Ø.11<1.54	Ø.11<1.56	Ø.11<1.84	1.14<3.84	Ø.18<3.44
I	Ø.56<2.12	Ø.39<1.84	Ø.31<1.86	Ø.43<2.19	Ø.52<4.56	Ø.Ø5<4.Ø9
			Age 2 x Maternal Attitude			
P	2.22>1.96	2.Ø3>1.7Ø	1.66<1.71	2.31>2.Ø2	4.91>4.21	6.2Ø>3.78
D	1.14<2.51	2.3Ø>2.17	1.59<2.19	2.85>2.58	5.45>5.39	6.55>4.83
I	3.54>2.61	1.84<2.26	1.83<2.28	1.82<2.69	4.55<5.62	6.Ø5>5.Ø4

Notes: CG = Comparing Group; P = Possessive; D = Dominant; I = Ignoring

Table 24. Student's Newman Keuls Q Test by Gender, Maternal Attitude.

Group (Continuous Quantity)	Male x MA	Female x MA
Possessive	1.Ø7 < 1.26	Ø.21 < 1.36
Dominant	1.ØØ < 1.48	Ø.Ø6 < 1.55
Ignoring	Ø.73 < 1.56	Ø.65 < 1.94

Table 25. Student's Newman Keuls Q Test by Gender, Social Class.

Group (Two-Dimensional Space)	Male x SC	Female x SC
SC I	3.93 > 1.77	2.22 > 1.91
SC II	1.Ø4 < 1.Ø7	Ø.58 < 2.17
SC III	3.57 > 2.18	2.53 < 2.72

Table 26. Student's Newman Keuls Q Test by Gender, Social Class, and Maternal Attitude (Distance).

Age 1 × SI	Ø.64 < 2.29		SI × M1	Ø.15 < 3.49	
M1	Ø.79 < 2.95		M2	1.56 < 4.76	
M2	Ø.92 < 4.38		M3	1.44 < 5.13	
M3	2.Ø8 < 4.77				
SII	Ø.48 < 2.Ø2		SII × M1	1.28 < 3.Ø4	
M1	1.76 < 2.64		M2	1.74 < 3.63	
M2	1.26 < 3.29		M3	Ø.76 < 5.Ø1	
M3	Ø.28 < 4.77				
SIII	Ø.Ø1 < 1.61		SIII × M1	Ø.12 < 2.58	
M1	Ø.11 < 2.42		M2	Ø.15 < 2.47	
M2	Ø.16 < 2.29		M3	Ø.Ø5 < 2.85	
M3	Ø.Ø4 < 2.71				
Age 2 × SI	1.49 < 2.15		SI × M1	Ø.Ø1 < 2.86	
M1	1.48 < 2.53		M2	1.48 < 4.63	
M2	1.26 < 4.44		M3	Ø.27 < 4.63	
M3	1.76 < 4.44				
SII	1.15 < 2.23		SII × M1	1.22 < 3.22	
M1	Ø.Ø7 < 2.87		M2	1.43 < 3.96	
M2	2.58 < 3.69		M3	1.Ø9 < 4.67	
M3	2.24 < 4.44				
SIII	1.24 < 3.25		SIII × M1	3.ØØ < 1Ø.9	
M1	1.76 < 1Ø.54		M2	Ø.6Ø < 5.57	
M2	1.84 < 4.83		M3	Ø.ØØ < 4.38	
M3	1.24 < 4.44				

Notes: SI = Social Class I; SII = Social Class II; SIII = Social Class III; M1 = Possessive Maternal Attitude; M2 = Dominant Maternal Attitude; M3 = Ignoring Maternal Attitude.

Table 27. Student's Newman Keuls Q Test by Gender, Age, and Maternal Attitude (Substance, Behavior, Explanation).

	Substance	Behavior Score	Explanation Score
Male x Age 1	1.18 < 1.45	6.14 > 3.28	3.79 > 2.95
M1	1.13 < 2.Ø1	5.59 > 4.54	3.94 < 4.Ø8
M2	1.24 < 2.1Ø	6.67 > 4.76	3.49 < 4.27
M3	1.15 > 2.47	6.28 > 5.59	3.97 < 5.Ø2
Male x Age 2	2.1Ø > 1.76	11.Ø2 > 4.Ø1	6.8Ø > 3.59
M1	2.94 > 2.25	18.Ø5 > 5.12	15.29 > 4.59
M2	2.Ø8 < 3.69	3.2Ø < 8.37	3.61 < 7.51
M3	Ø.53 < 2.99	2.58 < 6.79	2.8Ø < 6.79
Female x Age 1	Ø.97 < 1.65	6.Ø3 > 3.73	4.18 > 3.35
M1	Ø.17 < 2.14	3.98 < 4.85	3.68 < 4.35
M2	1.88 < 2.5Ø	8.21 > 5.67	5.Ø8 < 5.Ø9
M3	2.23 < 3.15	7.46 > 7.15	3.86 < 6.42
Female x Age 2	1.32 < 1.83	8.26 > 4.15	5.72 > 3.73
M1	Ø.29 < 2.44	1Ø.4Ø < 5.54	9.Ø4 > 4.97
M2	1.46 < 2.81	5.Ø4 < 6.37	1.65 < 5.71
M3	3.77 > 3.71	8.74 > 8.42	4.75 < 7.55
Male x Age 1			
x M1	Ø.Ø5 < 2.11	Ø.55 < 4.8Ø	Ø.15 < 4.31
M2	Ø.Ø6 < 2.21	Ø.53 < 5.ØØ	1.3Ø < 4.48
M3	Ø.Ø3 < 2.56	Ø.14 < 5.81	Ø.18 < 5.2Ø
Male Age 2			
x M1	Ø.85 < 2.56	7.Ø4 > 5.81	8.49 > 5.21
M2	Ø.Ø2 < 3.89	7.82 < 8.81	1Ø.41 > 7.9Ø
M3	1.57 < 3.23	8.44 > 7.32	7.45 > 6.57
Female x Age 1			
x M1	1.14 < 2.3Ø	2.Ø5 < 5.22	Ø.5Ø < 4.68
M2	Ø.91 < 2.65	2.18 < 5.99	1.9Ø < 5.38
M3	1.26 < 3.27	1.43 < 7.41	Ø.32 < 6.65
Female x Age 2			
M1	1.Ø5 < 2.71	2.14 < 6.14	3.32 < 5.51
M2	Ø.14 < 3.Ø4	3.22 < 6.89	4.Ø7 < 6.18
M3	2.45 < 3.89	Ø.46 < 8.83	Ø.97 < 7.92

Notes: M1 = Possessive Maternal Attitude; M2 = Dominant Maternal Attitude; M3 = Ignoring Maternal Attitude.