

STATEMENT OF PERMISSION TO COPY

In present this paper in partial fulfillment of the requirements for an advanced degree at Montana State University, I agree that the Library shall make it freely available for inspection. I further agree that permission for extensive copying of this paper for scholarly purposes may be granted by my major professor, or in his absence, by the Director of Libraries. It is understood that any copying or publication of this paper for financial gain shall not be allowed without my written permission.

Signature

William O. Miller

Date

July 26, 1977

THE STAGES OF INTELLECTUAL DEVELOPMENT OF HELENA JUNIOR HIGH SCHOOL
EIGHTH GRADE STUDENTS ACCORDING TO THE PIAGETIAN MODEL

by

DALLAS ORVIN MILLER

A professional paper submitted in partial fulfillment
of the requirements for the degree

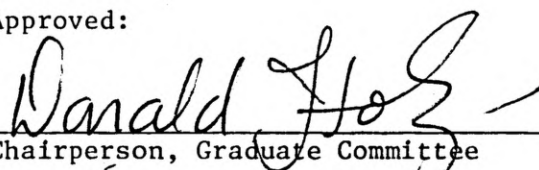
of

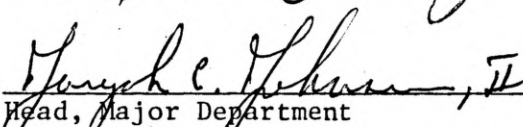
MASTER OF EDUCATION

with concentration in

Elementary Administration

Approved:


Chairperson, Graduate Committee


Head, Major Department


Graduate Dean

MONTANA STATE UNIVERSITY
Bozeman, Montana

August, 1977

ACKNOWLEDGMENTS

I would like to thank Professor Donald M. Holz for his many patient hours, understanding, and help with this project. "Thanks" seems hardly enough.

I wish to express my thanks to Dr. Eleanor A. Old Coyote, Dr. Douglas Herbster, and Dr. Gregory Stefanich for serving on the committee. Their help and support were deeply appreciated.

Mr. Archie H. Lucht and Mr. Ervin Winslow gave me full cooperation so that this study could become a reality. I am extremely grateful to both of them.

Lastly, I would like to thank my parents who instilled in me the belief that I could succeed.

TABLE OF CONTENTS

VITA	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
ABSTRACT	vii

Chapter	Page
1. INTRODUCTION	1
Statement of the Problem	2
Purpose of the Study	2
General Questions Answered	2
General Procedures	3
Limitations and/or Delimitations	3
Definition of Terms.	4
Summary.	5
2. REVIEW OF LITERATURE	7
Stages of Intellectual Development	7
Piagetian Studies.	10
Application to Teaching	12
Summary.	13
3. PROCEDURE.	16
Population	16
Testing Procedure	16
Method of Collecting Data	19
Method of Organizing Data.	20
Statistical Hypotheses	21
Precautions Taken for Accuracy	22
Summary.	22
4. ANALYSIS OF DATA	23
Population	23
Organization of Findings	23
Summary.	31

Chapter	Page
5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.	33
CONCLUSIONS	34
RECOMMENDATIONS	34
BIBLIOGRAPHY.	36
APPENDICES	39
Appendix A	40
Appendix B	44

LIST OF TABLES

Tables	Page
1. The Operational Levels of Student(s) Population.	24
2. The Operational Levels of Male and Female (Students)	25
3. Operational Levels of Students Based on Age.	27
4. The Operational Levels of Males 12 to 13.5 Years Old	28
5. The Operational Levels of Females 12 to 13.5 Years Old	29
6. The Operational Levels of Males 13.5 to 15 Years Old	30
7. The Operational Levels of Females 13.5 to 15 Years Old	31
8. Individual Student Data Pertaining to Sex, Age Task Performance, Majority Score and Means	45

ABSTRACT

The problem of this study was to determine the stage of intellectual development according to the Piagetian Model of 141 eighth grade students at Helena Junior High School during the 1976-77 school term. The students were randomly assigned by computer.

Test data was collected from three Piagetian task tests administered in the researcher's classroom. These results of the tests were verified by three general questions dealing with the population, sex, and age.

General conclusions were: 1) there was no significance between males and females with regard to their performance on Piagetian tasks; 2) the population was predominantly in concrete operations; and 3) students 12 to 13.5 years old were more adept at employing formal thought processes.

Recommendations were: 1) a study should be undertaken comparing effectiveness of traditional teaching techniques and methods reflecting the child's operational level according to the Piagetian model; 2) future research should employ more than three Piagetian tasks; 3) similar studies should be undertaken in other academic disciplines; and 4) a study of preoperational adolescents could be of value in reading, spelling or mathematics.

Chapter 1

INTRODUCTION

Educators must attempt to understand how children think in order to make their school years meaningful. Jean Piaget spent many years discovering the nature and direction of children's intellectual development. The study undertaken in this paper was concerned with the Piagetian periods of intellectual development at which eighth grade pupils in a junior high school were operating. The study population was measured involving three of the four developmental periods in the Piagetian Model. These developmental stages are:

PREOPERATIONAL PERIOD (two to seven years) Characterized by Egocentric thinking expressed in animism, artificialism, realism, and magic omnipotence.

a. Preconceptual Stage (two to four years) Development of perceptual constancy and of the representation through drawings, language, dreams, and symbolic conceptualization, in which representatives of a class are not distinguished from the class itself (e.g., All dogs are called by the name of the child's own dog).

b. Preceptual or Intuitive Stage (four to seven years) Prelogical reasoning appears, based on preceptual appearances untempered by reversibility (e.g., Grandma in a new hat is no longer recognized as Grandma). Trial and error may lead to an intuitive discovery of correct relationships, but the child is unable to take more than one attribute into account at one time (e.g., Brown beads cannot at the same time be wooden beads).

CONCRETE OPERATIONAL PERIOD (seven to eleven years) Characterized by thought that is logical and reversible. The child understands the logic of classes and relations and can coordinate series and part-whole relationships dealing with concrete things.

FORMAL OPERATIONAL PERIOD (eleven years to adulthood) Characterized by the logic of propositions, the ability to reason from a hypothesis to all its conclusions, however, theoretical. This involves second order operations, or thinking about

thoughts of theories rather than concrete realities (Pulaski, 1971:208).

Statement of the Problem

The problem of this study was to determine the stage of intellectual development according to the Piagetian Model using selected eighth grade social studies students at Helena Junior High during the 1976-77 school term.

Purpose of the Study

The importance of the problem and this study was to provide a useful tool for arriving at the most effective method of teaching academic material to eighth grade pupils. All too often educators have assumed that youth older than twelve years of age were fully functional at the formal operations level of intellectual development without testing to ascertain the level at which pupils are functioning. This needed to be undertaken so that teachers at Helena Junior High School may have a more accurate insight as to how their students operate intellectually. The result of this information would serve as the basis for the development of specific modes of instruction to serve the needs of the students.

General Questions Answered

Through testing pupils with the three Piagetian tasks, (The Test of Floating Bodies, The Test of Flexibility and the Operations,

Mediations the Separation of Variables, and The Oscillation of the Pendulum Test) the following questions were answered:

1. Do eighth grade students at Helena Junior High School function at the Formal, Concrete, or Preoperational Period?
2. Will performance be influenced by the pupils' sex?
3. Will the subjects tested in this study demonstrate an increase in their operational ability corresponding with increased age?

General Procedures

The first procedure was to review related literature. People experienced with Piagetian tasks and the methods of Piaget were interviewed to obtain information about practical test application. Finally the Piagetian test types were screened so that appropriate selection could be made to develop a meaningful test. This enabled the researcher to test the subjects and report his findings in accordance with the study guidelines.

Limitations and/or Delimitations

This study was restricted to the examination of eighth grade students at Helena Junior High School who would be twelve no later than November 1, 1976, and who would not exceed fifteen years of age. The delimitation imposed on the study was to exclude the extreme age factor.

This study was further limited by the ruling of the building principal that no questions regarding parents marital status, income of the family, religious preference, ethnic heritage, or questions relating to other school age siblings of the same family would be asked.

Definition of Terms

Accommodation. The process of reading out and adjusting to new and changing conditions in the environment, so that pre-existing patterns of behavior are modified to cope with new information or situations is accommodation (Pulaski, 1971:221).

Assimilation. The process of taking from the environment all forms of stimulation and information, which are then digested and reintegrated into the organism's existing forms or structures is known as assimilation (Pulaski, 1971:221).

Cognition. All of the intellectual activities of the mind, such as thinking, nowing, remembering, perceiving, recognizing, or knowing is cognition (Pulaski, 1971:224).

Junior high setting. A situation where a school has the seventh, eighth, and ninth grades exclusively is known as a junior high setting.

Operations: The interiorized activities of the mind, as opposed to the sensory-motor or physical activities of the body. Characterized by logical thought processes which are reversible.

Concrete operations. Concrete or tangible existing objects which include ordering, serial arrangements, and classifications, as well as mathematical processes is known as concrete operations.

Formal or second order operations. Formal or second order operations are concerned with logical propositions and hypothetical reasoning, based on theoretical constructs rather than concrete objects (Pulaski, 1971:227).

Stages. Levels of development characterized by successively more complex behavior and more highly integrated patterns of thought or behavior. These are usually characteristics of certain chronological ages which are known as stages (Pulaski, 1971:228).

Summary

The problem of this study was to determine the intellectual development of eighth grade students at Helena Junior High School. This development was measured using the Piagetian Model.

The study will answer a number of general questions. Do eighth grade students at Helena Junior High School function at the formal, concrete, or preoperational period? Will performance be influenced by the pupils sex? Will the subjects tested in this study demonstrate an increase in their operational ability corresponding with increased age?

In order to clarify the limits of the study, its limitations

were stated. Working definitions used in the study were included.

The general procedures were outlined.

The goal of this study was to make available information which would be useful in developing teaching procedures appropriate for eighth grade students at Helena Junior High School.

Chapter 2

REVIEW OF LITERATURE

The literature reviewed in this chapter will be confined to three specific areas of Piagetian theory and research. They are 1) stages of intellectual development according to Piaget; 2) studies relating to Piagetian research; and 3) possible application of Piagetian research in education.

Piaget's work was not widely observed in the United States until recent years. The prominence of B.F. Skinner may account in part for this fact. The problem of translation into English and Piaget's training as a biologist rather than as a formally trained psychologist may be other factors which impeded American interest.

Piaget's work and research related to his findings indicate many students in schools are asked to perform tasks above their capabilities. The results of these investigations seem to indicate a need to alter teaching strategies to meet individual student needs.

Stages of Intellectual Development

Piaget constructed a hierarchy of intellectual development arranged in four stages. According to Pulaski (1971:24-29) these stages are: 1) sensory motor stage, which spans from birth to 18 months approximately; 2) preoperational stage, usually spanning 18 months through 7 years of age; 3) concrete operational stage, which spans from 7 years to 11 years of age; 4) formal operational stage,

beginning at approximately at age 11 or 12 (on) through adulthood.

During the preoperational stage, often called the instructive substage, children require structured activities and games tending to knowledge and acquisition of concepts. These concepts need to be followed by practice and drill (Beard, 1969:73). At the concrete operational stage, children need tangible objects to manipulate through which they gain concepts. Using these objects over a span of time children usually evolve and enter formal operations (Beard, 1969: 92-96). A child in the formal operational stage has the ability to reason, abstract, and hypothesize with ideas and symbols. At this point the need the need for tangible objects to manipulate as a basis of his thought process is reduced (Beard, 1969:113-118).

A large discrepancy develops concerning the age of which children enter the formal operational stage. Piaget (1950:148) said "An individual who thinks beyond the present and forms theories about everything, delighting especially in consideration of that which is not . . . has entered formal operations and should be encouraged." Piaget seems to be saying that an environment of cooperation and discussion may be as, or more important, than age alone. Cooperation is the first of a series of forms of behavior for the development of logic. Although Piaget states the stages he set forth are not fixed, they must come in order according to Maier (1965:147) and Sklar (1975: 118-123). No stage is omitted or passed through out of sequence. The

order is constant: sensory motor, preoperational, concrete operational, formal operational. Many factors influence the time a child will spend at various levels of intellectual development.

As to the onset of formal thought Piaget and Inhelder state:

. . . even though the appearance of formal thought is not a direct consequence of puberty, could we say that it is a manifestation of cerebral transformations due to the maturation of the nervous system and that these changes do have a relation, direct or indirect, with puberty? Given that in our society the 7-8 year old child (with rare exceptions) cannot handle the structures which the 14-15 year old adolescent can handle easily, the reason must be that the child does not possess a certain number of coordinations whose dates of development are determined by stages of maturation (1958:336).

Piaget and Inhelder (1958:337) go on to state that cultural and educational conditions can retard or accelerate the emergence of the formal operational process. The environment does make a difference as to the speed at which these stages will be achieved. They also will not be the same ages for all children in like environments. Also to be considered is the child's basic intelligence. Piaget stated

Concerning the problem of intelligence . . . from its beginnings, due to the hereditary adaptations of the organism, intelligence finds itself entangled in a network of relations between the organism and the environment. Intelligence does not therefore appear as a power of reflection independent of the particular position which the organism occupies in the universe but is linked, from the very onset, by biological apriorities. It is not all an independent absolute, but is a relationship among others, between the organism on things (1952:19).

Considering these many variables it is a difficult task to affix age limits to Piaget's stages.

Piagetian Studies

A variety of studies surrounding Piaget's work have shown that the emergence of formal thinking usually does not occur until the middle or later adolescence. Mealing's study (1963:194-207) one of the first done outside of continental Europe, suggested

A mental age of at least 13 years is required before boys and girls structure relations between relations or make use of proportional reasoning, and that a mental age of 15 or 16 years must be reached before thinking at the level of formal operations can be expected.

Ross (1975:119) attempted to prove Piaget's thesis that elements of formal thinking began at ages 11 or 12 and full formal operations would be developed by age 15. Ross used a questionnaire designed by R. P. Tischer and administered it to 35 sixth graders and 43 tenth graders. The groups were approximately split between moderate and high achievers. The study indicated that 1) formal thinking appeared in higher achieving sixth graders; 2) there was a significant increase in formal operational thought from the sixth grade to the tenth grade; and 3) tenth graders were in the 40-50 percent range irrespective of the achievement level.

Ross compared these findings to his 1972 study conducted with undergraduates at a university in Mississippi. That study showed 70 percent of college undergraduates capable of formal operational thought. When this information is compared to the results of his later works showing 40 percent of tenth graders in formal operations

it can be concluded there is continued growth toward formal operational thought on Piagetian tasks. He suggests somewhere between early high school and middle college years many people are beginning to utilize formal operational thinking.

A study that was released in June, 1975, involved seven countries utilizing proportional reasoning and control of variables tasks (Karplus, et. al. 1975:39-50). This study was done by Robert Karplus, Elizabeth Karplus, Marina Formisano, and Albert-Christian Paulsen. The population of 3600 students was split about evenly between girls and boys. The ages ranged between 13 and 15 years. The countries involved were Denmark, Sweden, Italy, Austria, United States, Germany, and Great Britain. Two tasks (proportional reasoning and control of variables) were used to obtain the following results:

1. Only Italian upper middle class prep school boys used formal operational thought on the tasks used while urban low income groups in the United States appeared to lack formal thought.
2. The United States population did not compare favorably with the approximately equivalent European groups, especially European boys.
3. Urban, low income boys in the United States performed in an average range in the control of variables task, whereas they were virtually unable to perform the proportional reasoning task.
4. The United States was the only country where the propor-

tional reasoning task had a lower success level than the control of variables task.

Karplus (1975:48) actually found 251 students or 7 percent were using formal operational thought. Karplus (1975:46) said their findings supported the findings of others in that the development of formal thought among adolescents is a gradual and incomplete process.

Application to Teaching

Using the preceding studies as a gauge to the development of children, many teachers incorrectly assume their students are miniature adults. Karplus (1964:113) felt this was a common mistake when he said:

Teachers with whom I have been in contact have not seemed to be much aware that there is such a change taking place and I would say that most instruction above the kindergarten takes place on what one might call the formal level. As an unfortunate consequence of this fact many students never understand the intent of instruction and become dissatisfied with school by the time they are fourteen or sixteen.

Formal and concrete operational children can be identified. A study released in 1975 conducted by Edward M. Docherty (1975:14-19) said stage identification can be done to facilitate grouping. The purpose was to make most applicable teaching strategies available to student needs. He assigned ten Piagetian tasks (five at concrete level and five at the formal level) to 64 students. The population consisted of eight girls and eight boys in each of the grade levels (2, 4, 6, 8). Docherty used a cluster analysis on the results of the

ten tasks and concluded this useful to identify formal and concrete operational students.

Piaget (1952:187) asks the question,

For the physical science and mathematics, the invariant sequences are readily apparent. Is the system as applicable for other fields of knowledge, e. g., history, economics, etc.?

Teffer and Suchotleff answer the question by saying,

It would be therefore reasonable to assume that information from the social environment is acquired by the same mechanisms. Thus, the social science builder may well find that the relevance of Piaget to his area of concern. . . . How knowledge is utilized and how the problems are solved are means of identifying the underlying mental operations. The teacher who observes how a child thinks and reasons in one area will be alerted to how the child thinks and reasons in other areas. For example, the teacher who knows that a child is a nonconservers should be alert to the possibility of nonconservation in social science concepts (1966: 415-418).

Summary

Piaget established a model of intellectual development. The stages of the Piagetian model are 1) sensory-motor stage (0-18 months); 2) preoperational stage (17 months - 7 years); 3) concrete operational stage (7 years to 11 or 12 years approximately); 4) formal operational stage (11 years on through adulthood). Formal operations is the most advanced stage and with it comes the ability to apply abstract logical thought.

Students often have difficulty with the transition from concrete operations to formal operational thought. Conditions of cooperation and discussion are helpful for this student according to Piaget.

Studies have been undertaken to identify these students.

Ross, in a 1974 study, set about to validate Piaget's assertion that elements of formal operations began at age eleven or twelve and continued until middle adolescence. His study revealed three facts: 1) there was a significant increase in formal thinking from the sixth to tenth grade; 2) formal thinking is found in high achieving sixth graders; 3) the percentage of tenth graders demonstrating formal thinking converge to the 40-50 percent range irrespective of achievement level.

In 1975, Robert Karplus directed a massive study in seven countries testing 13 to 15 year old children. The test had two components (proportional reasoning and control of variables). He concluded three facts: 1) 7 percent of 3600 children tested used formal thought; 2) the United States population did not compare with the approximately equivalent European group, especially boys; 3) urban low income boys in the United States performed in an average range in the control of variables task whereas they were virtually unable to perform the proportional reasoning task.

The results of these studies can be useful to teachers. Although most of the research projects dealt with mathematics and science, social studies teachers can also utilize this data. The reasoning process is not basically dependent on subject matter. Instructional approaches related to the Piaget model are therefore

determined by the child's operational stage.

Chapter 3

PROCEDURE

The purpose of this study was to determine the level of intellectual development of eighth grade pupils at Helena Junior High School in Helena, Montana, according to the Piagetian Model. Care will be taken to develop an exact set of procedures, and a proper evaluation to convert data into useful information.

Population

The population consisted of eighth grade students assigned to Helena Junior High School in Helena, Montana, during the 1976-77 school term. Members of the population were no less than twelve years old and no more than fifteen years and zero days on November 1, 1976. These students were a cross section of normal, regularly enrolled eighth graders. The population included approximately 141 pupils selected by computer.

Testing Procedure

Subjects in this study were tested on a group basis. By using a group testing procedure, it was possible to involve the entire population.

The administration of each of the three Piagetian tasks required not less than thirty minutes and not more than forty-five minutes. The administering took place at two week intervals during the

months of September, October, and November. The students were all tested on the same days from the hours of 8:35 a.m. to 2:40 p.m. in five groups of approximately 25-30. Those students absent were tested individually or in small groups as soon as possible after the original testing days.

The first Piagetian task is known as the Test of Floating Bodies. The subjects were presented with seven varied objects and asked to classify them as to whether they would or would not float on water. The subjects were asked for the reasons for their classifications. After the subjects had given their reasons, the researcher tested their hypotheses by putting each object in the aquarium of water provided for that purpose. After testing each object's ability to float, the subjects were asked to formulate a law using their own intuition to explain why objects float. The researcher waited 5-7 minutes for the subjects' formulation of the law (Piaget and Inhelder, 1958:20-46).

The second test is known as the Test of Flexibility and the Operations Mediation, the Separation of the Variables. The researcher presented the subjects with an aquarium of water and a set of nine rods of various composition (steel, copper and brass), length and thickness which could be attached horizontally by the use of a clamp to the aquarium's edge. The subjects were presented with three weights which could be interchangeably attached to the end of the rods. The subjects were first asked to speculate which rods in combination with

the weights were flexible enough to just touch the water, which would not reach, and which rods would sink with which weights. The subjects were then asked to verbalize their reasons for this set of hypotheses. The researcher then tested the hypotheses after which the subjects were asked to formulate and write a law explaining flexibility. It was possible to obtain adequate equipment and the students did in small groups, test their hypotheses. After 5-7 minutes they were asked for proof of their laws (Piaget and Inhelder, 1958:47-66). The second set of hypotheses were tested by the researcher. The subjects were then asked to formulate a law to explain the oscillation rates (Piaget and Inhelder, 1958-67-79).

The effect of contaminating factors were controlled by eliminating deviations in the fast format. The researcher conducted the three tasks tested at three settings. All tests were administered to five groups of 25-30 students. The opening explanation explained that this is a research project which will in no way effect the school life of the subjects. The subjects were further assured that their responses as individuals, would be held in strict confidence. All subjects were asked a few short questions about age, date of birth, and sex. The three tasks were administered in a quiet atmosphere. The subjects were thanked as a group upon the completion of each task.

Method of Collecting Data

All data was collected in the researcher's classroom. The response of the subjects were recorded on an individual test form designed by the researcher to record the data in a uniform manner. A narrative of the responses made by the subjects were immediately recorded upon the completion of the Piagetian tasks.

The written responses to the tasks were compared to the categories to be found in the text of The Growth of Logical Thinking from Childhood to Adolescence, written by Jean Piaget and Barbel Inhelder in 1958. This researcher found no inconsistencies. In the event he had, he would have taken the written responses to Montana State University at Bozeman, Montana, for interpretation.

The researcher could not obtain data on the reliability of the task tests previously described. The researcher determined from the test results whether each subject had performed at a consistent level on each task. If they did not, the researcher used a system of majority to determine the performance of the subject (e.g., formal-formal-concrete .'. formal).

Piaget and Inhelder have performed these task tests literally more than ten thousand times. Piaget formed the Piagetian Model and is still the foremost authority on it. The model describes the stages of intellectual development. Examining these task tests in light of the model, one can see that the test measures the responses of the

subject as being either at the formal, concrete, or preoperational level of intellectual development. Therefore this testing procedure has substantitive validity due to the replication of tasks and contemporary research.

Method of Organizing Data

All data used in Chapter 4 are on tables displaying population numbers or percentages. These tables are organized in the following manner: column 1 - formal operations; column 2 - concrete operations; column 3 - preoperations; column 4 - totals; column 5 - means (for population numbers only). All data classified is organized to reflect questions relating to population, sex, age, or combinations of age and sex. Description of the data precedes the table.

Raw data collected during this study is displayed on tables. It is organized in the following fashion: Column 1, subject identification number; Column 2, sex ("M" for male and "F" for female); Column 3, date of birth; Column 4, age in years and months as of November 1, 1976; Columns 5, 6, 7, labeled "X", "Y", and "Z", results of Test of Floating Bodies, Test of Flexibility and the Operations, Mediation, the Separation of Variables, and The Oscillation of a Pendulum Test, respectively.

Statistical Hypotheses

"Do eighth grade students at Helena Junior High School function at the formal, concrete, or preoperational stage?", was left in question form. That data was used as the basis of other statistical testing.

The second question was, "Will performance be influenced by the pupils' sex?" The null hypothesis was that there would be no difference in performance in the two groups. The alternative hypothesis was that the mean will not be equal. Stated in mathematical terms:

$$\begin{aligned} H_0 &: \overset{M}{f} = \overset{M}{m} \\ H_1 &: \overset{M}{f} \neq \overset{M}{m} \end{aligned}$$

The mean performance score of the females is designated as f and the males as m .

The third question was, "Will the subjects tested in this study demonstrate an increase in their operational ability corresponding with increased age?" The null hypothesis was that there will be no difference in performance in the two groups. The alternate hypothesis was that the mean would not be equal. Stated in mathematical terms:

$$\begin{aligned} H_0 &: 12, 13.5 \overset{M}{=} 13.5, 15 \overset{M}{} \\ H_1 &: 12, 13.5 \overset{M}{\neq} 13.5, 15 \overset{M}{} \end{aligned}$$

The mean performance score of the twelve to thirteen and one half year olds was designated as 12, 13.5 and the thirteen and one half year olds to fifteen year olds as 13.5, 15.

The nature of the data collected was nominal.

Precautions Taken for Accuracy

The researcher took his raw data and calculations to a competent statistician at Montana State University at Bozeman, Montana, for initial inspection. Once the researcher and the consultant were certain the data was correctly calculated and in proper structure, the data was checked by a second statistician to correct any possible error.

Summary

The population for this study was regularly enrolled eighth graders at Helena Junior High School during the 1976-77 school term. The participants were not less than twelve nor more than fifteen years old by November 1, 1976. The population was 141 students. The students were divided into five groups and the Test of Floating Bodies, Test of Flexibility and the Operations, Mediation, the Separation of Variables, and The Oscillation of a Pendulum Test were administered. The raw data is displayed on a table. There were two null hypotheses. The first stated was that there will be no difference in test performance due to sex. The non-directional alternate hypothesis was that there will be a difference. The second null hypothesis was that the age of the subjects would not affect the performance on the tasks. The non-directional alternate hypothesis was that there would be a difference. The statistics in this study were means, modes, and medians.

Chapter 4

ANALYSIS OF DATA

This chapter reports the testing of eighth grade social studies students using Piagetian tasks. The tests were performed at Helena Junior High School, Helena, Montana, in October of 1976.

Population

The population consisted of 141 eighth grade social studies students in classes at Helena Junior High School. Students were assigned to classes by computer which is a normal procedure in Helena School District Number 1. Two class members were omitted from the population because they were more than 15 years of age on November 1, 1976. The group consisted of 74 males and 67 females.

Organization of Findings

The findings are organized to correspond with the three basic questions established in Chapter 3. Narrative descriptions will be followed by tables displaying population numbers and percentages for each operational level. The population will be categorized on three tables in three columns labeled as follows: 1) formal operations, form (3); concrete operations, con (2); 3) preoperational, preop (1). A statement as to the acceptance or rejection of the null hypothesis follows the presentation of the three basic questions.

The first question of the study sought to determine the

operational level at which Helena Junior High School students functioned. The population was found to include 39 (27.7%) members in formal operations; 96 (68.0%) in concrete operations; and 6 (4.3%) in pre-operations. The largest percentage of eighth graders at Helena Junior High School functioned within the concrete operations level.

Table 1

The Operational Levels of Student(s) Population

	form (3)	con (2)	preop (1)	Total	Mean ^m
Numbers of students in each operational level	39	96	6	141	2.26
Percentage of students in each operational level	27.7	68.0	4.3	100.0	--

There was no null hypothesis to be rejected or retained.

The second question concerned the influence on performance by the pupils' sex. The population (141) was made up of 67 females and 74 males. The female population comprised 15 (22.4%) in formal operations; 49 (73.1%) in concrete operations; and 3(4.5%) in preoperations (2.24^m). By contrast, the male population contained 24 (32.4%) in formal operations; 47 (63.5%) in concrete operations; and 3 (4.1%) in preoperations (2.29^m). The male population had more members reflecting higher percentages in formal operations. The means

of the two populations displayed a .05 difference.

Table 2

The Operational Levels of Male and Female (Students)

	form (3)	con (2)	preop (1)	Total	Mean ⁿ
Female population at each operational level	15	49	3	67	2.24
Male population at each operational level	24	47	3	74	2.29
Female population percentage at each operational level	22.4	73.1	4.5	100	--
Female population percentage of study population at each operational level	10.6	34.65	2.15	47.5	--
Male population percentage at each operational level	32.4	63.5	41	100	--
Male population percentage of study population at each operational level	17.1	33.35	2.14	52.5	--

There was no apparent difference in performance. The null hypothesis was retained.

The third question dealt with the subjects' tested ability to demonstrate an increased operational level corresponding with increased age. Students 12 to 13.5 years old (60) included 20 (33.3%) in formal

operations; 39 (65.0%) in concrete operations; and 1 (1.7%) in preoperations (2.34^u). Students in the 13.5 to 15 year old group (81) contained 19 (23.5%) in formal operations; 57 (70.3%) in concrete operations; and 5 (6.2%) in preoperations (2.21^u). The 12 to 13.5 year old group excelled in numbers in formal operations reflecting higher percentages and means.

Table 3

Operational Levels of Students Based on Age

	form (3)	con (2)	preop (1)	Total	Mean ^m
Student population 12 to 13.5 years old at each operational level	20	39	1	60	2.34
Student population 13.5 to 15 years old at each operational level	19	57	5	81	2.21
Student population 12 to 13.5 years old percentages at each operational level	33.3	65.0	1.7	.7	--
Student population 12 to 13.5 years old percentage of study population at each operational level	14.2	27.7	.7	42.6	--
Student population 13.5 to 15 years old percentages at each operational level	23.5	70.3	6.2	100	--
Student population 13.5 to 15 years old percentage of study population at each operational level	13.5	40.3	3.6	57.4	--

There appeared to be a perceptible difference in the two age groups. Therefore, the null hypothesis was rejected.

A further breakdown of the data utilizing age and sex

combinations was undertaken. A hierarchy was developed based on higher group means and percentage of group population at the formal operational level. These groups included: 1) males 12 to 13.5 years old; 2) females 12 to 13.5 years old; 3) males 13.5 to 15 years old; and 4) females 13.5 to 15 years old.

The male population 12 to 13.5 years old (29) was comprised of 11 (37.9%) in formal operations and 18 (62.1%) in concrete operations (2.38^u).

Table 4

The Operational Levels of Males 12 to 13.5 Years Old

	form (3)	con (2)	preop (1)	Total	Mean ^u
Male population 12 to 13.5 years old at each operational level	11	18	0	29	2.38
Male population 12 to 13.5 years old percentage at each operational level	37.9	62.1	0	100	--
Male population 12 to 13.5 years old percentage of the study population at each operational level	7.8	12.8	0	20.6	--

The female population 12 to 13.5 years old (31) was comprised of 9 (29.0%) in formal operations; 21 (67.8%) in concrete operations;

and 1 (3.2%) in preoperations (2.31^u).

Table 5

The Operational Levels of Females 12 to 13.5 Years Old

	form (3)	con (2)	preop (1)	Total	Mean ^u
Female population 12 to 13.5 years old at each operational level	9	21	1	31	2.31
Female population 12 to 13.5 years old percentages at each operational level	29.0	67.8	3.2	100	--
Female population 12 to 13.5 years old percentages of the study population at each operational level	6.4	15.43	.07	21.9	--

The male population 13.5 to 15 years old (45) was comprised of 13 (28.9%) in formal operations; 29 (66.7%) in concrete operations; and 3 (4.4%) in preoperations (2.23^u).

Table 6

The Operational Levels of Males 13.5 to 15 Years Old

	form (3)	con (2)	preop (1)	Total	Mean ⁴
Male population 13.5 to 15 years old at each operational level	13	29	3	45	2.23
Male population 13.5 to 15 years old percentages at each operational level	28.9	66.7	4.4	100	--
Male population 13.5 to 15 years old percentages of the study population at each operational level	9.15	20.6	2.15	31.9	--

The female population 13.5 to 15 years old (36) was comprised of 6 (16.7%) in formal operations; 28 (77.7%) in concrete operations; and 2 (5.6%) in preoperations (2.17⁴).

Table 7

The Operational Levels of Females 13.5 to 15 Years Old

	form (3)	con (2)	preop (1)	Total	Mean ^{<i>n</i>}
Female population 13.5 to 15 years old at each operational level	6	28	2	36	2.17
Female population 13.5 to 15 years old percentages at each operational level	16.7	77.7	5.6	100	--
Female population 13.5 to 15 years old percentage of the study population at each operational level	4.3	19.9	1.4	25.6	--

Summary

Three Piagetian tasks were administered to determine the intellectual development of a population of 141 students. The findings were that the population was comprised of 39 (27.7%) students in formal operations; 96 (68.0%) in concrete operations; and 6 (4.3%) in preoperations.

Findings of performance level on the tasks based on the consideration of the students' sex showed no appreciable difference. The male population contained a larger number in formal operations (24 to 15). Formal operational percentages were greater (32.4% to

22.4%) and the means varied with a .05 difference (2.29^u to 2.24^u).

Findings concerning age indicated the student population in the 12 to 13.5 year category achieved higher scores in numbers in formal operations (20 to 19), formal percentages (33.3% to 23.5%) and group means (2.34^u to 2.21^u). Students in the 13.5 to 15 year old category fell below the others in all areas.

Tables showing the influence of students' age, and male or female combinations in the population were ranked in this order: 1) males 12 to 13.5 years old; 2) females 12 to 13.5 years old; 3) males 13.5 to 15 years old; and 4) females 13.5 to 15 years old.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMENDATIONS

This research was developed to determine the level of intellectual development of eighth grade students at Helena Junior High School during the 1976-77 school term. The population, assigned to the researcher by computer contained 141 members.

The review of literature was concerned with Piagetian stages of development, research to determine formal operations, and applications to teaching especially in the social sciences.

The procedures were set forth for the collection of data utilizing three Piagetian tasks. Questions were asked concerning pupil population operational level and possible achievement on tasks based on sex (male or female) or age differentials (12 to 13.5 years old versus 13.5 year olds).

The results showed a population containing 39 students in formal operations, 96 in concrete operations, and 6 in preoperations. Although more males were in formal operations and achieved slightly higher means there was no appreciable difference between boys and girls. Students 12 to 13.5 years old achieved higher means and included greater numbers in formal operations. The study population was ranked according to both age and sex. The following order was evident: 1) males 12 to 13.5 years old; 2) females 12 to 13.5 years old; 3) males 13.5 to 15 years old; and 4) females 13.5 to 15 years old.

CONCLUSIONS

Information gained by the three questions of the study suggest the following conclusions:

1. There is no significance between males and females with regard to their performance on Piagetian tasks.
2. The population was predominantly in concrete operations.
3. Students 12 to 13.5 years old were more adept at employing formal thought process.

RECOMMENDATIONS

A study should be undertaken comparing the effectiveness of traditional teaching techniques and methods reflecting the child's operational level according to Piaget. The findings of this study clearly demonstrated a teacher could have three operational levels in a single classroom. This fact is exhibited in the study by the placement of 68 percent of the population in concrete operations, 27.7 percent in formal, and 4.3 percent in a preoperational stage. Since teachers are required to fill the needs of all students and encourage intellectual growth, it would seem important to carefully consider individual intellectual levels.

Additional recommendations of the researcher are:

1. Future research of this nature should employ more than three Piagetian tasks.

2. Similar studies should be undertaken in other academic disciplines.
3. A study of preoperational adolescents could be of value to certain skills in reading, spelling, and mathematics.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Beard, Ruth M. An Outline of Piagetian Developmental Psychology for Students and Teachers. New York Basic Books, Inc., 1969.
- Docherty, Edward M. "Identifying Concrete and Formal Operational Children", Piagetian Theory and the Helping Professions. ed. G. I. Lubin, J. F. Magary, M. K. Poulsen: Los Angeles: Publications Department, Bookstore, U.S.C., 1975.
- Feffer, M. and L. Guchotliff. "Decentering Implications of Social Interactions." Journal of Personality and Social Psychology, 1966, 4:415-442.
- Inhelder, Barbel and Jean Piaget. The Growth of Logical Thinking from Childhood to Adolescence. New York: Basic Books, Inc., 1958.
- Karplus, Robert. "The Science Improvement Study." eds. R. E. Ripple and V. N. Rockcastle. Piaget Revisited. Ithaca, New York: Cornell University Press, 1964, pp 13-118.
- Karplus, Robert, Elizabeth Karplus, Marina Formisano, Albert-Christian Paulsen. "Proportional Reasoning and Control of Variables in Seven Countries." June, 1975.
- Maier, Henry. Three Theories of Child Development. New York: Harper and Row, Publishers, 1965.
- Mealings, R. J. "Problem-Solving in Science Teaching," Educational Review, XV, 1963, 194-207.
- Piaget, Jean. The Origins of Intelligence in Children. trans. Margaret Cook. New York: W. W. Norton & Co., Inc., 1952.
- Piaget, Jean. The Psychology of Intelligence. London: Routledge and Kegan Paul, Publishers, 1950.
- Pulaski, Mary. Understanding Piaget. New York: Harper and Row, Publishers, 1971.
- Ross, Robert J. "The Development of Formal Thinking for High and Average Achieving Adolescents". Piagetian Theory and the Helping Professions. Ed. G. I. Lubin, J. F. Magary, M. K. Poulsen. Los Angeles: Publications Dept., Bookstore, U.S.C., 1975.

Sklar, Mark J. "Is Piaget a Developmental or Learning Theorist?"
Piagetian Theory and the Helping Professions. ed. G. I. Lubin,
J. F. Magary, M. K. Poulsen. Los Angeles: Publications
Dept., Bookstore, U.S.C., 1975.

APPENDICES

APPENDIX A

Student Response Sheets

41

Name _____

Age _____

Date of Birth _____

WHAT IS YOUR BEST GUESS AS TO WHICH WEIGHTS WILL BEND WHAT RODS JUST
ENOUGH TO TOUCH THE WATER? PLEASE LIST THEM.

GIVE THE REASONS FOR SELECTING YOUR CHOICES.

FORMULATE A LAW TO EXPLAIN FLEXIBILITY.

42

Name _____

Age _____

Date of Birth _____

LIST THE ITEMS THAT WILL FLOAT.

LIST THE ITEMS THAT WILL SINK.

WHICH ITEMS DID FLOAT? (LIST)

WHICH ITEMS DID SINK? (LIST)

WHY DID THE ITEMS FLOAT? MAKE A THEORY TO EXPLAIN THIS.

Name _____

Age _____

Date of Birth _____

SELECT ONE OF THE FIVE WEIGHTS. (LIST HERE)

STATE IF YOU WANT A SHORT OR LONG STRING TO TEST THE WEIGHT.

WILL THE STRING MAKE WEIGHT MOVE BACK AND FORTH SLOW OR FAST?

STATE IF YOU FEEL THAT HEAVIER OR LIGHT WEIGHTS WILL INCREASE OR DECREASE THE SPEED WITH WHICH THE WEIGHT PENDULATES.

FORMULATE A LAW THAT EXPLAINS WHY CERTAIN WEIGHTS PENDULATE FASTER AND/OR SLOWER THAN OTHERS.

APPENDIX B

Raw Data Table

Table 8. Individual Student Data Pertaining to Sex, Age Task Performance, Majority Score and Means.

Ident. No.	Sex	Birthdate	Age on 11/1/76	X	Y	Z	Majority	Mean
101	F	6/12/62	14 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
102	M	12/12/62	14 yrs 10 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
103	F	4/23/63	13 yrs 6 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
104	F	8/2/63	13 yrs 3 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
105	F	8/18/63	13 yrs 3 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33
106	M	10/9/62	14 yrs 0 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
107	F	9/14/63	13 yrs 1 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
108	F	1/13/63	13 yrs 9 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
109	F	1/5/63	13 yrs 9 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
110	F	6/20/62	14 yrs 4 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
111	F	10/24/63	13 yrs 0 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
112	M	5/26/63	13 yrs 5 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
113	M	6/25/63	13 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
114	F	9/24/62	14 yrs 1 mos	Preop (1)	Preop (1)	Preop (1)	Preop (1)	1.0
115	F	6/22/62	14 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
116	F	11/6/62	13 yrs 11 mos	Con (2)	Form (3)	Form (3)	Form (3)	2.66
117	M	8/29/62	14 yrs 2 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
118	M	2/22/63	13 yrs 8 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.00
119	F	6/12/63	13 yrs 4 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
120	F	2/18/63	13 yrs 8 mos	Preop (1)	Preop (1)	Preop (1)	Preop (1)	1.0
121	M	1/8/62	14 yrs 9 mos	Con (2)	Con (2)	Preop (1)	Con (2)	1.66
122	M	7/26/63	13 yrs 3 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.01
123	M	12/6/62	13 yrs 11 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33
124	F	2/5/63	13 yrs 8 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
125	M	8/7/63	13 yrs 2 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
201	M	8/15/63	13 yrs 2 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
202	F	10/14/63	13 yrs 0 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0

Table 8 Continued

Ident. No.	Sex	Birthdate	Age on 11/1/76	X	Y	Z	Majority	Mean
203	F	2/11/63	13 yrs 8 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
204	F	3/21/63	13 yrs 7 mos	Con (2)	Preop (1)	Con (2)	Con (2)	1.66
205	F	9/14/63	13 yrs 1 mos	Con (2)	Preop (1)	Con (2)	Con (2)	1.66
206	M	12/18/62	13 yrs 10 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
207	M	11/17/63	12 yrs 11 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
208	F	11/7/63	12 yrs 11 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
209	F	6/5/63	13 yrs 4 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
210	M	9/17/63	13 yrs 1 mos	Form (3)	Form (3)	Form (3)	Form (3)	2.66
211	F	11/11/62	13 yrs 11 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
212	M	1/31/62	14 yrs 9 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
213	M	2/14/63	13 yrs 8 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
214	M	1/25/63	13 yrs 9 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
215	M	6/11/63	13 yrs 4 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
216	M	3/1/62	14 yrs 7 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
217	M	9/5/62	14 yrs 1 mos	Preop (1)	Preop (1)	Con (2)	Preop (1)	1.33
218	M	12/27/62	13 yrs 10 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
219	M	9/26/63	13 yrs 1 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
220	F	7/24/62	14 yrs 3 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
221	M	12/18/62	13 yrs 10 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
222	M	5/24/63	13 yrs 5 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
223	M	11/7/62	13 yrs 11 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
224	F	6/30/63	13 yrs 4 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
225	M	2/5/63	13 yrs 8 mos	Preop (1)	Preop (1)	Con (2)	Preop (1)	1.33
226	F	10/17/62	14 yrs 0 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
227	M	2/26/62	13 yrs 8 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
228	M	7/2/62	14 yrs 3 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
229	M	12/15/62	13 yrs 10 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
230	F	6/23/63	13 yrs 4 mos	Con (2)	Con (2)	Preop (1)	Con (2)	1.66

Table 8 Continued

Ident. No.	Sex	Birthdate	Age on 11/1/76	X	Y	Z	Majority	Mean
231	M	5/4/63	13 yrs 5 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33
232	M	6/19/62	13 yrs 4 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
301	M	7/24/62	14 yrs 3 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
302	F	12/20/62	13 yrs 10 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
303	F	12/29/62	13 yrs 16 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
304	M	5/23/63	13 yrs 7 mos	Preop (1)	Form (3)	Form (3)	Con (2)	2.33
305	F	1/25/63	13 yrs 9 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
306	F	11/28/62	13 yrs 11 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.00
307	F	3/2/63	13 yrs 7 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
308	M	2/22/63	13 yrs 8 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
309		9/5/63	13 yrs 1 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
310		6/16/63	13 yrs 4 mos	Con (2)	Con (2)	Form (2)	Con (2)	2.33
311		5/9/63	13 yrs 5 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
312		7/16/63	13 yrs 3 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
313		3/21/63	13 yrs 7 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
314		7/8/63	13 yrs 3 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
315		12/4/62	13 yrs 10 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
316		8/4/63	13 yrs 2 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
317		10/9/62	14 yrs 0 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
318		6/3/63	13 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
319		2/18/63	13 yrs 8 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
320		3/7/63	13 yrs 7 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
321		8/14/63	13 yrs 2 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
322		7/4/62	14 yrs 3 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
323		3/7/62	13 yrs 7 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
324		12/18/62	13 yrs 10 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
325		6/30/63	13 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
326		11/23/63	12 yrs 11 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
327		5/13/63	13 yrs 5 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0

Table 8 Continued

Ident. No.	Sex	Birthdate	Age on 11/1/76	X	Y	Z	Majority	Mean
328		8/4/63	13 yrs 2 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33
329		12/3/63	12 yrs 10 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
401	M	4/10/63	13 yrs 6 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
402	M	3/12/63	13 yrs 7 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
403	M	6/3/63	13 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
404	M	6/10/63	13 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
405	M	10/23/64	12 yrs 0 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
406	F	5/10/63	13 yrs 5 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
407	F	1/26/62	14 yrs 9 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
408	M	10/18/62	14 yrs 0 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
409	M	5/6/63	13 yrs 5 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
410	F	10/31/62	14 yrs 0 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
411	F	6/22/63	13 yrs 4 mos	Con (2)	Form (3)	Form (3)	Form (3)	2.66
412	F	6/7/63	13 yrs 4 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
413	F	8/18/63	13 yrs 2 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
414	M	9/20/63	13 yrs 1 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
415	F	7/9/63	13 yrs 5 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
416	F	6/19/62	14 yrs 4 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
417	M	4/3/63	13 yrs 6 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
418	F	10/9/63	13 yrs 0 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
419	M	12/19/62	13 yrs 10 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
420	M	12/14/62	13 yrs 10 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
421	F	2/21/63	13 yrs 8 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33
422	F	2/13/63	13 yrs 8 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
423	F	11/16/62	13 yrs 11 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
424	M	3/31/63	13 yrs 8 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
425	F	11/12/62	13 yrs 11 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
426	F	1/18/62	14 yrs 9 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33

Table 8 Continued

Ident. No.	Sex	Birthdate	Age on 11/1/76	X	Y	Z	Majority	Mean
427	F	5/12/63	13 yrs 7 mos	Con (2)	Form (3)	Form (3)	Form (3)	2.66
428	F	8/8/63	13 yrs 2 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
429	M	4/22/63	13 yrs 6 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
501	M	1/30/63	13 yrs 9 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
502	M	7/5/63	13 yrs 3 mos	Preop (1)	Form (3)	Form (3)	Con (2)	2.33
503	M	8/6/63	13 yrs 2 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
504	M	1/26/62	14 yrs 9 mos	Preop (1)	Preop (1)	Con (2)	Preop (1)	1.33
505	M	3/20/63	13 yrs 7 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
506	F	10/5/62	14 yrs 0 mos	Prep (1)	Con (2)	Form (3)	Con (2)	2.0
507	M	1/14/63	13 yrs 9 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66
508	F	4/29/63	13 yrs 6 mos	Con (2)	Con (2)	Form (3)	Con (2)	2.33
509	M	9/23/62	14 yrs 1 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
510	F	11/11/62	13 yrs 11 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
511	M	1/13/63	13 yrs 9 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
512	F	9/10/63	13 yrs 1 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
513	M	2/4/63	13 yrs 8 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
514	F	8/7/63	13 yrs 2 mos	Con (2)	Form (3)	Form (3)	Form (3)	2.66
515	F	9/5/63	13 yrs 1 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
516	M	8/19/63	13 yrs 2 mos	Form (3)	Form (3)	Form (3)	Form (3)	3.0
517	F	10/26/63	12 yrs 11 mos	Preop (1)	Preop (1)	Con (2)	Preop (1)	1.33
518	M	2/4/63	13 yrs 8 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
519	F	8/22/63	13 yrs 2 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
520	M	11/12/62	12 yrs 11 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
521	M	11/9/62	13 yrs 11 mos	Con (2)	Con (2)	Con (2)	Con (2)	2.0
522	M	3/9/62	14 yrs 7 mos	Form (3)	Con (2)	Form (3)	Form (3)	2.66
523	M	8/8/63	13 yrs 2 mos	Form (3)	Form (3)	Con (2)	Form (3)	2.66
524	M	11/19/62	13 yrs 11 mos	Con (2)	Form (3)	Con (2)	Con (2)	2.33
525	M	4/28/63	13 yrs 6 mos	Form (3)	Con (2)	Con (2)	Con (2)	2.33
526		3/14/63	13 yrs 7 mos	Preop (1)	Con (2)	Con (2)	Con (2)	1.66